

VICE PRESIDENT FOR RESEARCH AND PARTNERSHIPS



# ANNUAL REPORT 2021

Igniting and Catalyzing Excellence  
in Research to Change Lives

*The* UNIVERSITY of OKLAHOMA



## We Change Lives

The COVID-19 pandemic shook the world and compounded global grand challenges, certainly in the realm of public health, but also geopolitical instability, climate change, social injustice and others. At the University of Oklahoma, we are building transdisciplinary teams to tackle and contribute solutions to some of these defining societal challenges of our time.

This annual report draws attention to the future of OU research, grounded in our support of the university's strategic plan and the strategic areas of research in which OU is well positioned to drive convergent solutions to impact global grand challenges.

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# 01

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## SUPPORTING THE LEAD ON, UNIVERSITY STRATEGIC PLAN

Pillar 5 of the Lead On, University Strategic Plan lays out the university's ambition to change lives through discovery, innovation, and creative works.

# 02

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## STRATEGIC RESEARCH INSTITUTES

The OU strategic plan defines four strategic areas of research that represent global grand challenges for which OU can make a direct and tangible impact.

# 03

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## CROSS-CUTTING FOUNDATIONS

These multidisciplinary cross-cutting centers and institutes span the university, supporting the enabling core capabilities that support OU's research enterprise.

# 04

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## INNOVATION AT OU

In support of the strategic plan, OU has established an Office of Innovation and Corporate Partnerships and launched a new approach to licensing terms for corporate sponsored research.

# 05

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## SOLVING GLOBAL GRAND CHALLENGES

In our vision for research and creative activity, researchers move beyond traditional academic boundaries, collaborating across disciplines and globally with other universities, policymakers, economists, and business leaders to create solutions for a better world.

# 06

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## SOWING SEEDS

The Office of the Vice President for Research and Partnerships is sowing the seeds of research excellence through nine recent internal seed funding and research investment programs.

# 07

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## BY THE NUMBERS

Despite the challenges brought on by the COVID-19 pandemic, OU research has made significant growth.



## SUPPORTING THE LEAD ON, UNIVERSITY STRATEGIC PLAN

The University of Oklahoma released the Lead On, University Strategic Plan in July 2020 that describes a path forward toward establishing OU as one of the nation's top public research universities. The plan is built upon five foundational pillars that support OU's core tradition and purpose: "We Change Lives."

Each pillar is supported by targeted strategies and specific tactics to help achieve our ambitious goals. Specifically, Pillar 5 contemplates the creation of university-wide, multicampus, multidisciplinary centers of excellence (institutes) focused on real-world challenges. During FY21, a dedicated team of colleagues, working with strategy consulting firm Thinkenomics, completed our strategic research framework with detailed strategies and tactics for the four vertical areas of research and creative activity focus (Pillar 5, Strategy 2, Tactic 1).

These verticals form the foundation for the launch of four new university-wide institutes and provide the basis for incentivizing the convergence of transdisciplinary teams of OU faculty, staff, and students to tackle and contribute solutions to some of the defining societal challenges of our time such as social inequality, climate change, energy, health pandemics, national security and global stability, and others.

Along with these verticals, the research strategic framework describes the need for major initiatives in key cross-cutting foundational areas of academic research such as data science, public policy research and analysis, quantum information science, advanced microelectronics, radar applications, and others yet to be defined.

# STRATEGIC VERTICALS



## AEROSPACE, DEFENSE, AND GLOBAL SECURITY

### Oklahoma Aerospace and Defense Innovation Institute (OADII)

Lt. Gen. (Ret.) Gene Kirkland, Executive Director

- > Radar Innovations
- > Sustainment and Modernization
- > Advanced Technologies
- > International Security Policy



## ENVIRONMENT, ENERGY, AND SUSTAINABILITY

### Institute for Resilient Environmental and Energy Systems (IREES)

Tim Filley, Director

- > Earth Systems
- > Energy and Infrastructure
- > Community Resilience and  
Environmental Justice



## THE FUTURE OF HEALTH

### Institute for the Future of Health

- > Eliminating Health Disparities
- > Molecules to Medicine
- > Emergent Pathogenic Threats



## SOCIETY AND COMMUNITY TRANSFORMATION

### Institute for Community and Society Transformation (ICAST)

Shane Connelly, Director

- > Technology and Society
- > Native Nations, Sovereignty, and Partnerships
- > Equity and Opportunity

## CROSS-CUTTING FOUNDATIONS

### Data Institute for Societal Challenges (DISC)

David Ebert, Director

### Center for Quantum Research and Technology (CQRT)

T. Venky Venkatesan, Executive Director

### Institute for Public Policy Research and Analysis (IPPRA)

Hank Jenkins-Smith, Co-Director | Carol Silva, Co-Director

### Advanced Radar Research Center (ARRC)

Robert D. Palmer, Executive Director

# OKLAHOMA AEROSPACE AND DEFENSE INNOVATION INSTITUTE

OADII brings together the full range of the university's capabilities and resources to provide holistic solutions addressing the aerospace, defense, and global security challenges of today and tomorrow. By uniting the vast resources of a major research university with a network of industry and government partners, OADII advances security, liberty, and prosperity for our state, nation, and world.



## Four crucial areas of national prominence:



### **RADAR INNOVATIONS:**

Ensuring National and Global Security Through Radar Innovations



### **SUSTAINMENT AND MODERNIZATION:**

Supporting the Defense Sustainment and Modernization Enterprise



### **ADVANCED TECHNOLOGIES:**

Addressing Emerging Security Challenges Through Advanced Technologies



### **INTERNATIONAL SECURITY POLICY:**

Developing Innovative and Agile International Security Policy Solutions



**Lt. Gen. (Ret.) Gene Kirkland, Executive Director**  
Kirkland is leading the institute's efforts to connect with strategic partners in the aerospace, defense, and global security sectors, as well as strengthen OU research in support of Oklahoma's aerospace and defense industry.

### **STRATEGIC HIRES**

Cliff Wojtalewicz, Operations Manager  
Don Wetekam, Chief Strategist

### **SUSTAINMENT MODERNIZATION PARTNERSHIP**

The Oklahoma City Air Logistics Complex, headquartered at Tinker Air Force Base, is funding six research projects at the University of Oklahoma. A seventh project is being funded by the Air Force Research Laboratory. The nearly \$5 million total investment will fund research that addresses sustainment and modernization needs for the Air Force.

# INSTITUTE FOR RESILIENT ENVIRONMENTAL AND ENERGY SYSTEMS

**IREES addresses sustainability grand challenges for Oklahoma, the nation, and the world. IREES is developing equitable solutions that help drive the transformation of the U.S. energy sector toward a net-zero carbon economy, solutions that provide access to clean water, air, and safe built environments, and do so without degrading our planetary ecosystems and climate.**



## Sustainability Initiatives

### LASI

The Latin American Sustainability Initiative, a newly created program within IREES, will expand OU's research, outreach, and educational initiatives that address the interconnected environmental, economic, and societal challenges to sustainable development across Latin America.

### UNSA

OU researchers are working with the Universidad Nacional de San Agustín, one of Peru's largest and oldest public research universities, on four collaborative projects to study climate change impacts and adaptation strategies for Latin America, as well as advanced public health monitoring and technologies to mitigate the disparate impact of diseases such as cancer and COVID-19 among the indigenous populations of Peru. UNSA is providing nearly \$5 million in funding for four projects that pair OU and UNSA researchers to study these urgent global challenges.

### USAID

OU signed a multi-institutional contract with the United States Agency for International Development that will dedicate \$15 million toward the creation of a research hub to support sustainable agricultural, economic, and social improvement in the San Martin region of the Peruvian jungle. Researchers from OU will receive nearly \$1.5 million to support the project, coordinated through the Latin American Sustainability Initiative within IREES.



### Tim Filley, Director

Filley is leading the institute's efforts to engage the OU community, stakeholders, and industry partners to support OU research efforts in observing and predicting Earth systems, transforming energy and infrastructure, and advancing community resilience and environmental justice.

# INSTITUTE FOR COMMUNITY AND SOCIETY TRANSFORMATION

ICAST is bringing together expertise from multiple disciplines, in unique ways, to address community and societal challenges. Transformative, novel, creative, and effective solutions require understanding the individuals, groups, societies, and cultures involved. ICAST will enable a wide range of approaches and methods to expand basic, applied, and community-centered research to solve society's grand challenges.



ICAST is guided by a vision to transform societies by setting the national standard for convergent, community-engaged research and creative activity. ICAST addresses grand challenges facing communities and society today in the realms of:



Advancing equity and opportunity, particularly in the areas of health and education.



Understanding and addressing social and ethical challenges associated with technological advances and how they are integrated into workplaces, schools, and daily life.



Partnering with Native Nations to strengthen cultural continuance and sovereignty.



**Shane Connelly, Director**

Connelly is leading the institute's efforts to facilitate research and creative activities that consider human behavior in all of its complexity, at all levels – individual, group, organizational, cultural, and social systems in which they are embedded.

## The Future of Health

OU will advance positive health outcomes through convergence research to create new therapies, policies, and practices that will enable recognition of and response to continuing and emerging disease threats and address social and environmental risk factors to promote health equity in Oklahoma, America, and globally.



## CROSS-CUTTING FOUNDATIONS

### ADVANCED RADAR RESEARCH CENTER

ARRC is an innovation leader in radar systems, algorithms, and radio frequency components. ARRC is also the largest academic radar program in the nation. ARRC executes large projects in system development and prototyping, modeling, and associated science for the National Science Foundation, NOAA, NASA, the Department of Defense, and industry partners. Through the unique combination of academic foundations, first-class facilities, and full-time engineering staff, ARRC supports a wide range of technology readiness levels from fundamental research to fielded system prototypes.



**Robert D. Palmer, Executive Director**

Palmer leads the ARRC in its endeavor to be the top academic center for radar and radio frequency research and education. ARRC operates through the tenets of teamwork, transparency, strategic investment, and shared facilities.

### CENTER FOR QUANTUM RESEARCH AND TECHNOLOGY

CQRT is committed to making significant advances in the field of quantum science and technology by bringing together faculty, students, and industry partners. CQRT supports research in quantum materials, sensors and the scientific study of measurement, and quantum communications and computing. CQRT is also focused on developing the next generation of researchers through recruiting talented graduate students and postdocs conducting research in the areas of quantum sensing, quantum information, synthetic correlated quantum systems, and quantum materials.



**T. Venky Venkatesan, Executive Director**

Venkatesan leads CQRT's efforts in increasing entrepreneurship at OU, collaborations with other research laboratories and institutions, and student success. CQRT is advancing cross-college collaborations, research activities, student mentoring, and technology translation.



## CROSS-CUTTING FOUNDATIONS



### DATA INSTITUTE FOR SOCIETAL CHALLENGES

DISC innovates data science, artificial intelligence, machine learning, and data-enabled research by developing convergent research teams dedicated to solving societal challenges and ensuring the responsible use of data to benefit society. The institute is committed to growing and sustaining OU's preeminent data science talent and engaging industry and community partners by creating a data science nexus.



**David Ebert, Director**

Ebert leads the institute's empowerment of transdisciplinary research and collaboration to drive convergent solutions to societal challenges in Oklahoma, the nation, and the world through data science research, tools, and capabilities.



### INSTITUTE FOR PUBLIC POLICY RESEARCH AND ANALYSIS

IPPRA conducts research and builds partnerships by integrating public policy scholarship with the physical and engineering sciences. IPPRA aims to increase human wellbeing, improve social choice infrastructure, enhance resilience by addressing complex public policy problems, and create opportunities that span natural, technological, and social systems.



**Carol Silva (left), Hank Jenkins-Smith (right), Co-Directors**

The IPPRA team is grounded in transdisciplinary thinking and collaboration. By placing an emphasis on finding new ways to bridge basic and applied research, the team brings fundamental knowledge and analysis to help solve urgent public problems.

# INNOVATION AT OU

Pillar 5 of the Lead On, University Strategic Plan states that the University of Oklahoma will “enrich and positively impact Oklahoma, the nation, and the world through research and creative activity.” Two of the strategies that aim to achieve this goal call for increased economic development through OU technology-based startup companies, angel investors and venture capital growth, as well as policies that foster an environment for achieving our goals.



**ABOVE** A team of top-level executives from the Oklahoma City Air Logistics Complex at Tinker Air Force Base toured the new Sustainment Modernization Partnership facility at 2 Partners Place, where OC-ALC personnel work and conduct joint research with OU on software-oriented projects.

**RIGHT** OU signed a Sponsored Research Agreement with Oklahoma City-based Bedrock Gas Solutions in Oct. 2021 as part of a comprehensive research effort to advance Oklahoma’s hydrogen economy.



TOP Oklahoma City Air Logistics Complex Cmdr. Brig. Gen. Jeffrey R. King and OU Vice President for Research and Partnerships Tomás Díaz de la Rubia signed an Educational Partnership Agreement in July 2020 to cultivate aerospace technology development and to improve and enhance education in science, technology, engineering, and mathematics.



LEFT Bison Underground - OU students’ startup wins \$250,000 global carbon removal competition.

## INNOVATING INTELLECTUAL PROPERTY AT OU

OU launched a new approach to licensing terms for corporate-sponsored research agreements that provides improved flexibility in negotiating intellectual property terms with potential sponsors.

## CORPORATE PARTNERSHIPS

The newly created Office of Innovation and Corporate Partnerships facilitates and integrates university efforts to strengthen corporate partnerships for strategic research, license new OU technologies, and launch OU-led startups based on faculty, staff, and students’ intellectual property.



**John Hanak**  
Chief Innovation and Corporate Officer  
Executive Director, Office of Innovation and Corporate Partnerships

# SOLVING GLOBAL GRAND CHALLENGES

Global social megatrends present the planet with wicked problems that are broad, challenging, and complex. Today more than ever, the rapid and global pace of innovation and the democratization of technology are bringing opportunity and a higher quality of life to many around the world. OU is uniquely positioned to bring disparate academic disciplines together to foster creative, comprehensive solutions to global challenges.

In our vision for research and creative activity, researchers move beyond traditional academic boundaries, collaborating across disciplines and globally with other universities, policymakers, economists, and business leaders to create solutions for a better world.



## OU Earns Lead for Up to \$208 Million NOAA Severe Weather Institute

OU was selected to host NOAA's new Cooperative Institute for Severe and High-Impact Weather Research and Operations (CIWRO). The selection comes with an award of up to \$208 million over five years.

## OU Receives \$20 Million Grant to Lead Inaugural National Science Foundation Artificial Intelligence Institute

OU is leading a National Science Foundation AI Institute for Research on Trustworthy AI in Weather, Climate, and Coastal Oceanography that is being hailed as a "historic milestone in environmental science" that will revolutionize what we know about weather and our environment.

## OK EPSCoR

Oklahoma researchers are innovating a new approach to develop and test science-based solutions for complex problems at the intersection of land use, water availability, and infrastructure through a \$20 million National Science Foundation grant through Oklahoma EPSCoR.

Carol Silva and Hank Jenkins-Smith, co-directors of the Institute for Public Policy Research and Analysis, are the science leads for the collaborative project which involves 34 researchers from seven Oklahoma universities and institutes working together to solve Oklahoma's most challenging wicked problems.

## GEOCARB

**The Geostationary Carbon Cycle Observatory, a first-of-its-kind space-based Earth science mission, will study how and why the global carbon cycle is changing, and monitor plant health and vegetation stress throughout the Americas. The GeoCarb instrument will enhance current carbon-cycle knowledge with millions of daily observations. The GeoCarb project is supported by NOAA with a contract valued at \$162.8 million.**



## New Stories of the West

Six key humanities programs received a record-breaking \$500,000 award from the National Endowment for the Humanities. This largest-ever total grant from the NEH to OU was made possible through funding by the American Rescue Plan and is intended to help humanities organizations across the country that have been negatively impacted by the COVID-19 pandemic.

Kimberly J. Marshall, director of the OU Arts and Humanities Forum and an associate professor of anthropology, spearheaded the "New Stories of the West, for the West" grant team. The humanities entities at OU funded by the grant are the OU Press, the OU Native Nations Center, the OU Arts and Humanities Forum, World Literature Today, the Oklahoma Weather Community Oral History Project, and the Oklahoma Native American Youth Language Fair.



## Parent-Child Assistance Program

OU is leading an effort to strengthen families in Oklahoma by implementing the national award-winning evidence-informed Parent-Child Assistance Program that aids pregnant and parenting mothers struggling with addiction. Evaluators of the PCAP program at OU will measure possible cost savings stemming from reductions in incarceration, substance use disorders, foster care, and future substance-exposed newborns. Supporting the effort is a consortium of public and private funders, including the Arnall Community Fund at the Oklahoma City Community Foundation — which has awarded a \$1.5 million gift to the OU Foundation to launch this project — along with additional support from Casey Family Programs, the Oklahoma Department of Human Services, and the Oklahoma Department of Mental Health and Substance Abuse Services.

# SOWING SEEDS

The Office of the Vice President for Research and Partnerships has launched seven research incentive initiatives intended to help faculty expand their research capabilities and interests, and in some cases, even enter new fields of research. Through rigorous peer review, in response to open requests for proposals, these incentive programs have provided more than \$1.7 million to OU faculty and have already generated a significant return on the investment.

**COVID-19 Seed Funding Outcomes**  
 (\$340,000 VPRP investment)  
 \$5.3M External Funding Received  
 \$3M in external grants pending

**Inequities Seed Funding Outcomes**  
 (\$198,514 VPRP investment)  
 \$793,976 External Funding Received  
 \$3.5M in external grants pending

## Our most recent funding initiatives include:

### MATCH PROGRAM

A match program targeted toward stimulating research and creative activity by supporting principal investigators who are sponsoring postdoctoral researchers on externally funded grants.

### SIGNIFICANT IMPACT RESEARCH GRANT PROGRAM

Supports lead Principal Investigators in developing competitive large-scale or significant grant applications focused on tackling challenging problems at a national scale that will notably advance OU's global reputation.



Big Idea Challenge



Match Program



Significant Impact Research Grant Program



Strategic Equipment Investment Program



Social Sciences, Humanities, and Arts Seed Grant Program



COVID-19 Seed Grant Program



Inequities in the Academic Research and Creative Activity Enterprise RFP

# SYSTEM-WIDE RESEARCH HIGHLIGHTS

FY20

## Record-Breaking Achievements for the University of Oklahoma

National R&D FY20 Expenditure Rankings from the National Science Foundation's Higher Education Research and Development (HERD) Survey

**TOP 7.9%** of 915 ranked institutions

\$362M TOTAL EXPENDITURES, A NEARLY 20% INCREASE FROM FY19

**TOP 11.6%** of 653 ranked institutions

\$184M FEDERAL EXPENDITURES, AN 11.5% INCREASE FROM FY19

**#1** in Atmospheric Science and Meteorology

\$75.5M, A 7.7% INCREASE FROM FY19

<b>\$85M</b> 18% INCREASE FROM FY19 ATMOSPHERIC, GEOLOGICAL AND OCEAN SCIENCES	<b>#6</b>
<b>\$25M</b> NEARLY 50% INCREASE FROM FY19 SOCIAL SCIENCES	<b>#27</b>
<b>\$119M</b> 11% INCREASE FROM FY19 HEALTH SCIENCES	<b>#60</b>
<b>\$24.6M</b> 28% INCREASE FROM FY19 NON-SCIENCE AND ENGINEERING FIELDS	<b>#75</b>
<b>\$18.7M</b> 22% INCREASE FROM FY19 PHYSICAL SCIENCES	<b>#77</b>
<b>\$40M</b> 14% INCREASE FROM FY19 BIOLOGY/BIOMEDICAL SCIENCES	<b>#89</b>
<b>\$36.6M</b> 38% INCREASE FROM FY19 ENGINEERING	<b>#98</b>

FY21

## Record-Breaking Expenditures

\*FY2021 totals as initially reported to the National Science Foundation HERD survey.

**\$387.2** MILLION  
**IN EXPENDITURES**

A **4.7%** increase from FY2020

**\$194.9** MILLION  
**FEDERAL EXPENDITURES**

A **5%** increase from FY2020

## Record-Breaking Proposals

**\$824.2** MILLION  
**TOTAL**

**969** PROPOSALS  
**SUBMITTED**

TOTAL AWARDS FY21  
**\$249.4** MILLION  
INVOLVING  
**1369** AWARDS

**\$20.3M**  
U.S. DEPT OF COMMERCE

**\$19.4M**  
NATIONAL SCIENCE FOUNDATION

**\$10.7M**  
U.S. DEPT OF EDUCATION

**\$11M**  
U.S. DEPT OF DEFENSE

## MAJOR FELLOWSHIPS



**Thirumalai (Venky) Venkatesan**, director of the Center for Quantum Research and Technology, has been named a Fellow of the National Academy of Inventors and a Fellow of the Royal Society.

## YOUNG INVESTIGATORS AWARDS



**DANIEL BECKER**  
» Scialog Fellow



**LUCA FORNELLI**  
» American Society for Mass Spectrometry Emerging Investigators Award



**MICHELE GALIZIA**  
» NSF CAREER Award  
» American Chemical Society Influential Researcher Award



**SHINYOUNG JEON**  
» American Education Research Association Early Career Award



**JUSTIN METCALF**  
» Department of Defense Young Faculty Award



**SEPIDEH RAZAVI**  
» NSF CAREER Award



**NAOKO SAKAEDA**  
» NSF CAREER Award



**BAYRAM SAPAROV**  
» NSF CAREER Award  
» Department of Energy Early Career Research Award



**STEFAN WILHELM**  
» NSF CAREER Award  
» Scialog: Advancing Bioimaging Fellow

## FELLOWSHIPS, AWARDS & PRIZES



**DEBRA BEMBEM**  
» Fellow of the American Society for Bone and Mineral Research



**DANIEL BUTKO**  
» Acoustical Society of America Rossing Prize



**AMANDA COBB-GREETHAM**  
» Radcliffe Fellow



**HONORÉE FANONNE JEFFERS**  
» NAACP Image Award for Outstanding Literary Work  
» Longlist National Book Award for Poetry



**BRIAN GRADY**  
» AIChE Fellow, American Institute of Chemical Engineers



**JENNIFER HOLLAND**  
» Armitage-Jameson Prize  
» David J. Weber Prize  
» W. Turrentine Jackson Award



**JEONG-NAM KIM**  
» Public Relations Society of America's Jackson, Jackson & Wagner Behavioral Science Prize



**PETRA KLEIN**  
» Helmut E. Landsberg Award from the Council of the American Meteorological Society



**ALEXIS MYCHAJLIW**  
» Alf Award for Excellence in Paleontological Research and Education



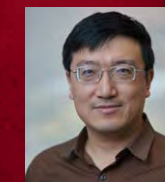
**DANIEL RESASCO**  
» AIChE Fellow, American Institute of Chemical Engineers



**SAMER SHEHATA**  
» International Affairs Fellowship from the Council on Foreign Relations



**CARYN VAUGHN**  
» Society for Freshwater Science Fellow



**BIN WANG**  
» American Chemical Society Influential Researcher Award



**DEBORAH WATSON**  
» American Physical Society Fellow

## OTHER HONORS & RECOGNITIONS



**DAVID S. EBERT**  
» Elected Second Vice President of the IEEE Computer Society



**DANIEL RESASCO**  
» Oklahoma Higher Education Hall of Fame



**CAROL SILVA**  
» National Committee on the Future of NSF EPSCoR



**DAVID SABATINI**  
» Oklahoma Higher Education Hall of Fame







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