UNMANNED SYSTEMS RESEARCH INSTITUTE
FIVE YEAR REPORT
2015 - 2020

The OSU Unmanned Systems Research Institute was founded with the goal of being the world leader in autonomous systems.

The first 5 years of USRI have been built on OSU's strong hands-on aerospace engineering curriculum and research program, and we have grown through hiring faculty subject matter experts who are thought leaders in their field and by cultivating and retaining student research expertise to support our ongoing mission.

Our core beliefs are founded in the land-grant mission of an A&M Tier 1 Research University – to serve our students, community, state, and the world – through fostering opportunities and developing research excellence. We look forward to the next 5 years of research excellence and growth, for where ever autonomous systems go in the future, USRI will be there to lead the way.

Dr. Jamey Jacob
Director of USRI

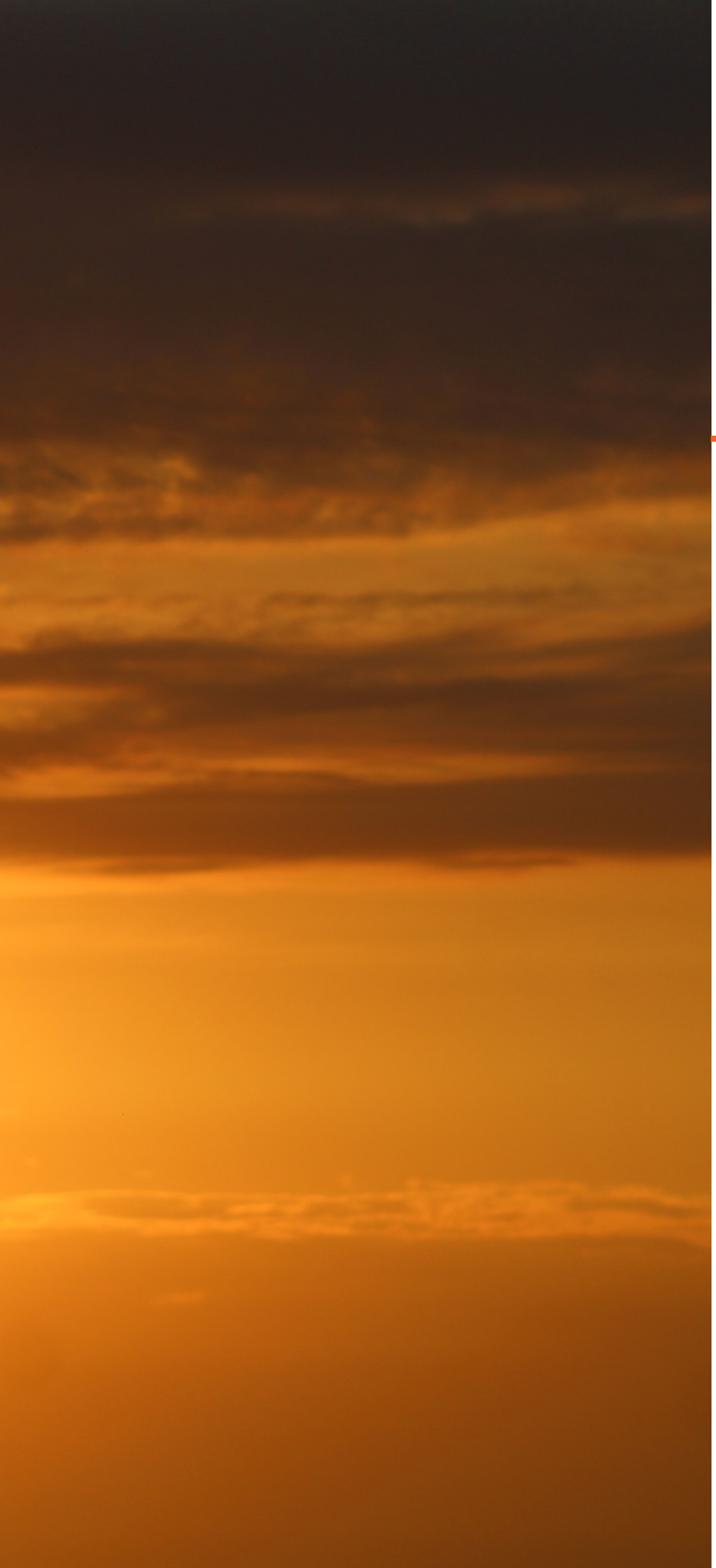


TABLE OF CONTENTS

ABOUT THE COVER

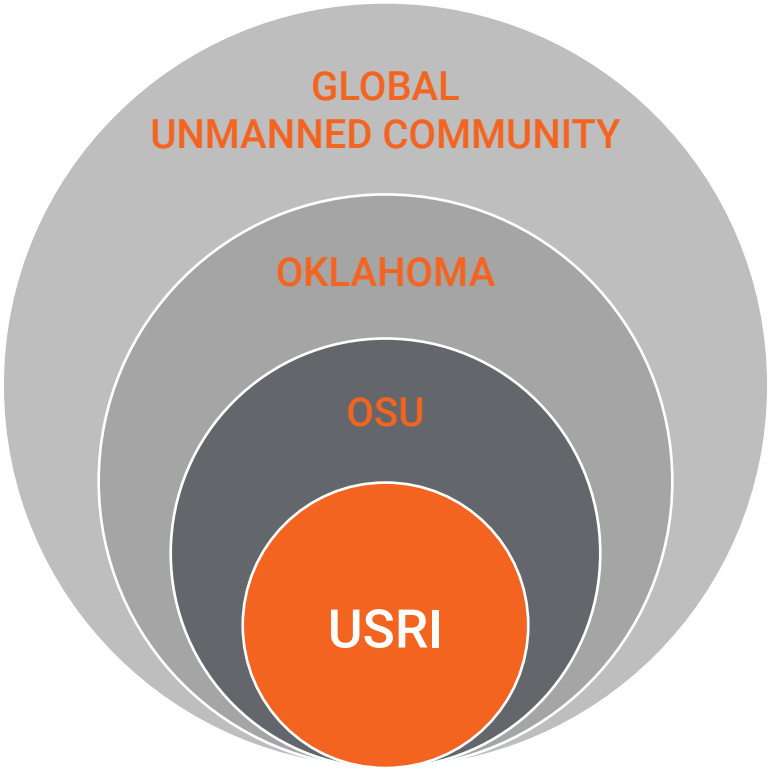
Unmanned Systems Research Institute celebrated the opening of it's building, Excelsior, on November 2, 2019. Excelsior provides campus-wide access to autonomous system expertise and solutions

OUR MISSION

USRI seeks to incubate ideas and research technologies within unmanned systems and provide related expertise for Oklahoma State University (OSU), the state of Oklahoma, and the global unmanned community.

OUR VISION

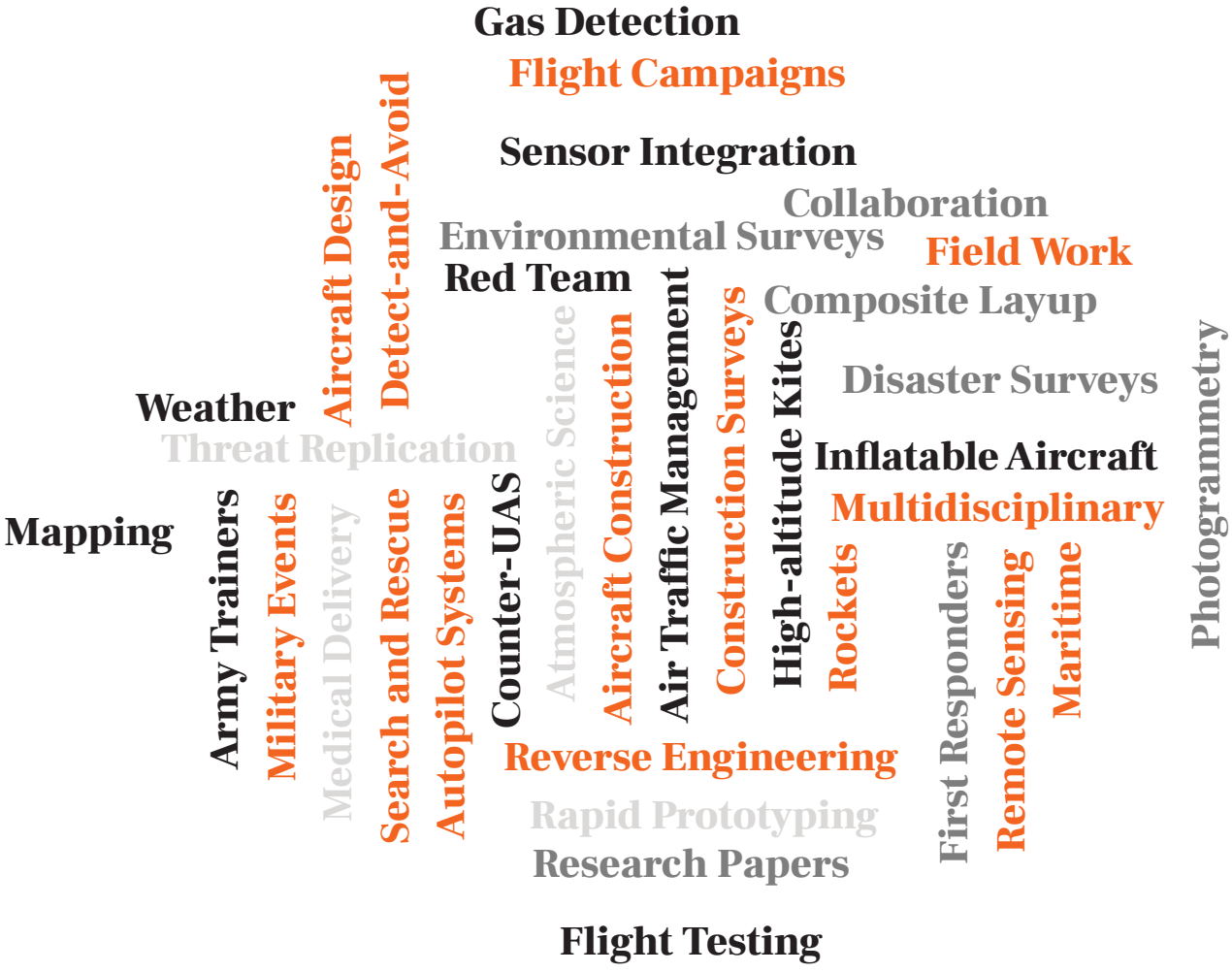
USRI will create an aerospace engineering center of excellence that attracts cutting edge research related to unmanned systems and a staff who is passionate about their work and their impact in the industry. USRI will provide resources for OSU locally and industry leaders globally.



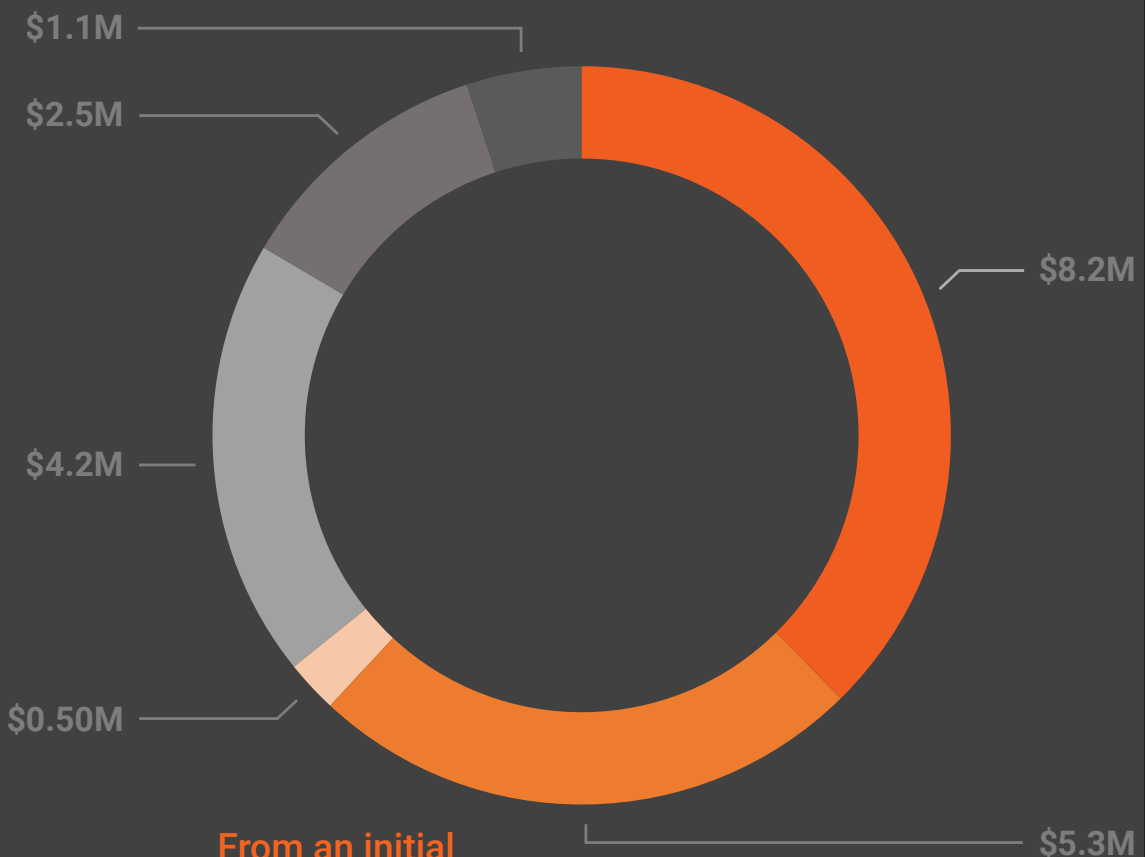

REACH
FOR
THE
SKY

WHAT DO WE DO? A LITTLE BIT OF EVERYTHING.

USRI's broad portfolio of expertise allows us to perform an array of services to OSU and outside entities.



USRI and collaborators have brought in over **$21M**

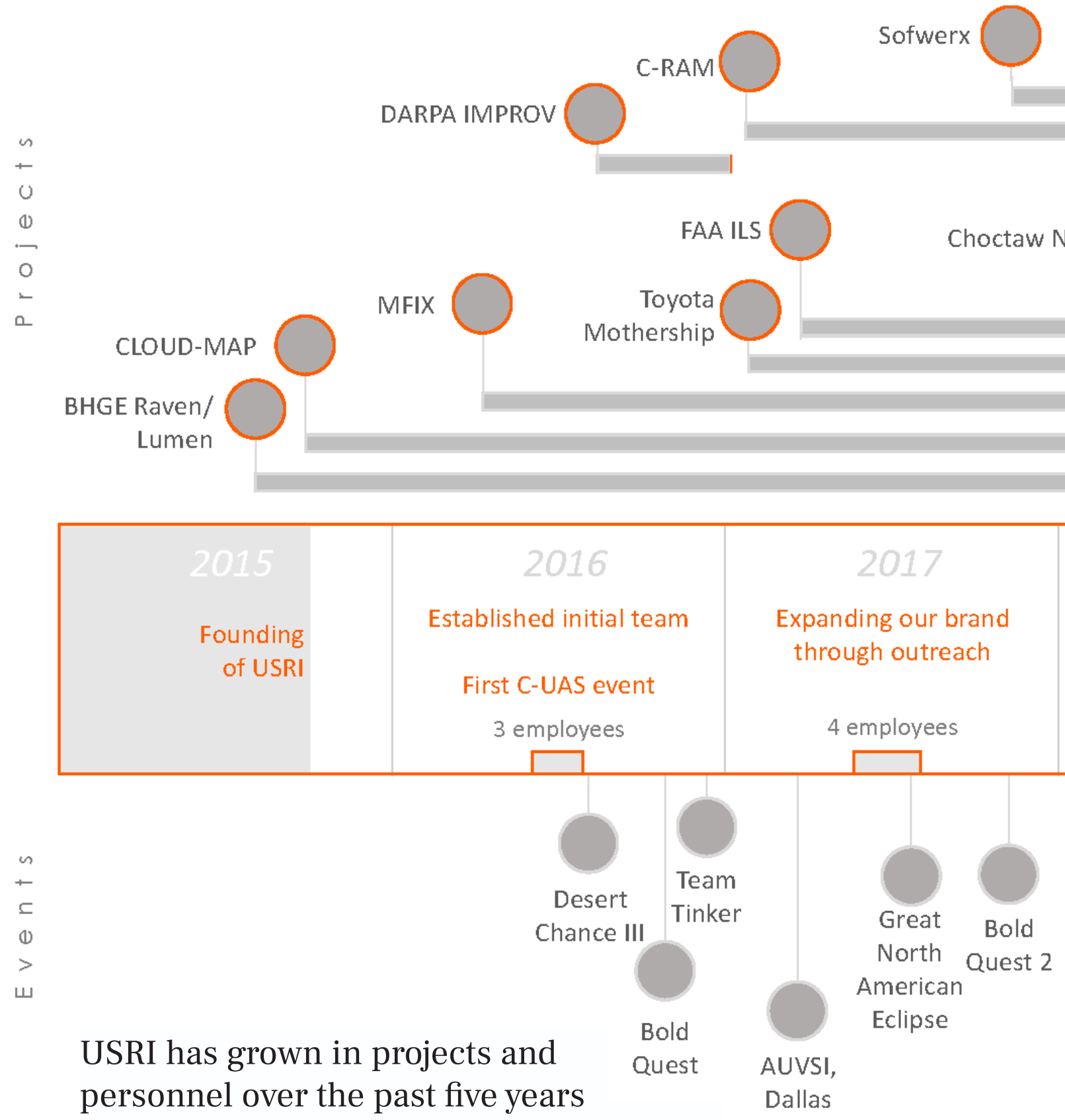


From an initial investment of **$1.8M**

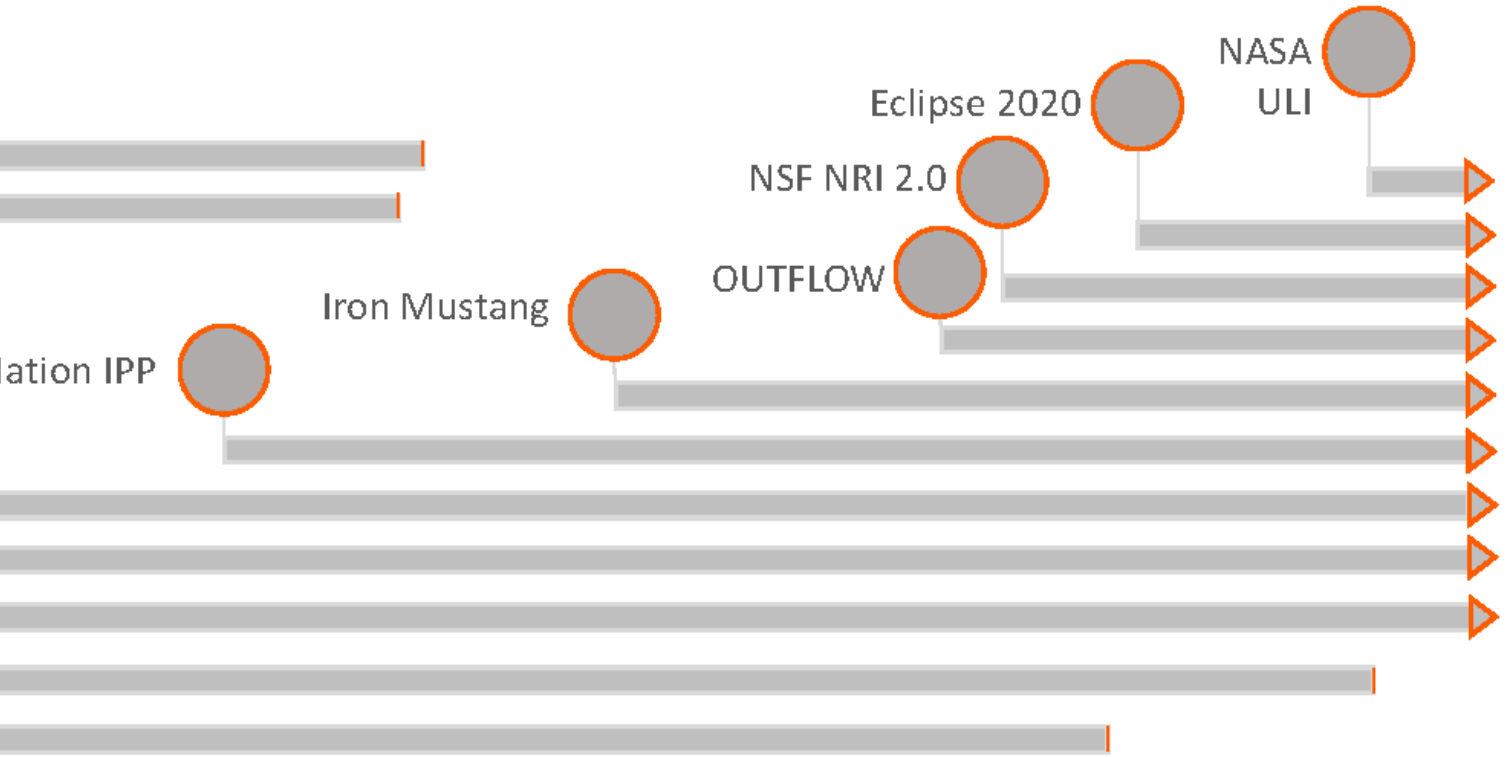
- NSF
- NASA
- OCAST
- Defense
- Commercial
- FAA

Over the past five years, USRI has brought in over $12 million in external research funding.

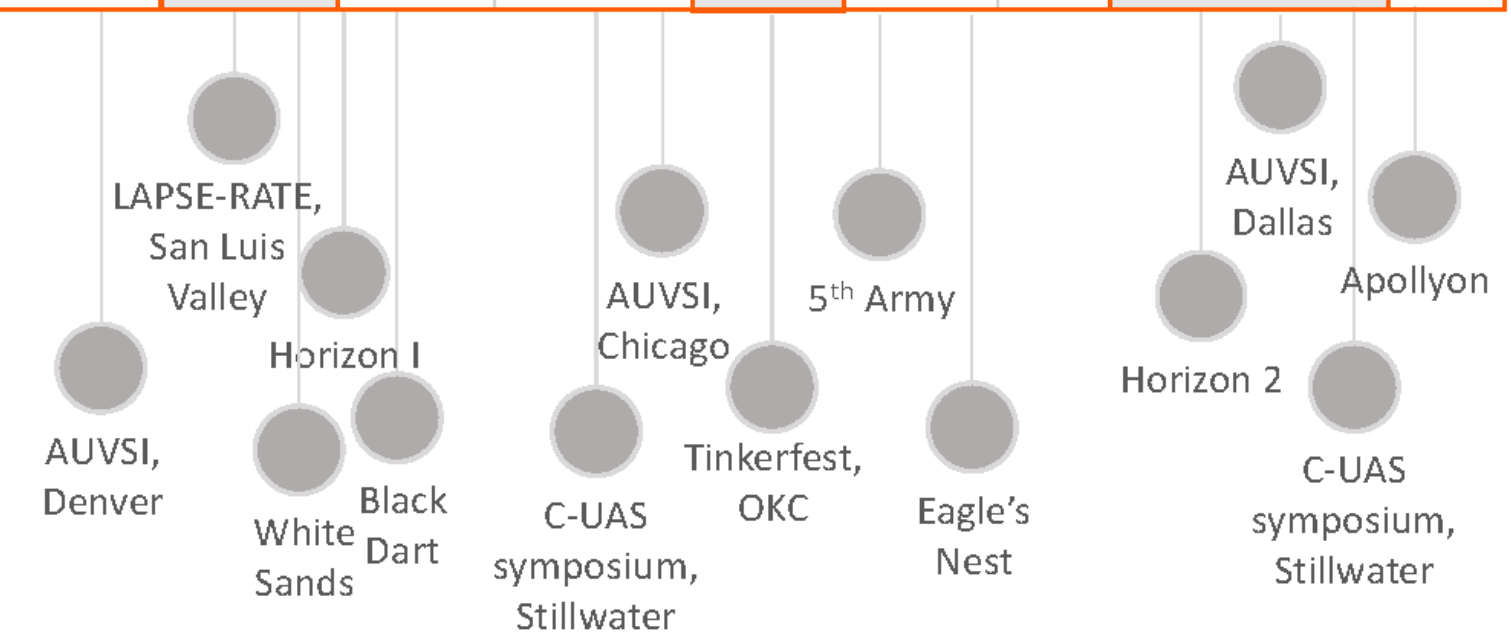
FUNDING SOURCES



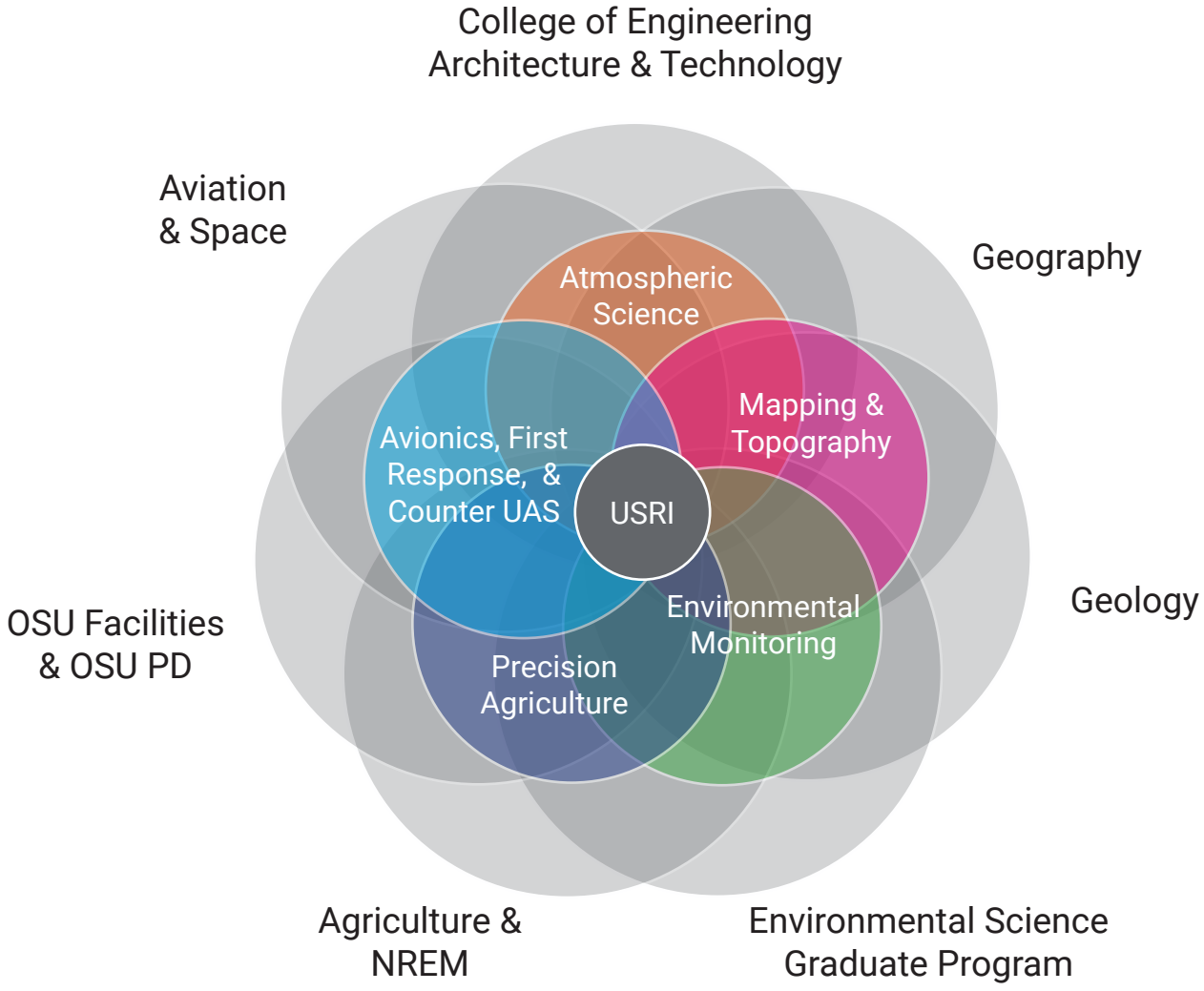
USRI has grown in projects and personnel over the past five years providing the ability to support multiple programs simultaniously.


NASA ULI
Eclipse 2020
NSF NRI 2.0
OUTFLOW
Iron Mustang
lation IPP


2018
Increasing scope
Multiple flight campaigns
7 employees
2019
Focusing on project growth
6 employees
2020
Forward Expansion
11 employees


AUVSI, Denver
LAPSE-RATE, San Luis Valley
Horizon I
White Sands
Black Dart
C-UAS symposium, Stillwater
AUVSI, Chicago
Tinkerfest, OKC
5th Army
Eagle's Nest
AUVSI, Dallas
Apollyon
Horizon 2
C-UAS symposium, Stillwater

Working at the center of the diagram.



SUPPORTING OSU...

Our core mission is to assist entities across campus with their unmanned needs.

Whether it is flights, system development, data collection, or expertise they are looking for, we are available to assist the university and further collaborative partnerships across campus.

USRI exists at the center of the diagram and is the bridge between unmanned technology and multi-disciplinary research.

FACULTY

Jamey Jacob

Director of USRI | Professor | John Hendrix Chair
Autonomous Systems, Atmospheric Science,
Environmental Monitoring
2015 - Present

Formed by

Andrew S. Arena, Jr.

Executive Director | Professor | Cunningham Chair
Aircraft Design, Flight Testing,
Aerodynamics, Control
2015 - Present

Richard J. Gaeta Jr.

CTO | Affiliate Professor
Propulsion, Aeroacoustics, Flow Control
2015 - 2020

excellence...

NEW FACULTY

Kurt P. Rouser

Assistant Professor
Gas Turbine and Rocket Propulsion,
Hybrid Power
2017 - Preset

Imraan A. Faruque

Assistant Professor
Flight Control, Guidance and Navigation,
Biological Systems
2017 - Present

...and met

Nicoletta Fala

Assistant Professor
Human Factors, Systems Engineering,
Pilot Training
2019 - Present

Ryan Paul

Assistant Professor
Unsteady Aerodynamics, Large UAS,
Flight Testing
2020 - Present

with growth.

AFFILIATE FACULTY

MAE

- He Bai
- Brian Elbing
- Rushi Kamalapurkar
- Arvind Santhanakrishnan

ECE

- Sabit Ekin
- John O'Hara
- Weihua Sheng
- James West

CEES

- David Lampert
- Deb Mishra

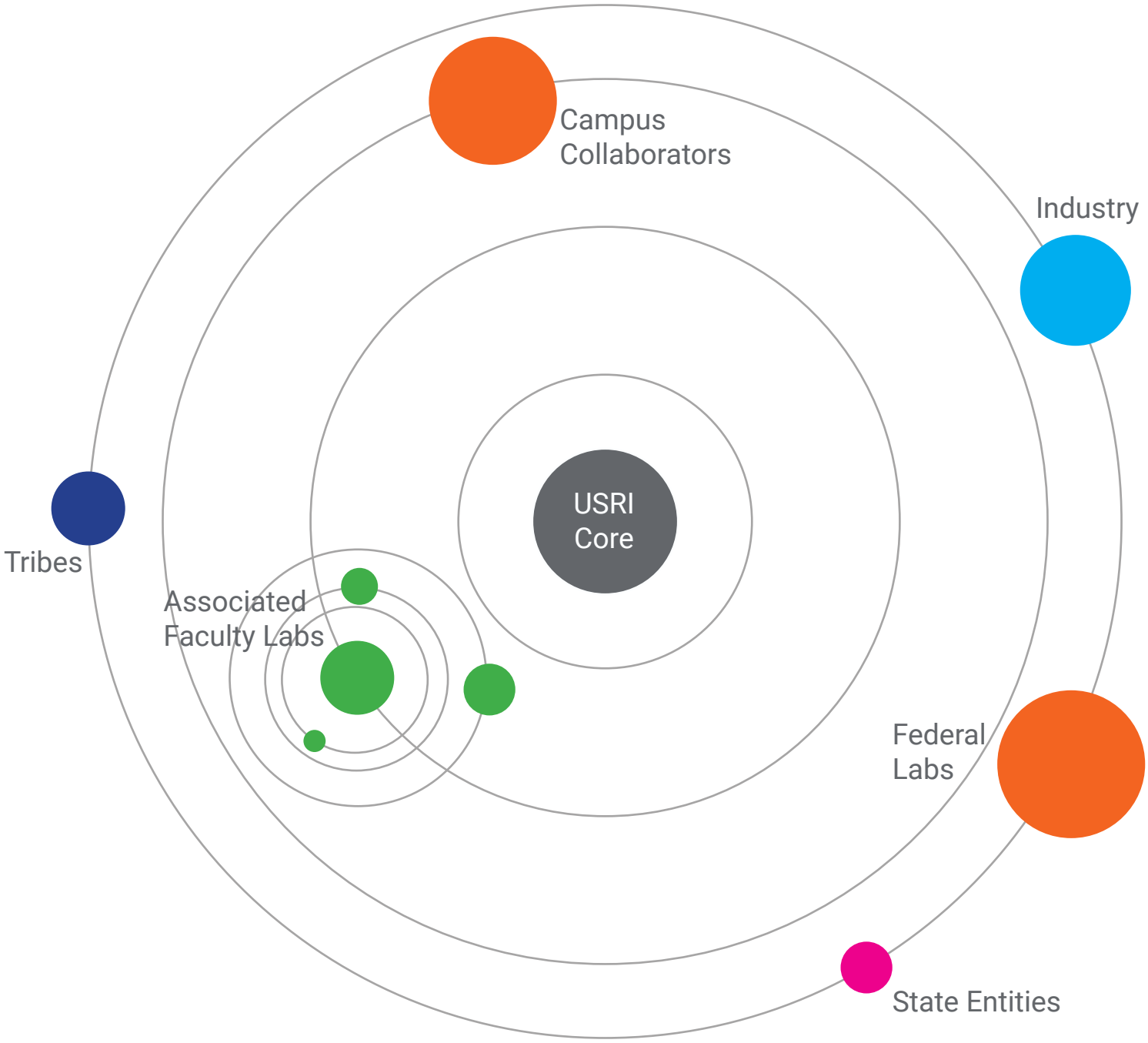
Other

- Hamed Gholizadeh (Geography)
- Gopal Kakani (PSS)
- Scott Loss (Animal Science)
- Ning Wang (BAE)
- Scott Stoodley (ESGP)
- Saleh Taghvaeian (OWRC)
- Paul Weckler (BAE)
- Yuting Zhou (Geography)
- Phil Alderman (PSS)
- Ahmed Ismail (Geology)
- Priyank Jaiswal (Geology)
- Brian Arnell (Agriculture)
- JD Carlson (NREM)

USRI works with a variety of faculty across campus to assist them in drone related research. Significant research collaboration results in USRI affiliate faculty status, providing faculty with recognition of their involvement with USRI.


“Adventure is worthwhile in itself.”
- Amelia Earhart

OUR COLLABORATION STRUCTURE



USRI can pull from a multitude of available resources and experts to complete projects.

“Once you have tasted flight, you will forever walk the earth with your eyes turned skyward, for there you have been, and there you will always long to return”

– Leonardo Da Vinci

EXCELSIOR!


Oklahoma State University
Unmanned Systems
USRI
Research Institute
Oklahoma State
University
College of


USRI


USRI
Oklahoma State
University
College of
Engineering,
Architecture,
& Technology

Excelsior's grand opening was on November 2, 2019. It provides the Unmanned Systems Research Institute with state-of-the-art offices, machinery, tools, technology, and collaboration spaces.

Excelsior in Latin means "Ever upward!" This embodies USRI's continued efforts to looks to the future of technology and UAVs.

Facility Capabilities

- **Collaboratory**
- **Rapid Prototyping**
- **Large Multipurpose Meeting Space**
- **Propulsion Test Cell**
- **Manufactring**
- **Dedicated Project Rooms**

ADDITIONAL FACILITIES

Discovery

Discovery is located in Oklahoma City and the newest addition to USRI's facilities. It houses state of the art labs, conference rooms, and offices.

Richmond Hill (RH)

Richmond Hills (RH) houses additional projects requiring more secure access. It's proximity allows USRI staff, students, and collaborators to use both facilities to complete an array of projects.

Unmanned Aircraft Flight Station

The UAFS is utilized for flight testing, including swarming and a one-of-a-kind beyong visual line of sight corridor for long range advanced aerial mobility flights.

DML & ATRC

The DML and ATRC provide USRI with additional tools and machines to successfully complete projects, as well as additional office and meeting spaces as USRI grows.

Endeavor

Endeavor provides various additional lab space for USRI, particularly it's multi-story indoor flight test arena.

STAFF

Kathleen McNamara
Reseach Engineer
“Let’s go!!!”

Taylor Mitchell
Chief Engineer
“I’ll get the car.”

Levi Ross
Reseach Engineer
“”

Victoria Natalie
Engineer Director
“...to the moon.”

Rylee Kohn
Personel Liason
Marketing Media Specialist
“I’m a good listener”

Rakshit Allamraju
Controls
Reseach Engineer
“Oh its easy, you just have to use Linux.”

Ben Loh
Senior Research and Development Engineer
“It’s not a death star.”

USRI has a robust staff that brings numberous skills and assets to the table and allows USRI to achieve an array of projects. Our team is comprised of the next generation of engineers and innovators who are pushing the boundaries of autonomous systems, research, design, and implementation.

Ever upward!

USRI ALUMNI SPOTLIGHT

Zach Barbeau
2017 Graduate

Zach worked on UAS flight operations in conflicted airspace and is now an engineer at Dynetics.

Racine Swick

2019 Graduate

Racine worked on GIS and environmental monitoring. She is now at University of Arkansas Graduate School and International Education studying Geography/ Space & Planetary Science.

Ben Hemingway

2019 Graduate

Ben developed techniques to determine optimal UAS configurations to observations. He now works at NASA.

Alyssa Fehrenbach

2019 Graduate

Alyssa developed techniques for modeling UAV icing and performed unique UAS icing tests. She is now an instructor and research scientist at OSU.

STUDENT INVOLVEMENT

UNDERGRADUATE STUDENTS

Zach Bettinger

AJ Burba

Andrew Cole

USRI empowers students to design their own future through participation in collaborative cutting edge research, multi-disciplinary events, and real-world training.

Charli DiCarlo

Rannock Thomas

Alexis Vance

PROJECTS

BHGE

- 2015 – 2019
- Methane sensing and mapping of well pads to identify and measure gas leaks.

CLOUD MAP

- 2015 - 2020
- Multi-institution project researching the application of UAS technology in atmospheric research.

Toyota

- 2017 - Ongoing
- Research effort to explore inflatable and other high-altitude kite structures for future power generation and communication efforts including a world record attempt for highest altitude kite.

NSF NRI

- 2020 - Ongoing
- Multi-disciplinary project exploring how UAS can aid in aviation weather predictions.

F A A

- 2017 – ongoing
- Partnership with FAA Mike Maroney Center in OKC to autonomously calibrate airport landing systems.

Integration Pilot Program

- 2018 - ongoing
- One of the partner organizations with the Choctaw Nation's IPP site – a White House program that explores technology and advances using UAS in the national airspace.

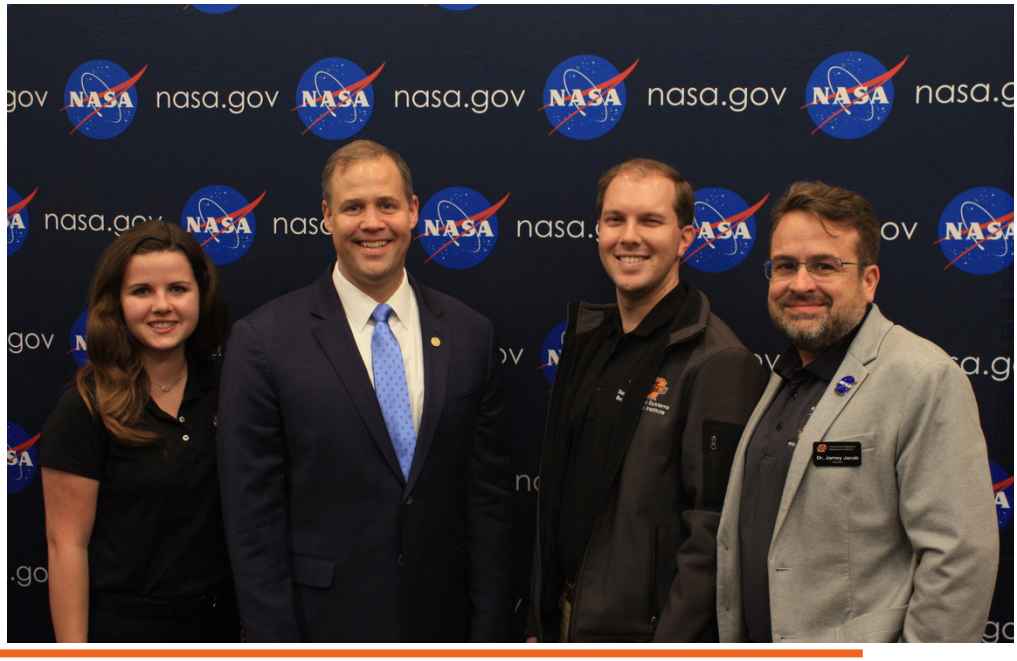
< Michael Kratsios, U.S. Chief Technology Officer and Deputy Assistant to the President at the White House Office of Science and Technology visiting with USRI's team.

Vigilant Aerospace

- 2019 - ongoing
- OCAST-funded project with an Oklahoma based company to develop a collision avoidance infrastructure to allow UAS to fly beyond visual line of sight

OUTREACH

USRI assisted in testing medical supply drops and the feasibility of transporting COVID tests with drones during the COVID-19 pandemic.



OSU team with NASA Administrator Jim Bridenstine. OSU was recently awarded a $5.2 M NASA University Leadership Initiative

FAA ACIS

Tinkerfest

FAA Summer Camp

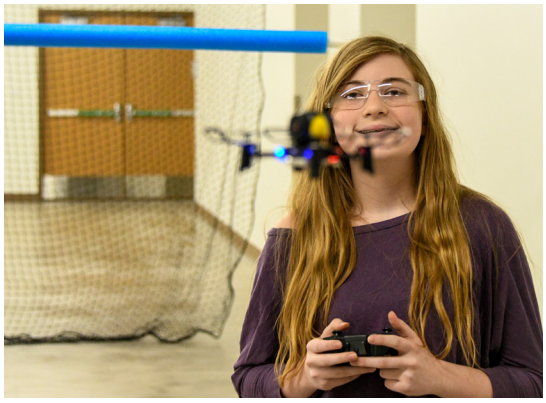
AUVSI

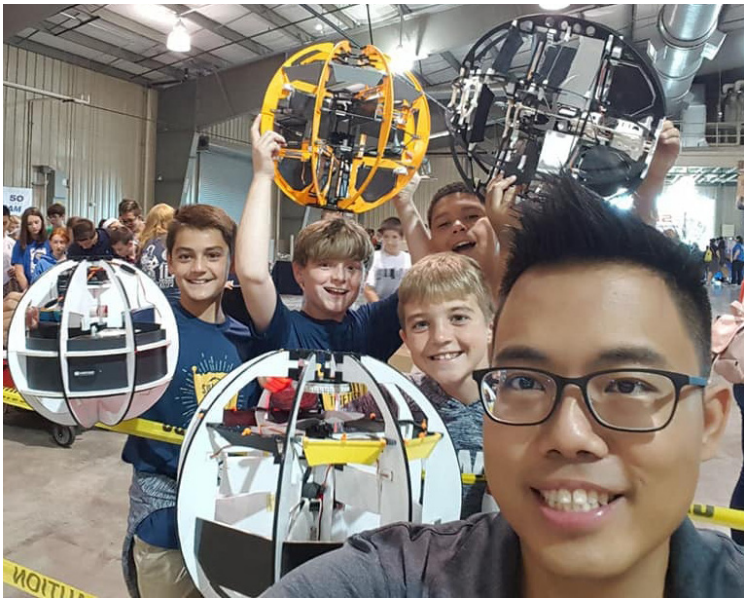
Flight Night - Nordam

Choctaw Nation

High School Summer Program

4H





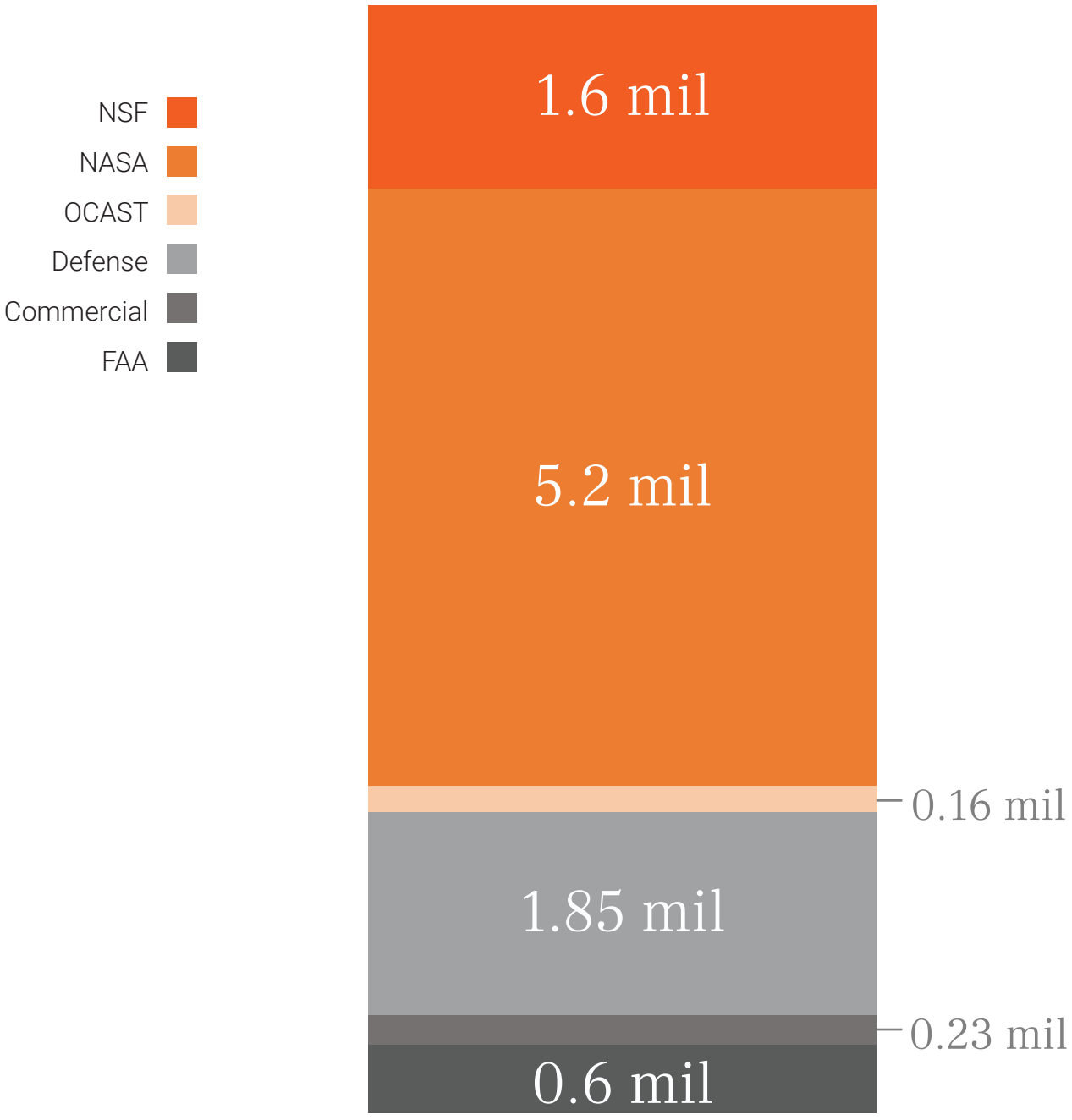
USRI strives to connect with the community to educate and foster interest in unmanned systems and provide STEM engagement to reach the engineers of the future.

STEM ENGAGEMENT

"Things are only impossible until they're not."

-Captain Jean-Luc Picard

FUNDING OUTLOOK STARTING IN 2020



“Step onto the road, and if you don’t keep your feet, there is no knowing where you might be swept off to”

- JRR Tolkien

NEXT STEPS

Foster projects and partnerships

We have a multi-disciplinary approach to our research and support campus and state-wide entities with their autonomous needs.

Increase entity awareness

We are active in the UAS community and strive to support local and global entities through our specialized expertise.

Develop advancing technologies

We aim to remain at the leading edge in this emerging industry and are constantly expanding our understanding of UAS tech.

Promote OSU leadership

Establish national centers to promote OSU's leadership in UAS

Expand and grow with the industry

As we continue to grow with this revolutionary technology, USRI looks to a collaborative future that is quick paced and exciting in order to bridge the gap between UAS and our clients.

FUTURE TIER 1 GOALS

As part of OSU's Tier 1 mission, over the next 5 years USRI will focus on developing national centers and assets that build on current expertise while expanding into new research directions. USRI will continue to work with colleges across the OSU campus to support any and all fields that can benefit from this new technology. These centers will establish OSU and Oklahoma as national leaders in autonomous systems, advanced air mobility, and aerospace engineering and help create a nexus of opportunities for faculty, students, and industry.

Opening a National Counter-UAS Center of Excellence

To support the continuing DoD mission, OSU will open a Counter-UAS Center of Excellence in 2021 to focus on developing and evaluating technologies to detect, identity, and mitigate threats from nefarious autonomous systems. This center will work directly with Ft. Sill and the Army-led Joint C-sUAS Office.

Establishing an Advanced Aerial Mobility Living Laboratory for Medical Delivery and First Response in Urban Areas

To support the growing advanced aerial mobility and urban air markets, USRI will work with the Tulsa Innovation Laboratories to establish a living laboratory capability in unmanned traffic management and autonomous delivery in the Tulsa region. USRI will work with tribal entities, the city of Tulsa, and regional interests to meet critical needs as part of demonstration exercises with operations planned to start in 2022.

Found a NSF Engineering Research Center for Drones in Weather, Wildfire and the Environment

Continue efforts in UAS in weather and wildfire building on the $6M NSF CLOUDMAP and $5M NASA WINDMAP programs, focused on establishing NSF centers for autonomous systems in weather and wildfire. As weather, wildfire, and environmental threats continue to increase, we will develop partnerships with federal entities and states to lead the development and use of this technology in the 21st century.

Developing Drones for NASA Interplanetary Exploration

As NASA continues to deploy robotic platforms for interplanetary exploration across the solar system, we will expand on our relationship with NASA centers to help develop autonomous platforms for the next stage of flight on Mars, Venus, Titan, and beyond to inspire the next generation of engineering and scientific pioneers.

Contact Us

usri.okstate.edu

EXCELSIOR
OKLAHOMA STATE UNIVERSITY
835 N. WILLIS ST.
STILLWATER, OK 74078-5016

usri@okstate.edu


USRI