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**Annual Research Report - FY2012**

From the design of mirrors that peer deep into space, to the creation of new techniques to detect bone loss, to the development of rapid diagnostics that characterize infectious diseases and biothreat agents, research at Arizona's public universities leads to real innovations that translates into technologies and products that improve lives and stimulate our economy.

These advances are the products of intense research and development. Much of the innovation that improves people's lives springs from university research and Arizona's public universities are critical incubators for such research and activity.

The body of knowledge created by university research can be measured in part by inventions, patents and start-up companies, all of which fuel the private sector and translate into jobs – high-paying, high-skill jobs.

The Arizona Board of Regents has defined several metrics by which it measures the growth of its research enterprise in the university system and in every metric, it continues to make steady progress.

Through research activity at the universities, millions of dollars are reinvested annually into the community. In 2012, Arizona's public universities brought in more than \$1 billion in research expenditures, dollars that drive purchases and employment within Arizona. Research activity also directly resulted in 15 different startup companies, nearly 400 invention disclosures, 47 U.S. patents issued, and public-private partnerships which will help fuel Arizona's economy going forward.

Funding research is a high priority for the enterprise. In addition to major grants and other funding sources, cross-university collaboration, long-range strategic research planning, and the hiring of nationally-recognized faculty in specific areas will help the enterprise fund its research initiatives. In addition, research collaborations with industry and entrepreneurial companies will help to promote economic growth in the state.

Increasing the research capabilities and performance of the Arizona University System to a level of competitive prominence with peer rankings of top American research universities is a significant part of the regents' overarching goal to contribute to the vitality of Arizona's future.

The information in this report demonstrates that the discovery and innovation taking place at Arizona's public universities is expanding and that translates to more discoveries, a better quality of life for Arizonans, and more jobs for the State.

## The Report's Design

This report provides an in-depth and comprehensive review of Arizona's higher education research enterprise. It is designed to allow the reader to easily locate any single research metric or indicator for any of Arizona's three public universities and quickly compare each Arizona university's performance against those of its Board-approved peers.

The metrics are categorized into five areas for each university:

- Enterprise size
- Discovery and scholarly impact
- Economic development
- Leadership and recognition
- Technology transfer activity

A review of the metrics in these five areas will provide the reader with a better understanding of the progress being made by Arizona's public universities toward creating new knowledge, finding solutions for challenges in Arizona and worldwide, and creating economic opportunity for the state.

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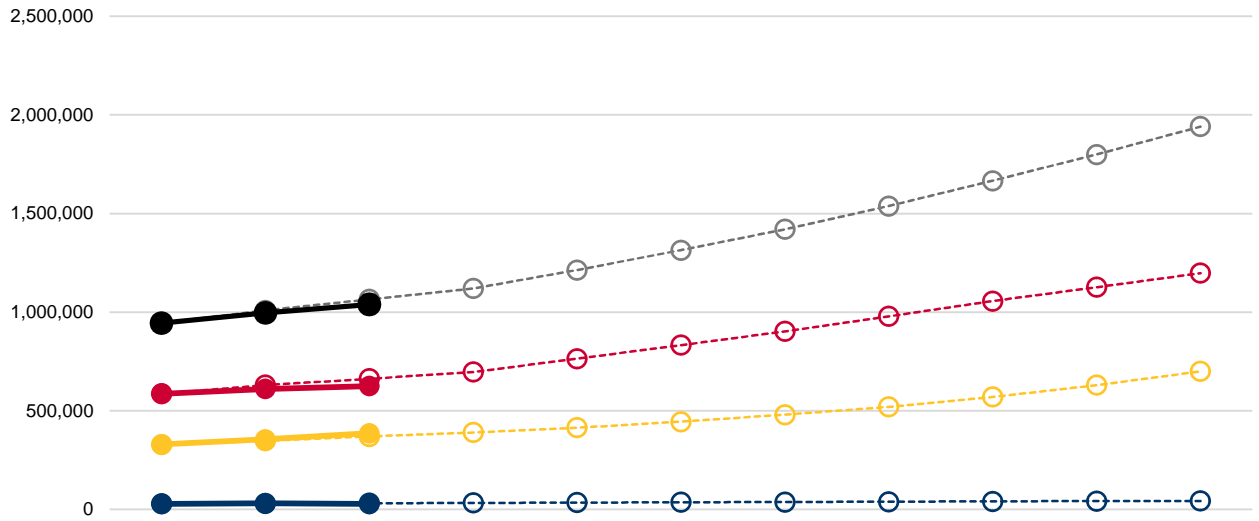


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## **Enterprise Metrics**

# Enterprise Size

Total Research Expenditures (in Thousands)



ABOR Enterprise Plan	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	945,080	1,009,276	1,065,160	1,120,569	1,213,978	1,314,387	1,420,796	1,538,205	1,666,614	1,799,023	1,941,432
Actual	944,795	996,565	1,039,424								
Difference	-285	-12,711	-25,736								

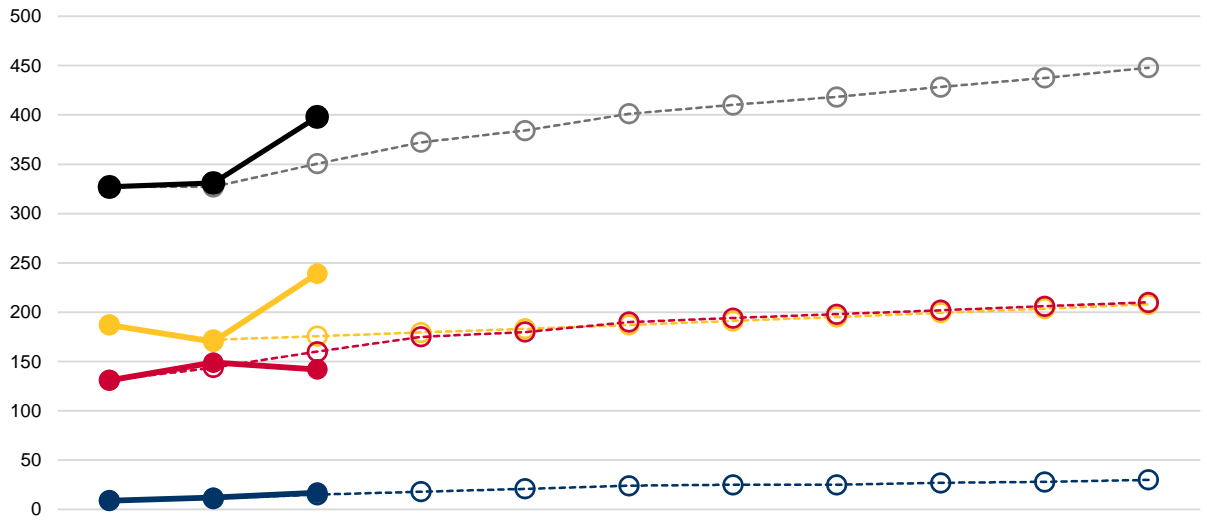
Arizona State University	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	329,345	348,525	370,000	390,000	415,000	445,000	480,000	520,000	570,000	630,000	700,000
Actual	329,345	355,215	385,959								
Difference	0	6,690	15,959								

Northern Arizona University	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	28,803	30,751	32,160	33,569	34,978	36,387	37,796	39,205	40,614	42,023	43,432
Actual	28,803	30,785	28,100								
Difference	0	34	-4,060								

The University of Arizona	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	586,932	630,000	663,000	697,000	764,000	833,000	903,000	979,000	1,056,000	1,127,000	1,198,000
Actual	586,647	610,565	625,365								
Difference	-285	-19,435	-37,635								

# Discovery and Scholarly Impact

Invention Disclosures Transacted



ABOR Enterprise Plan	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	327	327	351	372	384	401	410	418	428	438	448
Actual	327	331	398								
Difference	0	4	47								

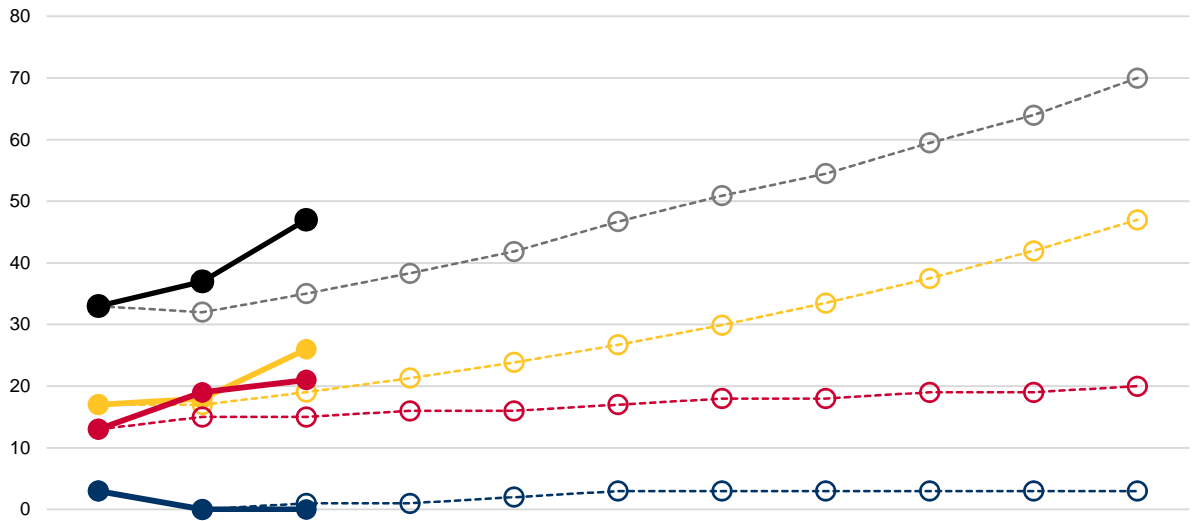
Arizona State University	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	187	172	176	179	183	187	191	195	199	204	208
Actual	187	170	239								
Difference	0	-2	63								

Northern Arizona University	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	9	11	15	18	21	24	25	25	27	28	30
Actual	9	12	17								
Difference	0	1	2								

The University of Arizona	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	131	144	160	175	180	190	194	198	202	206	210
Actual	131	149	142								
Difference	0	5	-18								

# Discovery and Scholarly Impact

U.S. Patents Issued



ABOR Enterprise Plan	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	33	32	35	38	42	47	51	54	59	64	70
Actual	33	37	47								
Difference	0	5	12								

Arizona State University	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	17	17	19	21	24	27	30	33	37	42	47
Actual	17	18	26								
Difference	0	1	7								

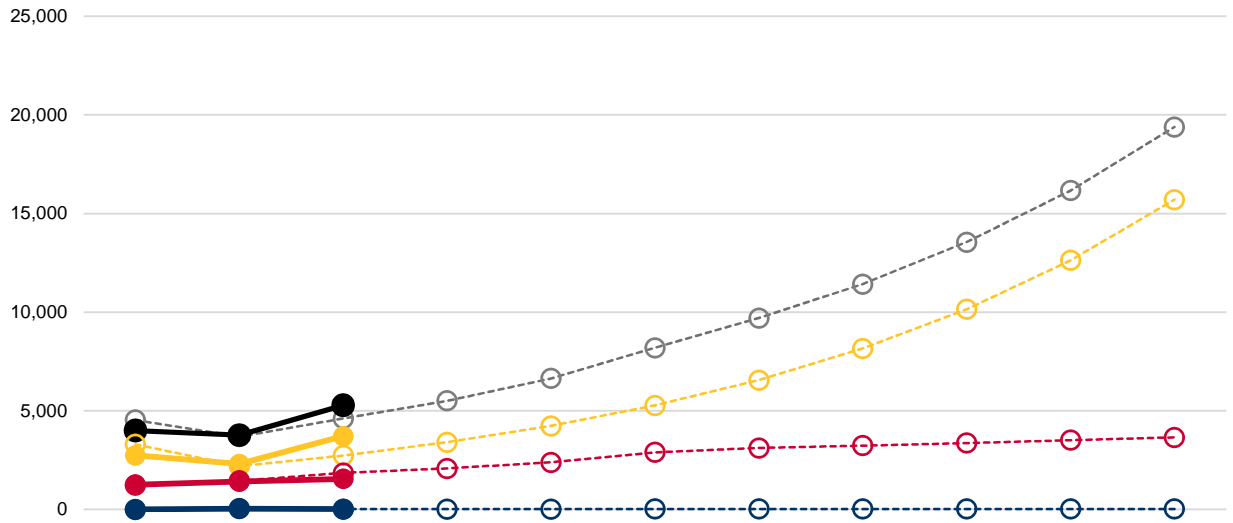
Northern Arizona University	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	3	0	1	1	2	3	3	3	3	3	3
Actual	3	0	0								
Difference	0	0	-1								

The University of Arizona	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	13	15	15	16	16	17	18	18	19	19	20
Actual	13	19	21								
Difference	0	4	6								



# Economic Development

Intellectual Property Income (in Thousands)



ABOR Enterprise Plan	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	4,533	3,690	4,607	5,506	6,647	8,193	9,700	11,422	13,544	16,164	19,389
Actual	4,003	3,764	5,284								
Difference	-530	74	677								

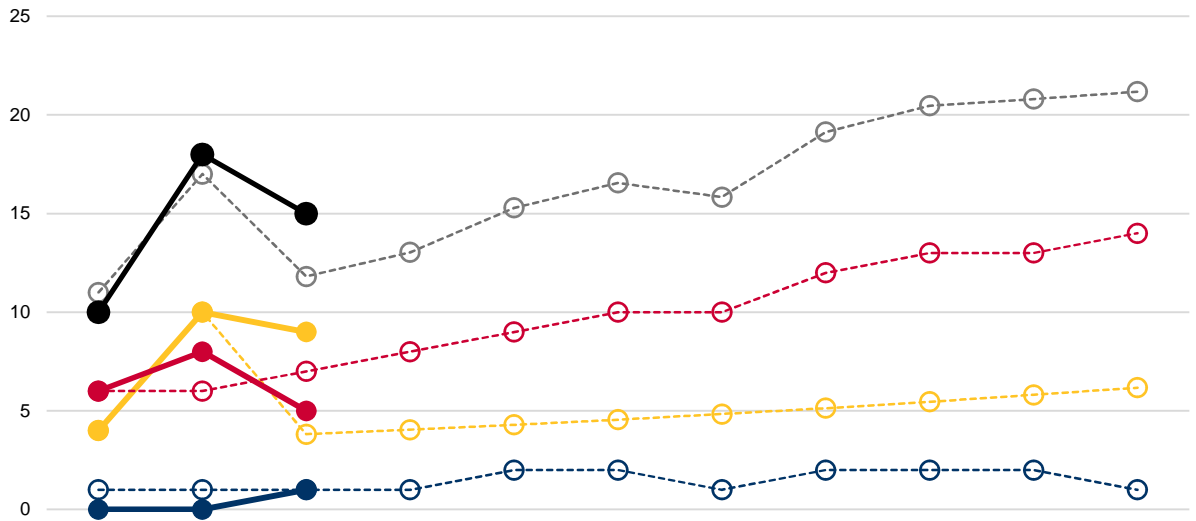
Arizona State University	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	3,300	2,200	2,737	3,405	4,236	5,271	6,557	8,158	10,149	12,627	15,709
Actual	2,742	2,307	3,716								
Difference	-558	107	979								

Northern Arizona University	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	3	40	20	21	21	22	23	24	25	27	30
Actual	3	43	18								
Difference	0	3	-2								

The University of Arizona	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	1,230	1,450	1,850	2,080	2,390	2,900	3,120	3,240	3,370	3,510	3,650
Actual	1,258	1,414	1,550								
Difference	28	-36	-300								

# Economic Development

## Startup Companies



ABOR Enterprise Plan	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	11	17	12	13	15	17	16	19	20	21	21
Actual	10	18	15								
Difference	-1	1	3								

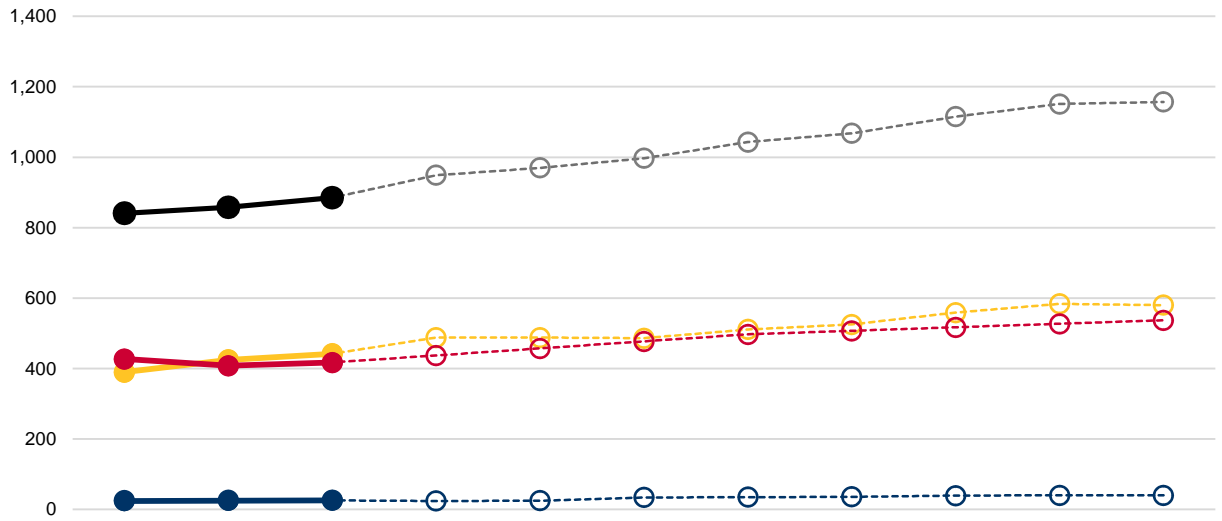
Arizona State University	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	4	10	4	4	4	5	5	5	5	6	6
Actual	4	10	9								
Difference	0	0	5								

Northern Arizona University	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	1	1	1	1	2	2	1	2	2	2	1
Actual	0	0	1								
Difference	-1	-1	0								

The University of Arizona	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	6	6	7	8	9	10	10	12	13	13	14
Actual	6	8	5								
Difference	0	2	-2								

# Economic Development

## Ph.D. Degrees Conferred



ABOR Enterprise Plan	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	842	859	885	949	970	997	1,043	1,068	1,115	1,151	1,157
Actual	841	858	885								
Difference	-1	-1	0								

Arizona State University	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	390	425	442	488	488	486	511	525	559	584	580
Actual	390	425	442								
Difference	0	0	0								

Northern Arizona University	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	25	26	26	24	25	34	35	36	39	40	40
Actual	24	25	26								
Difference	-1	-1	0								

The University of Arizona	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Goal	427	408	417	437	457	477	497	507	517	527	537
Actual	427	408	417								
Difference	0	0	0								

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**Annual Research Report - FY2012**

I am pleased to present this annual research update for Arizona State University (ASU). During fiscal year 2012 (FY12), ASU faculty and researchers made significant advances in research, generated new knowledge, and achieved economic and social impact. ASU remains one of the fastest growing research enterprises over the last five years among U.S. universities with portfolios exceeding \$100 million in research expenditures. The contributions of faculty and researchers are helping realize ASU's commitment to:

- Become a leader in trans-disciplinary science and technology discovery and development,
- Enhance research competitiveness to achieve \$700 million in annual research expenditures by 2020,
- Enhance regional economic competitiveness through advanced research, and value-added education programs, and
- Accelerate innovation and entrepreneurship through new approaches to technology transfer and startup incubation programs.

This bold vision is being achieved through the engagement of faculty members across disciplines, including collaborations between engineers, artists, natural and social scientists, and humanists. By retaining top talent and attracting exceptional new faculty and initiative leaders, ASU continues to accelerate the growth of this dynamic research enterprise.

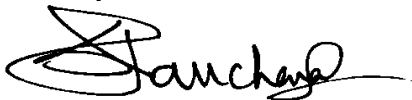


As a New American University, ASU recognizes the importance of communicating research not only to academic peers, but also to local communities whom we interface with and serve. Events throughout FY12 engaged community members to learn about the exciting range of research efforts at ASU.

Essential to ASU's success has been our commitment to advancing entrepreneurship in higher education. We have created an ecosystem of innovation through the establishment of programs and pathways for ideas and academic research to be translated into products, processes, and businesses. The epicenter of ASU's entrepreneurship and innovation programs is at the SkySong Scottsdale Innovation Center. The Venture Catalyst and Edson Student Entrepreneur programs, along with Arizona Technology Enterprises (AzTE), ASU's exclusive intellectual property management and technology transfer organization are located at SkySong. The spirit of entrepreneurship is vibrant throughout ASU and the resulting partnerships and opportunities are generating real impact beyond the university.

The following research update presents ASU's FY12 achievements and their impact.

Sincerely,

A handwritten signature in black ink, which appears to read "Sethuraman Panchanathan". The signature is fluid and cursive, written over a white background.

Sethuraman "Panch" Panchanathan

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**Enterprise Size**

# Enterprise Size

## Introduction

ASU is embarking on an ambitious goal to double our research volume and more importantly, accelerate the impact of our research. Achievement of this goal requires strategic growth in all disciplines, including humanities and arts, social sciences, physical and natural sciences, engineering and technology, coupled with commitment to conduct trans-disciplinary, use-inspired, socially-engaged research. By breaking down barriers between traditional disciplines and focusing on research designed with societal and technological purpose and impact, ASU has created a vibrant environment of collaboration, discovery, and innovation. Our trans-disciplinary efforts in personalized medicine, alternative energy, earth and space exploration, sustainability, security and defense, learning and teaching sciences, and social sciences all accelerated in FY12 and our arts and humanities portfolio continued to expand.

At the core of the entire research enterprise are ASU's faculty, students and staff. Together they have engaged in a myriad of research activities, from small individual efforts to very large multi-investigator campaigns. The results in terms of funding and research expenditures are quite striking. ASU researchers submitted proposals worth a total value of \$1.2 billion and received \$315 million in externally funded awards in FY12. Overall, ASU achieved \$386 million in total research expenditures, representing an 8.7% growth over FY11 and more than 200% growth since FY02. The research enterprise at ASU continues to grow strategically in diverse fields, encourages synthesis of ideas and activities across disciplines, and drives to improve ASU's reputation; as a result ASU has created a vibrant environment of collaboration, discovery, and innovation.

The approach of coupling use-inspired research and trans-disciplinary solutions has been effective in growing the overall research enterprise. Consistent with this, ASU's comparative rankings as illustrated by several indicators of the National Science Foundation (NSF) have risen,

- 17th in total research expenditures for academic institutions without a medical school.
- 19th out of 912 in non-science and engineering total research expenditures.
- 8th out of 912 in social sciences total research expenditures.
- 14th out of 912 in humanities total research expenditures.
- 21st in NSF funding by total value of FY12 awards.
- 17th in NSF funding by number of FY12 awards.



To expand and accelerate our growth, the University continues to invest in new research space and facilities. For example, the construction of ASU's single largest research building, Interdisciplinary Science and Technology Building IV (ISTB IV), was completed in FY12. Located on the Tempe campus, it houses more than 160 labs-including 81 labs capable of biological and chemical experiments and 73 labs for computer analysis and applied mathematics-plus 60 faculty offices and a 250-seat auditorium. Programs occupying the eight-story, 293,000-square-foot space include selected research laboratories and centers of the Ira A. Fulton Schools of Engineering, the School of Earth and Space Exploration (SESE), and the Security and Defense Systems Initiative. The collaboration space throughout the building was designed to encourage meaningful interactions across labs and disciplines, and the public.

In addition, ASU celebrated the opening of the 5,500-square-foot custom-designed Southwestern Center for Aberration Corrected Electron Microscopy. The center was dedicated in February 2012, becoming one of the premier microscopy facilities in the U.S. and further solidifying ASU as a leader in microscopy research and facilities. The \$3.3 million building was specially designed and built to house a new NSF funded \$5 million microscope that will advance materials and biological research. A unique aspect of the Center is its robust industry affiliates program, bringing local, national, and international industry based researchers to the facility. This Center exemplifies ASU's technical expertise and willingness to engage outside entities to facilitate the ongoing growth of the enterprise.

Seeking out and conducting trans-disciplinary, use-inspired, and socially-engaged research is instrumental to ASU's efforts to build and diversify its research portfolio, while cultivating recognition as a leading institution of higher education. Moreover, this strategy provides a mechanism to identify research problems that align strongly with the goals and missions of federal, foundation, and industrial funding by entities. This strategy also enables ASU to conduct the necessary planning for creating a high functioning, influential, and dynamic research enterprise.

## Enterprise Size

### *Selected Accomplishments*

- ASU maintains its distinction as being one of the fastest growing research enterprises over the previous five years among universities with portfolios exceeding \$100 million in research expenditures.
- Biodesign Institute scientists Drs. Stephen Johnston, Neal Woodbury, and George Poste were awarded a four-year contract worth \$30.7 million from the Defense Threat Reduction Agency of the U.S. Department of Defense (DOD). This project is aimed at developing and applying a novel diagnostic technology called immunosignaturing, which will allow the rapid detection of exposure to infectious disease agents before symptoms occur.
- The Global Institute of Sustainability received \$27.5 million from Rob and Melanie Walton of the Walton Family Foundation. This investment will be used to develop and deploy promising solutions to sustainability challenges.
- The Virginia G. Piper Charitable Trust established a \$10 million strategic investment fund to enable ASU to improve all aspects of health care delivery.
- ASU received a \$9 million investment from the McCain Institute Foundation to establish the McCain Institute for International Leadership. This institute will focus on promoting character-driven leadership, as well as research and decision-making in the areas of humanitarian work, human rights and national security.
- The Southwest Interdisciplinary Research Center (SIRC) received \$6.3 million of follow-on funding from the National Institute of Minority Health and Health Disparities of the National Institutes of Health (NIH). This award will enable SIRC to expand its research, education, training, community engagement, and outreach efforts over the next five years.
- The NIH has awarded over \$8 million for three grants to the College of Nursing and Health Innovation to study significant health issues in minority populations through community-based and community-focused interventions. The studies will examine ways to promote colorectal cancer screening among underserved populations, obesity prevention among low-income Mexican American women and children, and increase insulin sensitivity and weight specific quality of life in obese Latino adolescents
- Dr. Randy Nelson, director of the Molecular Biosignature Analysis Unit at the Biodesign Institute, was awarded a four-year, \$5 million investment from NIH aimed at discovering biomarkers that help predict cardiovascular disease and to assess potential new treatments in people with Type 2 diabetes.

## Enterprise Size

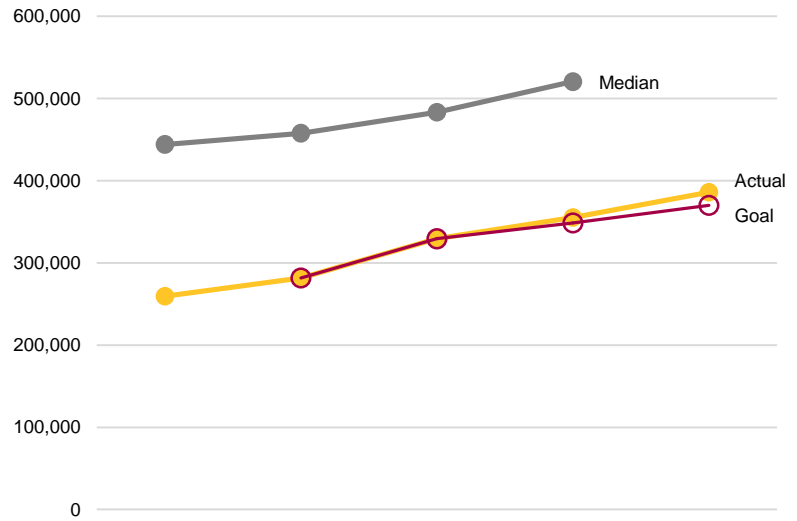
### Selected Accomplishments

- The Department of Energy (DOE) awarded \$15 million to the Algae Testbed Public-Private Partnership (ATP3), led by Dr. Gary Dirks, director of LightWorks. ATP3 will function as a testing facility for the algal research community, supporting the operation of existing outdoor algae cultivation systems and allowing researchers access to real-world conditions for algal biomass production for biofuel. Lightworks also led the submission of two United States Agency for International Development (USAID) proposals for \$22 million and \$15 million that focused on clean energy in partnership with teams from India and Vietnam, respectively.
- ASU submitted a \$100 million proposal to USAID to create the International Development Research Collaboratory. This truly trans-disciplinary effort leveraged over \$75 million in funds from domestic and international partners and offered USAID a transformative vehicle to craft development solutions.
- The Office of Global Outreach and Extended Education in the Ira A. Fulton Schools of Engineering submitted a \$6 million USAID proposal for continuation of the Higher Engineering Education Excellence Alliance Program (HEEAP 2.0), a partnership between ASU, Intel Vietnam, and USAID.
- Dr. Steven Corman, director of the Center for Strategic Communication, won a \$6 million grant from the DOD Defense Advanced Research Projects Agency to study narrative disruptors and inductors in a project titled “Mapping the Narrative Comprehension Network.”
- The Andrew W. Mellon Foundation awarded a grant of \$1.2 million beginning in March 2012, that will support the Center for Digital Antiquity Center’s operations and development. The Center develops, maintains and oversees the Digital Archaeological Record, the country’s largest digital repository of world-wide archaeological data and information. The grant enables the Center to greatly expand the content of its digital repository, to enlarge the community of users and to continue development and enhancement of software to improve the repository user’s experience.
- The recently published book, *Building Better Humans? Refocusing the Debate on Transhumanism*, is the culmination of a six-year project that brings together trans-disciplinary faculty to explore the social, legal, ethical, and religious implications of the futuristic scenario of transhumanism, the study of how humanity evolves using current and emerging technologies. The project, led by Dr. Hava Tirosh-Samuelson, professor in the School of Historical, Philosophical and Religious Studies, has been funded through the Metanexus Institute and the John Templeton Foundation. Under the auspices of ASU's Center for the Study of Religion and Conflict, the project has named 5 Fellows, brought in 23 visiting speakers, held 9 public lectures and 3 workshops, produced 5 books and 2 special issues; all demonstrating the impact of cross-disciplinary research collaboration.



# Enterprise Size

Total Research Expenditures (in Thousands)

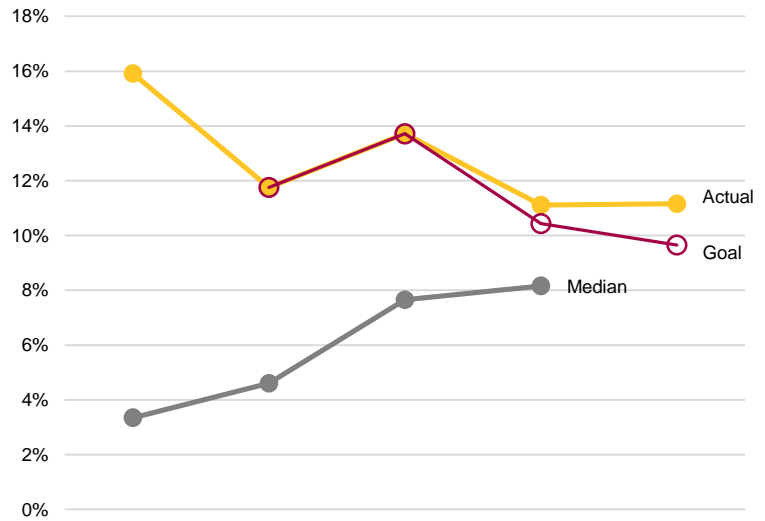


ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	259,503	281,588	329,345	355,215	385,959
Goal		281,588	329,345	348,525	370,000
Difference		0	0	6,690	15,959

ABOR Peer Group	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
University of Washington - Seattle	X	765,135	778,046	1,022,740	1,148,533		1
University of Wisconsin - Madison	X	881,777	952,119	1,029,295	1,111,642		2
University of California - Los Angeles	X	871,478	889,995	936,995	982,357		3
University of Minnesota - Twin Cities	X	682,662	740,980	786,074	847,419		4
Ohio State University - Columbus	X	702,592	716,461	755,194	832,126		5
Pennsylvania State University - University Park	X	620,430	662,955	677,995	699,464		6
University of Texas - Austin		493,294	506,369	589,502	632,171		7
University of Illinois - Urbana-Champaign		501,279	563,710	515,133	545,669		8
University of Maryland - College Park		395,037	409,190	451,415	495,382		9
Michigan State University	X	356,767	373,184	431,373	454,248		10
University of Iowa	X	293,564	329,901	444,034	443,893		11
Rutgers the State University of NJ - New Brunswick	X	297,693	320,275	428,432	432,306		12
<b>Arizona State University</b>		<b>259,503</b>	<b>281,588</b>	<b>329,345</b>	<b>355,215</b>	<b>385,959</b>	<b>13</b>
Florida State University	X	182,314	195,244	227,329	230,411		14
Indiana University - Bloomington	X	150,770	156,930	177,520	184,096		15
University of Connecticut - Storrs	X	110,128	130,626	137,987	147,199		16
<b>Median</b>		<b>444,166</b>	<b>457,780</b>	<b>483,274</b>	<b>520,526</b>		

# Enterprise Size

Average Growth Rate in Total Research Expenditures Over 3 Years

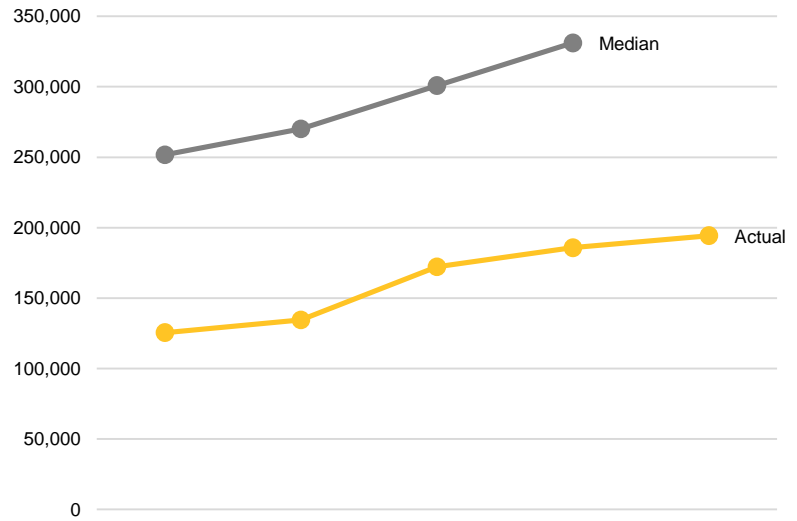


ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	15.9%	11.8%	13.7%	11.1%	11.2%
Goal		11.8%	13.7%	10.4%	9.6%
Difference		0	0.0%	0.7%	1.5%

ABOR Peer Group	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
University of Iowa	X	-3.6%	-0.6%	9.3%	15.6%		1
University of Washington - Seattle	X	2.8%	0.0%	11.4%	15.1%		2
Rutgers the State University of NJ - New Brunswick	X	2.6%	4.6%	15.7%	14.1%		3
<b>Arizona State University</b>		<b>15.9%</b>	<b>11.8%</b>	<b>13.7%</b>	<b>11.1%</b>	<b>11.2%</b>	<b>4</b>
University of Connecticut - Storrs	X	2.9%	7.7%	8.5%	10.3%		5
University of Texas - Austin		6.3%	5.5%	9.8%	8.8%		6
Michigan State University	X	2.3%	1.4%	6.4%	8.5%		7
Florida State University	X	1.9%	1.8%	6.6%	8.3%		8
University of Wisconsin - Madison	X	3.4%	4.6%	7.0%	8.0%		9
University of Maryland - College Park		5.3%	5.0%	7.9%	7.9%		10
University of Minnesota - Twin Cities	X	7.6%	7.6%	8.0%	7.5%		11
Indiana University - Bloomington	X	7.2%	3.4%	7.4%	7.0%		12
Ohio State University - Columbus	X	5.0%	3.3%	1.6%	5.9%		13
Pennsylvania State University - University Park	X	3.3%	5.4%	5.2%	4.1%		14
University of California - Los Angeles	X	3.5%	3.1%	4.4%	4.1%		15
University of Illinois - Urbana-Champaign		0.2%	5.9%	3.2%	3.3%		16
<b>Median</b>		<b>3.4%</b>	<b>4.6%</b>	<b>7.7%</b>	<b>8.2%</b>		

# Enterprise Size

Federally Financed Research Expenditures (in Thousands)



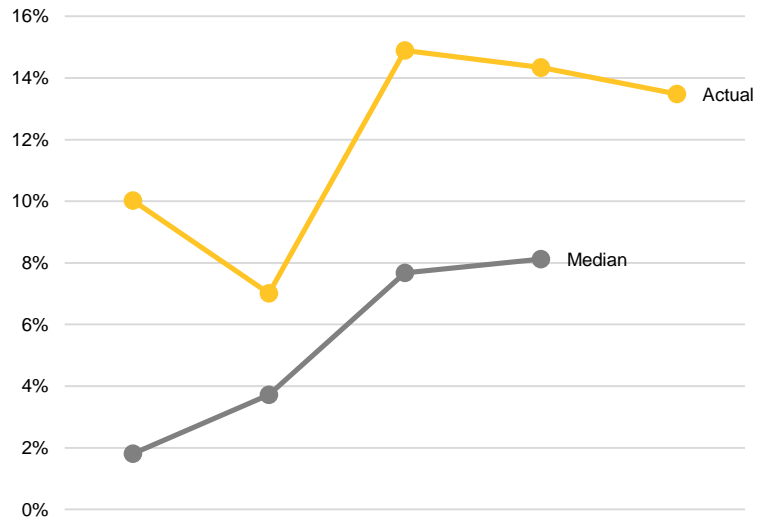
	2008	2009	2010	2011	2012
Actual	125,558	134,598	172,202	185,766	194,376

ABOR Peer Group	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
University of Washington - Seattle	X	614,069	619,353	829,885	948,976		1
University of Wisconsin - Madison	X	474,440	507,898	545,189	593,633		2
University of California - Los Angeles	X	471,932	467,505	538,521	563,560		3
Ohio State University - Columbus	X	335,121	339,820	399,942	493,130		4
University of Minnesota - Twin Cities	X	364,137	390,602	426,359	489,480		5
Pennsylvania State University - University Park	X	359,737	386,490	408,980	412,460		6
University of Texas - Austin		324,287	309,125	350,308	355,437		7
University of Maryland - College Park		236,417	246,985	297,896	338,780		8
University of Illinois - Urbana-Champaign		266,912	288,013	303,852	323,454		9
University of Iowa	X	229,903	252,336	282,465	283,627		10
Michigan State University	X	152,907	164,198	214,134	240,837		11
Rutgers the State University of NJ - New Brunswick	X	130,936	151,193	224,894	239,908		12
<b>Arizona State University</b>		<b>125,558</b>	<b>134,598</b>	<b>172,202</b>	<b>185,766</b>	<b>194,376</b>	<b>13</b>
Florida State University	X	110,618	117,294	134,794	140,850		14
Indiana University - Bloomington	X	68,336	78,431	71,208	74,143		15
University of Connecticut - Storrs	X	58,459	51,887	56,833	62,040		16
Median		251,665	270,175	300,874	331,117		



# Enterprise Size

Average Growth Rate in Federally Financed Research Expenditures Over 3 Years

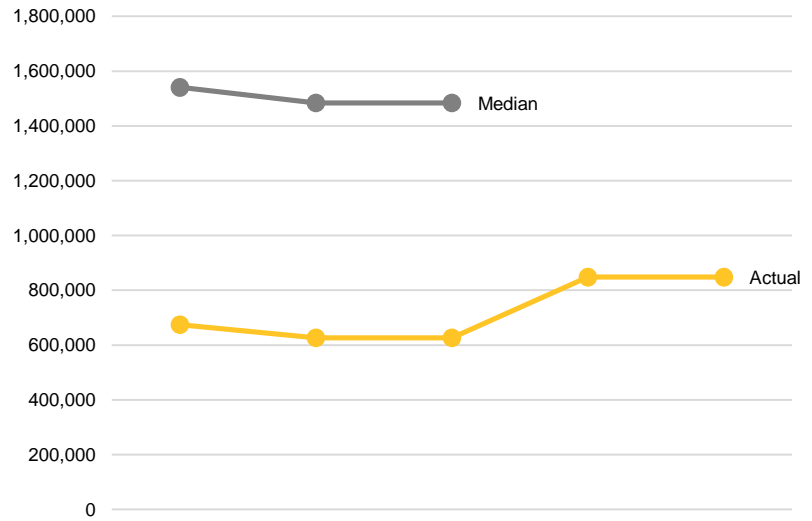


	2008	2009	2010	2011	2012
Actual	10.0%	7.0%	14.9%	14.3%	13.5%

ABOR Peer Group	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
Rutgers the State University of NJ - New Brunswick	X	2.3%	8.4%	22.9%	23.6%		1
Michigan State University	X	-0.5%	-0.7%	9.2%	16.8%		2
University of Washington - Seattle	X	0.5%	-1.6%	11.3%	16.4%		3
<b>Arizona State University</b>		<b>10.0%</b>	<b>7.0%</b>	<b>14.9%</b>	<b>14.3%</b>	<b>13.5%</b>	<b>4</b>
Ohio State University - Columbus	X	4.5%	2.5%	8.7%	14.1%		5
University of Maryland - College Park		6.5%	5.6%	11.0%	12.9%		6
University of Minnesota - Twin Cities	X	4.5%	6.2%	8.1%	10.4%		7
Florida State University	X	1.6%	2.1%	6.1%	8.5%		8
University of Wisconsin - Madison	X	-0.2%	1.2%	5.2%	7.8%		9
University of Iowa	X	2.1%	5.3%	8.3%	7.4%		10
University of Illinois - Urbana-Champaign		-2.6%	3.0%	6.2%	6.6%		11
University of California - Los Angeles	X	0.2%	-1.1%	3.6%	6.3%		12
Pennsylvania State University - University Park	X	3.8%	6.6%	7.3%	4.7%		13
University of Texas - Austin		8.4%	4.4%	6.9%	3.4%		14
Indiana University - Bloomington	X	0.0%	5.1%	3.8%	3.2%		15
University of Connecticut - Storrs	X	-2.9%	-8.2%	-0.8%	2.5%		16
<b>Median</b>		<b>1.8%</b>	<b>3.7%</b>	<b>7.7%</b>	<b>8.1%</b>		

# Enterprise Size

Net Assignable Square Feet

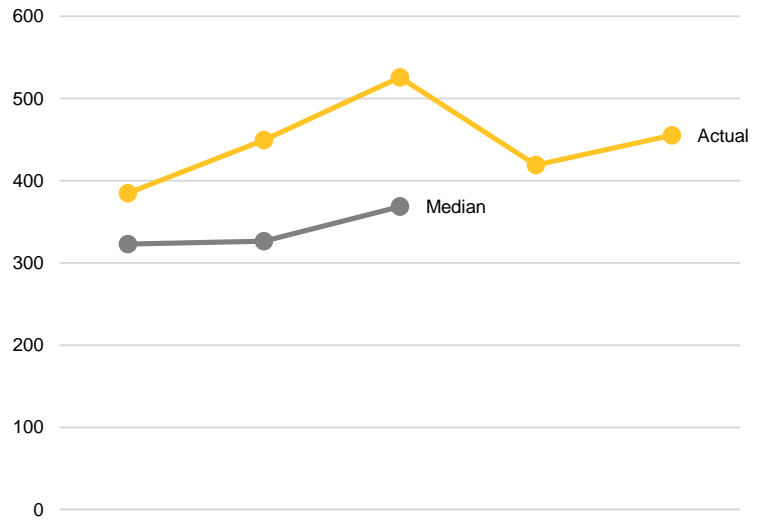


	2008	2009	2010	2011	2012
Actual	674,522	626,416	626,416	847,836	847,836

ABOR Peer Group	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
University of Illinois - Urbana-Champaign		4,319,500	4,561,500	4,561,500			1
University of Minnesota - Twin Cities	X	3,678,316	3,684,378	3,684,378			2
University of Wisconsin - Madison	X	2,844,272	2,844,272	2,844,272			3
Pennsylvania State University - University Park	X	2,577,836	2,637,870	2,637,870			4
University of California - Los Angeles	X	2,229,683	2,496,563	2,496,563			5
Michigan State University	X	2,289,100	2,324,423	2,324,423			6
University of Washington - Seattle	X	1,791,869	1,795,359	1,795,359			7
Ohio State University - Columbus	X	1,540,443	1,487,468	1,487,468			8
University of Texas - Austin		2,862,918	1,480,462	1,480,462			9
Indiana University - Bloomington	X	467,089	493,885	1,387,317			10
Rutgers the State University of NJ - New Brunswick	X	1,257,090	1,007,105	1,105,494			11
University of Maryland - College Park		987,352	712,085	712,085			12
Florida State University	X	397,662	675,000	675,000			13
<b>Arizona State University</b>		<b>674,522</b>	<b>626,416</b>	<b>626,416</b>	<b>847,836</b>	<b>847,836</b>	<b>14</b>
University of Iowa	X	760,591	616,700	616,700			15
University of Connecticut - Storrs	X	344,679	445,397	445,397			16
Median		1,540,443	1,483,965	1,483,965			

# Enterprise Size

Total Research Expenditures per Net Assignable Square Foot

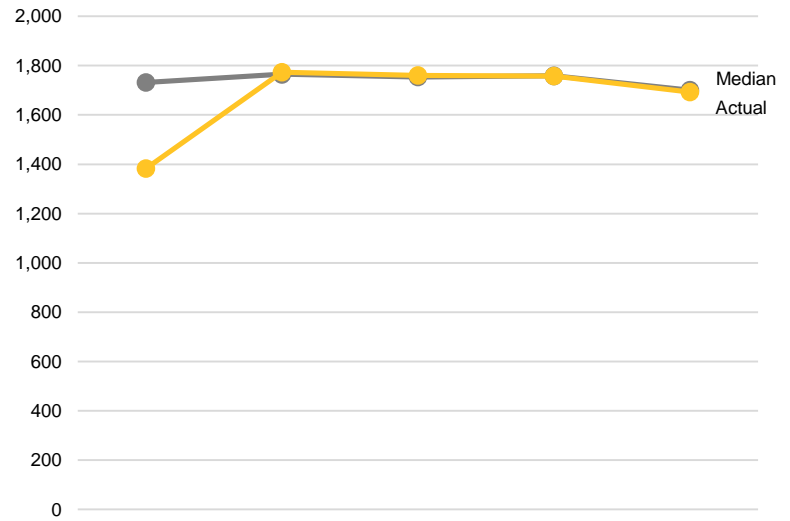


	2008	2009	2010	2011	2012
Actual	385	450	526	419	455

	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
<b>ABOR Peer Group</b>							
University of Iowa	X	386	535	720			1
University of Maryland - College Park		400	575	634			2
University of Washington - Seattle	X	427	433	570			3
<b>Arizona State University</b>		<b>385</b>	<b>450</b>	<b>526</b>	<b>419</b>	<b>455</b>	<b>4</b>
Ohio State University - Columbus	X	456	482	508			5
University of Texas - Austin		172	342	398			6
Rutgers the State University of NJ - New Brunswick	X	237	318	388			7
University of California - Los Angeles	X	391	356	375			8
University of Wisconsin - Madison	X		335	362			9
Florida State University	X	458	289	337			10
University of Connecticut - Storrs	X	320	293	310			11
Pennsylvania State University - University Park	X	241	251	257			12
University of Minnesota - Twin Cities	X	186	201	213			13
Michigan State University	X	156	161	186			14
Indiana University - Bloomington	X	323	318	128			15
University of Illinois - Urbana-Champaign		116	124	113			16
<b>Median</b>		<b>323</b>	<b>326</b>	<b>369</b>			

# Enterprise Size

Total Faculty Population

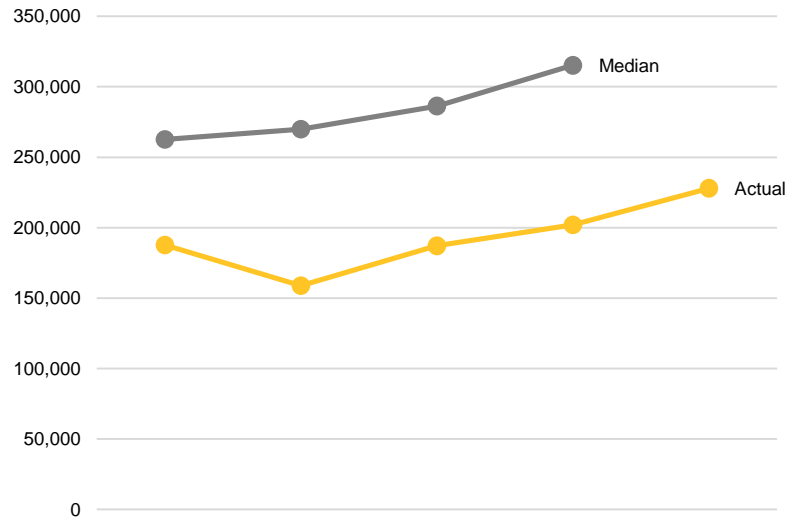


	2008	2009	2010	2011	2012
Actual	1,383	1,773	1,760	1,758	1,693

ABOR Peer Group	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
Ohio State University - Columbus	X	2,588	2,605	2,602	2,560	2,511	1
University of Minnesota - Twin Cities	X	2,489	2,377	2,319	2,277	2,251	2
University of Wisconsin - Madison	X	2,064	2,053	2,047	2,057	2,014	3
University of Texas - Austin		1,887	1,913	1,981	1,954	1,910	4
Michigan State University	X	1,885	1,921	1,948	1,906	1,883	5
University of California - Los Angeles	X	1,753	1,829	1,840	1,822	1,776	6
Pennsylvania State University - University Park	X	1,711	1,757	1,748	1,759	1,763	7
University of Illinois - Urbana-Champaign		1,900	1,883	1,856	1,778	1,707	8
<b>Arizona State University</b>		<b>1,383</b>	<b>1,773</b>	<b>1,760</b>	<b>1,758</b>	<b>1,693</b>	<b>9</b>
Rutgers the State University of NJ - New Brunswick	X	1,850	1,489	1,519	1,518	1,546	10
University of Iowa	X	1,549	1,599	1,572	1,527	1,538	11
University of Washington - Seattle	X	1,607	1,568	1,548	1,536	1,525	12
University of Maryland - College Park		1,472	1,485	1,472	1,463	1,501	13
Indiana University - Bloomington	X	1,329	1,334	1,368	1,351	1,356	14
University of Connecticut - Storrs	X	1,012	1,049	1,186	1,200	1,235	15
Florida State University	X	1,127	1,076	1,079	1,040	989	16
<b>Median</b>		<b>1,732</b>	<b>1,765</b>	<b>1,754</b>	<b>1,759</b>	<b>1,700</b>	

# Enterprise Size

Total Research Expenditures per Faculty



	2008	2009	2010	2011	2012
Actual	187,638	158,820	187,128	202,056	227,973

ABOR Peer Group	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
University of Washington - Seattle	X	476,126	496,203	660,685	747,743		1
University of Wisconsin - Madison	X	427,218	463,770	502,831	540,419		2
University of California - Los Angeles	X	497,135	486,602	509,236	539,164		3
Pennsylvania State University - University Park	X	362,612	377,322	387,869	397,649		4
University of Minnesota - Twin Cities	X	274,272	311,729	338,971	372,165		5
University of Maryland - College Park		268,368	275,549	306,668	338,607		6
Ohio State University - Columbus	X	271,481	275,033	290,236	325,049		7
University of Texas - Austin		261,417	264,699	297,578	323,527		8
University of Illinois - Urbana-Champaign		263,831	299,368	277,550	306,900		9
University of Iowa	X	189,518	206,317	282,464	290,696		10
Rutgers the State University of NJ - New Brunswick	X	160,915	215,094	282,049	284,787		11
Michigan State University	X	189,266	194,265	221,444	238,325		12
Florida State University	X	161,769	181,454	210,685	221,549		13
<b>Arizona State University</b>		<b>187,638</b>	<b>158,820</b>	<b>187,128</b>	<b>202,056</b>	<b>227,973</b>	<b>14</b>
Indiana University - Bloomington	X	113,446	117,639	129,766	136,266		15
University of Connecticut - Storrs	X	108,822	124,524	116,346	122,666		16
Median		262,624	269,866	286,350	315,214		

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**Discovery and Scholarly Impact**

ASU faculty and researchers pursue new knowledge with ambitions that lead to breakthrough, patentable discoveries and innovations, novel partnerships and scholarly works presented in premier publication venues. The impact of these pursuits expand well beyond ASU campuses due to our commitment to actively share the knowledge created at the university with audiences locally, nationally, and globally.

The FY12 accomplishment of ASU's Flexible Display Center (FDC) is an example of impactful innovation. It successfully manufactured the world's largest flexible color organic light emitting display (OLED) prototype using innovative mixed oxide thin film transistors. This accomplishment met another milestone as FDC continues to advance flexible display technology while successfully fulfilling its 10-year cooperative agreement with the U.S. Army.

ASU and the Mayo Clinic continued to expand their research collaborations and partnerships, which typically have synergized their respective expertise in novel ways. Dr. Ariel Anbar of ASU's School of Earth and Space Exploration and the Department of Chemistry and Biochemistry and Dr. Rafael Fonseca, chair of the Department of Medicine at the Mayo Clinic in Arizona have joined together their research interests to develop new techniques that detect bone loss. By bringing together an earth scientist and a biomedical researcher, a novel approach emerged for the measurement of calcium isotopes in humans.

ASU was selected by NSF as the new host university of the EarthScope National Office in recognition of its exceptional expertise in space and exploration and its commitment to educational outreach. EarthScope is a program that deploys thousands of seismic, GPS, and other geophysical instruments to study the structure and evolution of the North American continent and the processes the cause earthquakes and volcanic eruptions. With \$2.4 million NSF funding, this project facilitates scientific planning and coordinates education and outreach efforts for the EarthScope community.

ASU's newest research building, ISTB IV, not only advances research and discovery, but also educates the community. It is designed to encourage children to explore their futures as scientists and engineers through a mixture of interactive environments and open spaces that allow the public to witness research and technology advancement as it happens. For instance, the building features viewing windows that allow visitors to see the environmentally controlled facilities where the OSIRIS-REx Thermal Emission Spectrometer (OTES), will be built. OTES is being completely designed and built at ASU and will be a part of a future National Aeronautics and Space Administration (NASA) space mission. In addition, the publically accessible, 4,300-square-foot "Gallery of Scientific Exploration" on the first floor of the building includes interactive exhibits and large-format, high-definition monitors that display video from Earth-observing satellites and robotic probes of other worlds. Through a special gift from Carolyn "Susie" Marston, the building also contains a 238-seat theater for high-definition documentaries, 3-D planetarium-style shows and media-rich space for teaching undergraduates.



# Discovery and Scholarly Impact

## Introduction

ASU was one of the founders of the Arizona SciTech Festival, launched in spring of 2012, and which showcased Arizona as a national leader in science, technology and innovation through a series of events. Spearheaded by the Arizona Technology Council Foundation in partnership with ASU and the Arizona Science Center, the Arizona SciTech Festival became a grass roots collaboration of over 200 organizations from industry, academia, arts, and K-12 schools, geared to excite and inform Arizonans of all ages about how science, technology, and innovation will influence their lives and drive our state's economy for the next 100 years.

The Night of the Open Door event took place in March 2012 as part of the larger Arizona SciTech Festival. Events were held across the Tempe campus and an estimated 2,500 community members were able to explore the university through laboratory tours, book readings, hands-on activities, and museum and collections tours.

All of these activities exemplify the fundamental design principles and ambitions of the New American University. That is, by carrying out use-inspired research that will benefit society, ASU also engages a broad range of communities: the local community that it serves, as well as the national and international communities of science, technology and society, in general. It strives to address and help solve problems of the community, and in return, it benefits from the enlightened interest and involvement of the community.



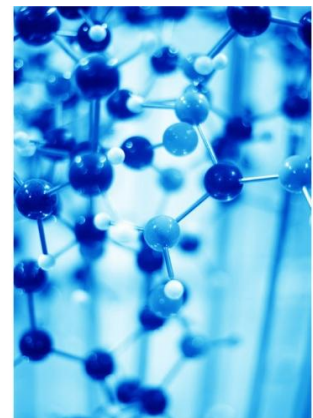
## Discovery and Scholarly Impact

*Selected Accomplishments*

- ASU faculty filed 239 invention disclosures in FY12. In conjunction with AzTE, faculty members applied for 106 new patents and were issued 26 patents. These numbers reflect our robust activity in translating our discoveries into the marketplace.

Of particular note is a patent issued to Dr. Cody Friesen, professor in the School for Engineering of Matter, Transport and Energy. The technology encompassed within the patent is exclusively licensed to Fluidic Energy, an energy company founded by Dr. Friesen in 2007 to create sustainable energy storage solutions.

- Among the nearly 3,000 research articles published by ASU research faculty in FY12, 25 articles appeared in the premier journals of *Science* and *Nature*. Selected examples include:
  - The September 6, 2011 issue of *Nature* featured an article entitled, “The phosphorous cycle: a broken biogeochemical cycle,” co-authored by Dr. James Elser, Regents’ Professor in the School of Life Sciences, and Elizabeth Bennet of McGill University. The article examines the lack of public and governmental discourse regarding the limited phosphorous supply.
  - Dr. Ann Kinzig, professor in the School of Life Sciences and Senior Sustainability Scientist in the Global Institute of Sustainability, and her collaborators published an article in *Nature* on biodiversity losses and their impact on humanity. It reviews two decades of research that has examined how biodiversity losses influence ecosystem functions, and the secondary impacts that this can have on the goods and services ecosystems provide.
  - Dr. Richard Fabes, the Dee and John Whiteman Distinguished Professor in the School of Social and Family Dynamics, and his colleagues published, “The Pseudoscience of Single-Sex Schooling” in *Science*. This article demonstrates that the use of single-sex classrooms to improve learning is based on faulty scientific data. The work by Dr. Richard Fabes and colleagues in the School of Social and Family Dynamics resonates with the broad mission of the School by exploring ways to better position students and educators to be successful in the classroom.
  - Dr. David Ferry, Regents’ Professor in the School of Electrical, Computer and Energy Engineering, provided a fundamental perspective of the physical properties of matter at the tiniest scales and at low temperatures in his *Science* paper, “Ohm's Law in a Quantum World”.

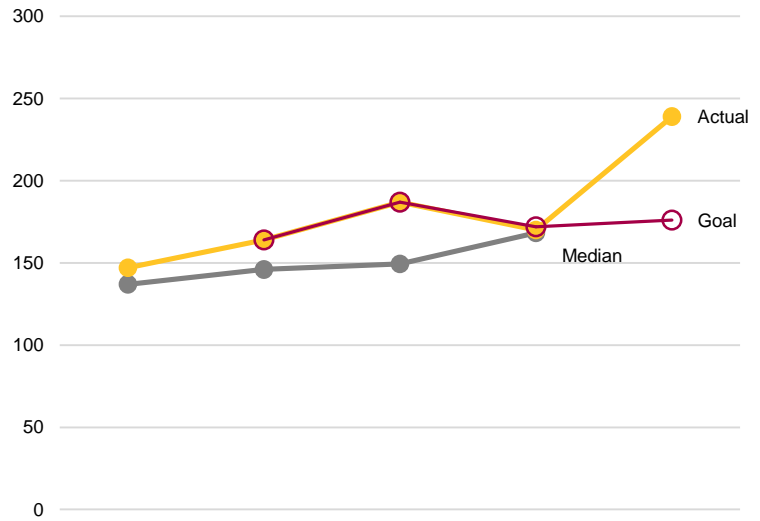


- In *Nature Chemistry*, Dr. John Chaput's article "Darwinian evolution of an alternative genetic system provides support for TNA as an RNA progenitor" examines the prospect of creating alternative chemical systems that may support life. He is a faculty member in Chemistry and Biochemistry and a member of the Center for Evolutionary Medicine and Informatics in the Biodesign Institute.
- Drs. John Spence, Bruce Doak and Petra Fromme, all of the College of Liberal Arts and Sciences were part of an international team that demonstrated how the world's most powerful X-ray laser can assist in cracking the atomic code of biomolecules. Their work, published in the May 31st edition of *Science*, advances the goal of showing molecule machines at work.
- Dr. Curtis Marean, professor in the School of Human Evolution and Social Change and in the Institute of Human Origin, and his colleagues discovered complex tools used by humans from 71,000 years ago in a cave in South Africa. The production of the tools was passed along across generations spanning 11,000 years providing evidence of a sophisticated process for educating next generations. This research was published in *Nature* and highlights the twin missions of both the School and the Institute.
- During FY12, Project Humanities sponsored or co-sponsored 64 events that merged public programs and humanities research and created collaborative synergies leading to research proposals and individual philanthropy. The Encoded Textiles Collaborative partnership with Project Humanities is an example of one such collaboration. By working together to utilize art and interactive media technology the partnership is working to preserve indigenous language and culture. The partnership recently submitted a proposal to the National Endowment for the Humanities and was invited to submit to the NSF as an expansion of this work.
- Future Tense, a continuing partnership between ASU, the New American Foundation and Slate magazine brought relevant articles on emergent technologies and their effects on society and public policy to an average of two million viewers each month through the Future Tense portal on Slate's website.
- Emerge: Artists and Scientists Redesign the Future was held throughout the ASU campus in March 2012. It included hands-on workshops as well as the Digital Culture Festival that included exhibits, interactive shows, and live presentations. Participants were encouraged to reflect on the question, "What kind of future do we want to make?" Keynote speakers, including noted writers such as Neal Stephenson, designers and futurists, provided engaging perspectives on this topic.



# Discovery and Scholarly Impact

Invention Disclosures Transacted

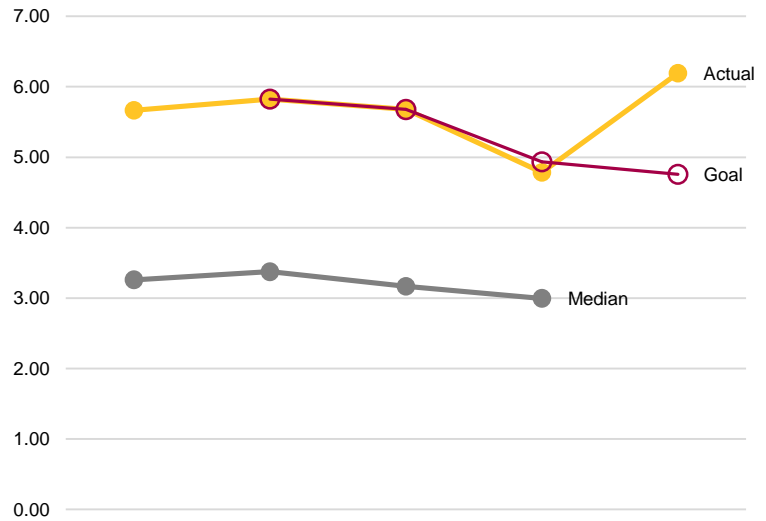


ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	147	164	187	170	239
Goal		164	187	172	176
Difference		0	0	-2	63

ABOR Peer Group	Med. Sch. AUTM Adj.	2008	2009	2010	2011	2012	Rank
University of Wisconsin - Madison	X	381	333	356	357		1
University of Washington - Seattle	X	349	349	354	356		2
University of California - Los Angeles	X	314	333	379	299		3
University of Minnesota - Twin Cities	X	217	244	255	250		4
Ohio State University - Columbus	X	142	163	173	216		5
University of Illinois - Urbana-Champaign		243	203	180	182		6
<b>Arizona State University</b>		<b>147</b>	<b>164</b>	<b>187</b>	<b>170</b>	<b>239</b>	<b>7</b>
Rutgers the State University of NJ - New Brunswick	X	87	70	126	167		8
Pennsylvania State University - University Park	X	127	105	117	127		9
Michigan State University	X	91	129	116	110		10
University of Iowa	X	68	70	70	68		11
Florida State University	X	56	45	45	64		12
Indiana University - Bloomington	X	53	47	55	62		13
University of Connecticut - Storrs	X	38	50	53	39		14
University of Maryland - College Park		132					
University of Texas - Austin		154					
<b>Median</b>		<b>137</b>	<b>146</b>	<b>149</b>	<b>168</b>		

# Discovery and Scholarly Impact

Invention Disclosures Transacted per \$10 Million in Total Research Expenditures

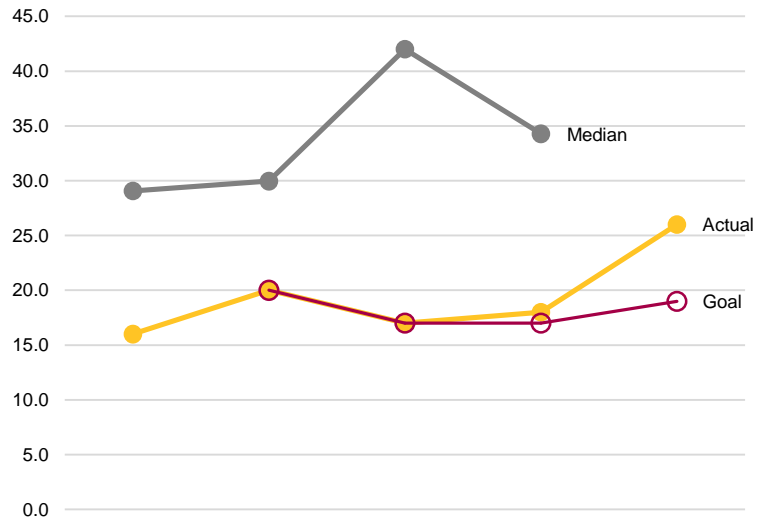


ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	5.7	5.8	5.7	4.8	6.2
Goal		5.8	5.7	4.9	4.8
Difference		0.0	0.0	-0.1	1.4

ABOR Peer Group	Med. Sch.	NSF Adj.	AUTM Adj.	2008	2009	2010	2011	2012	Rank
Arizona State University				5.7	5.8	5.7	4.8	6.2	1
Rutgers the State University of NJ - New Brunswick	X	X		2.9	2.2	2.9	3.9		2
Indiana University - Bloomington		X	X	3.5	3.0	3.1	3.4		3
University of Illinois - Urbana-Champaign				4.8	3.6	3.5	3.3		4
University of Wisconsin - Madison	X			4.3	3.5	3.5	3.2		5
University of Washington - Seattle	X			4.6	4.5	3.5	3.1		6
University of California - Los Angeles	X			3.6	3.7	4.0	3.0		7
University of Minnesota - Twin Cities	X			3.2	3.3	3.2	3.0		8
Florida State University	X			3.1	2.3	2.0	2.8		9
University of Connecticut - Storrs		X	X	3.4	3.8	3.8	2.6		10
Ohio State University - Columbus	X			2.0	2.3	2.3	2.6		11
Michigan State University	X			2.6	3.5	2.7	2.4		12
Pennsylvania State University - University Park		X	X	2.0	1.6	1.7	1.8		13
University of Iowa	X			2.3	2.1	1.6	1.5		14
University of Maryland - College Park				3.3					
University of Texas - Austin				3.1					
<b>Median</b>				<b>3.3</b>	<b>3.4</b>	<b>3.2</b>	<b>3.0</b>		

# Discovery and Scholarly Impact

U.S. Patents Issued

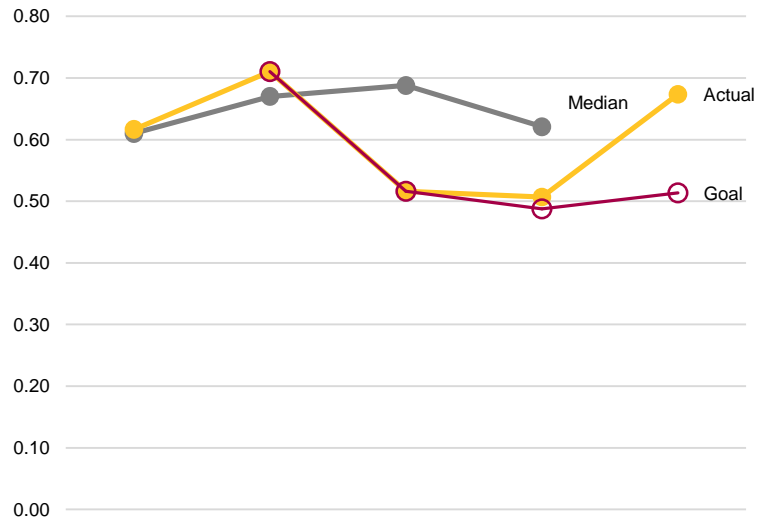


ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	16	20	17	18	26
Goal		20	17	17	19
Difference		0	0	1	7

ABOR Peer Group	Med. Sch. AUTM Adj.	2008	2009	2010	2011	2012	Rank
University of Wisconsin - Madison	X	98	119	133	156		1
University of Washington - Seattle	X	56	40	69	70		2
University of Illinois - Urbana-Champaign		38	42	69	68		3
University of California - Los Angeles	X	42	60	47	56		4
University of Minnesota - Twin Cities	X	37	37	46	41		5
Michigan State University	X	48	41	52	38		6
Florida State University	X	11	10	21	36		7
Pennsylvania State University - University Park	X	34	30	48	33		8
University of Iowa	X	24	30	32	31		9
Ohio State University - Columbus	X	15	20	38	30		10
Rutgers the State University of NJ - New Brunswick	X	33	26	28	27		11
<b>Arizona State University</b>		<b>16</b>	<b>20</b>	<b>17</b>	<b>18</b>	<b>26</b>	<b>12</b>
University of Connecticut - Storrs	X	11	9	19	10		13
Indiana University - Bloomington	X	3	1	3	6		14
University of Maryland - College Park		23					
University of Texas - Austin		25					
<b>Median</b>		<b>29</b>	<b>30</b>	<b>42</b>	<b>34</b>		

# Discovery and Scholarly Impact

U.S. Patents Issued per \$10 Million in Total Research Expenditures



ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	0.6	0.7	0.5	0.5	0.7
Goal		0.7	0.5	0.5	0.5
Difference		0.0	0.0	0.0	0.2

ABOR Peer Group	Med. Sch.	NSF Adj.	AUTM Adj.	2008	2009	2010	2011	2012	Rank
Florida State University	X			0.6	0.5	0.9	1.6		1
University of Wisconsin - Madison	X			1.1	1.2	1.3	1.4		2
University of Illinois - Urbana-Champaign				0.8	0.7	1.3	1.2		3
Michigan State University	X			1.3	1.1	1.2	0.8		4
University of Connecticut - Storrs		X	X	1.0	0.7	1.3	0.7		5
University of Iowa	X			0.8	0.9	0.7	0.7		6
Rutgers the State University of NJ - New Brunswick		X	X	1.1	0.8	0.7	0.6		7
University of Washington - Seattle	X			0.7	0.5	0.7	0.6		8
University of California - Los Angeles	X			0.5	0.7	0.5	0.6		9
<b>Arizona State University</b>				<b>0.6</b>	<b>0.7</b>	<b>0.5</b>	<b>0.5</b>	<b>0.7</b>	<b>10</b>
University of Minnesota - Twin Cities	X			0.5	0.5	0.6	0.5		11
Pennsylvania State University - University Park		X	X	0.5	0.5	0.7	0.5		12
Ohio State University - Columbus	X			0.2	0.3	0.5	0.4		13
Indiana University - Bloomington		X	X	0.2	0.0	0.2	0.3		14
University of Maryland - College Park				0.6					
University of Texas - Austin				0.5					
<b>Median</b>				<b>0.6</b>	<b>0.7</b>	<b>0.7</b>	<b>0.6</b>		

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## **Economic Development**

ASU is steadfastly committed to strengthening Arizona's economy. As the nation's largest university, ASU is uniquely positioned to contribute to economic development both in Arizona and nationally. Each year ASU produces graduates with the skills and knowledge necessary to meet the demands of the marketplace. These graduates create a lifetime of value for Arizona and provide significant return on the state's investment.

ASU has created an innovation ecosystem throughout its campuses and is committed to supporting entrepreneurs at every level. This is creating adaptable, flexible graduates who are competitive in today's ever-changing economy. While the university's economic development and entrepreneurship programs are co-located at SkySong, related activities are not limited to that location. All of ASU's programs train and support entrepreneurs, launch and accelerate new companies, attract companies to Arizona, open new markets for Arizona companies in other countries through global partnerships, and partner ASU researchers with companies to translate research discoveries into the marketplace.

SkySong is home to 1,000 employees working at 60 companies from 10 countries, and maintains virtual connection to an additional 12 companies. The Greater Phoenix Economic Council estimates SkySong's annual economic output at \$134 million. SkySong currently hosts more than 5,000 people monthly at meetings and events. It also advances important industry clusters in Arizona through the sponsorship and management of the Arizona Solar Summit and the annual Education Innovation Summit, both of which bring hundreds of entrepreneurs, investors, and thought leaders together to ignite dialogue, foster collaborations, and advance joint projects.

Venture Catalyst, founded in FY11 and located at SkySong, helps new ventures find the critical resources they need to succeed. Venture Catalyst has the tools to help companies at all stages of development and provides services for ASU faculty, student, and alumni companies, as well as U.S. and international firms. Services include entrepreneurial education, connections to mentors, capital formation, intellectual property (IP) assistance, access to faculty researchers, student interns, and employee workforce development. Programs available through Venture Catalyst include "pracademic" training through Rapid Startup School; the Techiepalooza networking event; the AZ Furnace Accelerator program, which encourages new startups based on Arizona IP; and the Edson Student Entrepreneur Initiative, which provides entrepreneurial training to ASU students. Recently the Edson Initiative revamped its approach to accelerate companies beginning with the FY12 cohort of 26 student companies.

# Economic Development

## Introduction

SkySong also houses ASU's technology transfer entity, AzTE, the exclusive IP management and technology transfer organization of ASU, and ASU's Office of Industry Research and Collaborations (OIRC), responsible for negotiating and executing contracts with industry. The staff at AzTE includes professionals with experience in both academics and business across a range of disciplines. Through AzTE, the novel discoveries of faculty and researchers translate to commercial products that provide real-world solutions. OIRC facilitated more than 500 agreements in FY12 (sponsored research agreements, consortium agreements, material transfer agreements, non-disclosure agreements, and other teaming and collaborative type agreements), an increase of approximately 20% over FY11.

ASU has an integrated network of entrepreneurship activities across all campuses that involve several departments and schools. The interweaving of entrepreneurship across academic disciplines results in a broad scope of programming in support of tomorrow's workforce.



# Economic Development

## Selected Accomplishments

- 80 license and option agreements were executed through AzTE. Most notably, Roche, a global leader in pharmaceutical and diagnostics, licensed several nanopore based DNA sequencing technologies from ASU. The technologies were developed in the laboratory of Dr. Stuart Lindsay, Director of the Center for Single Molecule Biophysics in the Biodesign Institute. The licensing agreement with Roche will help translate the technologies into an affordable commercial instrument.
- The second Arizona Solar Summit, held in March 2012 at SkySong, was conducted by the Program on Law and Sustainability and the Center for Law, Science and Innovation at the Sandra Day O'Connor College of Law, in conjunction with ASU LightWorks, ASU SkySong, and the Greater Phoenix Economic Council. The Solar Summit explored current barriers to solar expansion and had a special focus on how state policy makers can work together with federal agencies toward developing a solar future for the Southwest.
- The third annual Education Innovation Summit brought together 800 of the leading education industry innovators, thinkers, and investors at SkySong. There were more than 91 company presentations, 24 panel discussions, and five keynotes, including former Florida Governor Jeb Bush, NetFlix CEO Reed Hastings, and Michael Milken of the Milken Institute.
- The FY12 Edson entrepreneur cohort enjoyed great successes including:
  - Two ASU student-run spin-out companies were selected as finalists in the Global Entrepreneurship Week Startup Open competition. Ellens Technology developed the Veterinary Diagnostic Tree, a diagnostic reference tool and mobile application that helps veterinarians, technicians, and students reduce diagnostic time and potential human error. reNature is a company capitalizing on industrializing the natural process of waste management to produce sustainable alternatives for petrochemical products.
  - The ASU student startup Arizona Pro DJs was named "Coolest American College Startup of the Year" by Inc. magazine. Second place went to an ASU student startup, G3Box, who were also named Entrepreneur magazine's "College entrepreneur of the Year" in December 2011.



# Economic Development

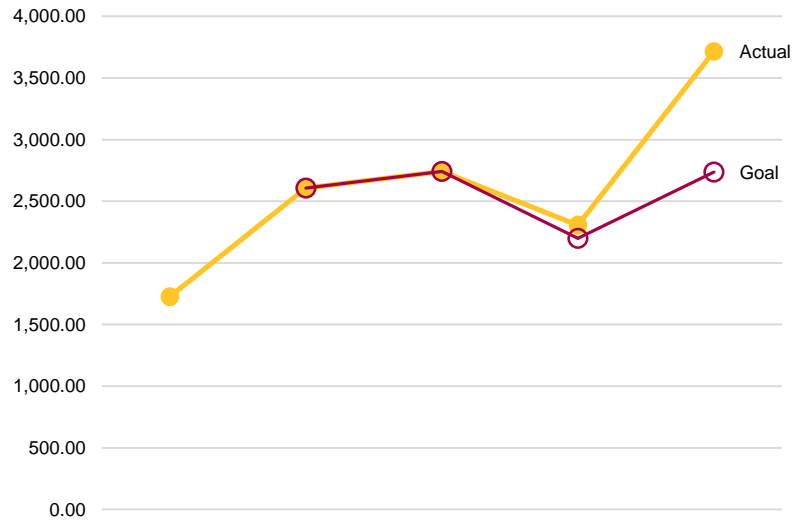
## *Selected Accomplishments*

- Arbsource, a spin-out company from ASU, won second place in the energy track of the Idea2Product Global Competition (I2P) in Stockholm, Sweden in November. Arbsource uses biotechnology developed by Dr. Bruce Rittman, Regent's Professor in the School of Sustainable Engineering and the Built Environment at the Biodesign Institute, to transform wastewater treatment from a costly energy liability into a valuable resource for food and beverage companies.
- The first place winner in the U.S. Finals of the Microsoft Imagine Cup was the start-up company FlashFood, founded by four ASU students as part of the Engineering Projects in Community Service program in the Ira A. Fulton Schools of Engineering and the Students in Free Enterprise program in the W. P. Carey School of Business. The team went on to compete in the Imagine Cup World Competition in Sydney, Australia. FlashFood is based on forming a network of restaurants and banquet halls to donate leftover and surplus food to local community centers and churches for distribution to families and individuals. It is the second year in a row that an ASU team has won first place at the U.S. Microsoft Imagine Cup.
- Five ASU engineering students won a spot in the final round of the international Dell Social Innovation Challenge in June at the University of Texas at Austin with their 33 Buckets project. The ASU team designed and built a water filtration system that they plan to install at a school in Bangladesh. Only five teams were admitted to the final competition, from approximately 1,700 that entered the competition.
- ASU's College of Technology and Innovation (CTI) supported the City of Mesa's successful effort to create AZLabs (Arizona Laboratories for Security & Defense Research), which retained the classified research designation of the Air Force Research Laboratory in east Mesa. The lab is operated by Alion Science and Technology.
- CTI hosted a DOD-led, two-day event, "Net Zero – At the Tactical Edge", that brought together commercial, academic, and government entities who were interested in the development and testing of solutions for U.S. government partners related to green energy and sustainability.



# Economic Development

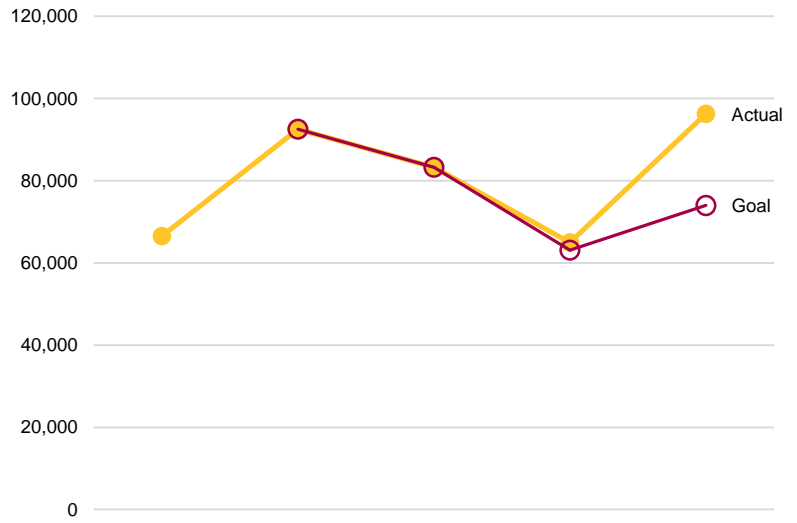
Intellectual Property Income (in Thousands)



ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	1,726	2,606	2,742	2,307	3,716
Goal		2,606	2,742	2,200	2,737
Difference		0	0	107	979

# Economic Development

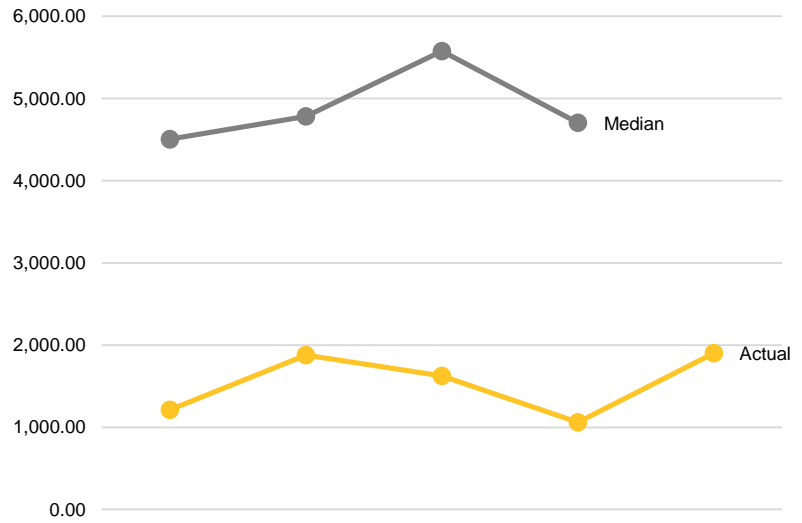
Intellectual Property Income per \$10 Million in Total Research Expenditures



ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	66,501	92,550	83,252	64,946	96,279
Goal		92,550	83,252	63,123	73,973
Difference		0.0	0.0	1,823	22,306

# Economic Development

Licenses and Options Income (in Thousands)



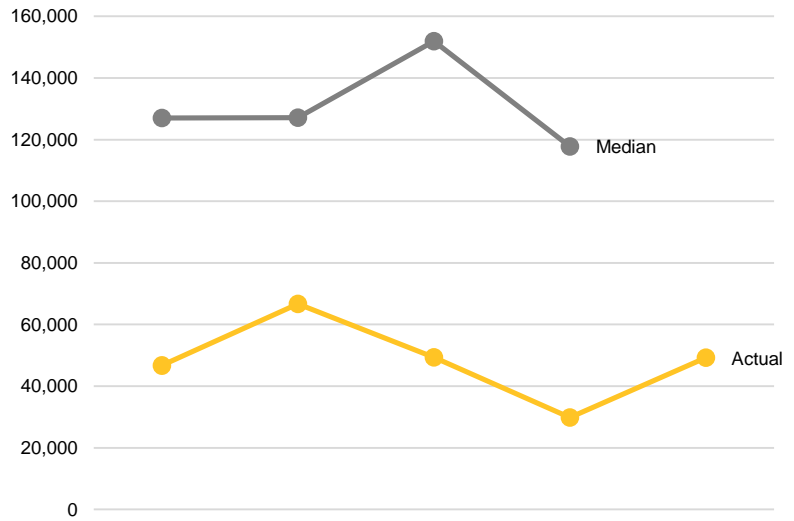
	2008	2009	2010	2011	2012
Actual	1,212	1,879	1,626	1,059	1,901

ABOR Peer Group	Med. Sch. AUTM Adj.	2008	2009	2010	2011	2012	Rank
University of Washington - Seattle	X	80,331	87,340	69,032	67,362		1
University of Wisconsin - Madison	X	54,130	56,714	54,300	57,730		2
University of California - Los Angeles	X	32,837	22,557	27,485	16,153		3
University of Minnesota - Twin Cities	X	84,669	95,169	83,906	10,079		4
University of Illinois - Urbana-Champaign		4,241	5,116	6,126	6,363		5
University of Iowa	X	23,560	42,922	26,991	6,285		6
Rutgers the State University of NJ - New Brunswick	X	7,344	7,405	7,923	5,447		7
Indiana University - Bloomington	X	1,816	2,119	5,029	3,961		8
Michigan State University	X	4,769	4,449	4,017	3,616		9
Pennsylvania State University - University Park	X	1,331	1,080	1,998	2,594		10
Florida State University	X	1,257	1,192	1,315	1,468		11
Ohio State University - Columbus	X	2,095	1,712	1,907	1,420		12
<b>Arizona State University</b>		<b>1,212</b>	<b>1,879</b>	<b>1,626</b>	<b>1,059</b>	<b>1,901</b>	<b>13</b>
University of Connecticut - Storrs	X	337	435	521	439		14
University of Maryland - College Park		1,555					
University of Texas - Austin		11,554					
<b>Median</b>		<b>4,505</b>	<b>4,783</b>	<b>5,578</b>	<b>4,704</b>		



# Economic Development

Licenses and Options Income per \$10 Million in Total Research Expenditures

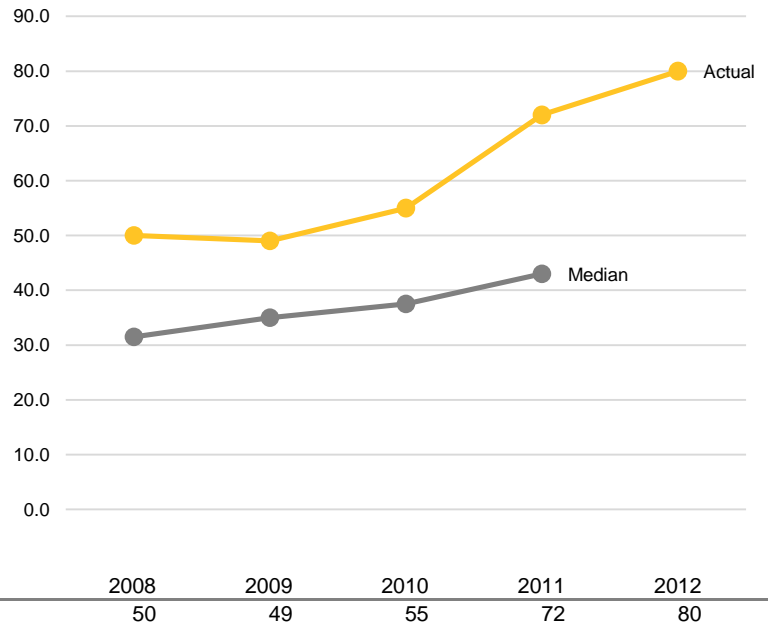


	2008	2009	2010	2011	2012
Actual	46,705	66,720	49,362	29,823	49,264

ABOR Peer Group	Med. Sch. AUTM Adj.	2008	2009	2010	2011	2012	Rank
University of Washington - Seattle	X	1,049,890	1,122,555	674,973	586,506		1
University of Wisconsin - Madison	X	613,874	595,661	527,546	519,322		2
Indiana University - Bloomington	X	120,420	135,034	283,303	215,144		3
University of California - Los Angeles	X	376,797	253,451	293,331	164,431		4
University of Iowa	X	802,556	1,301,059	607,862	141,587		5
Rutgers the State University of NJ - New Brunswick	X	246,711	231,213	184,930	125,989		6
University of Minnesota - Twin Cities	X	1,240,281	1,284,360	1,067,402	118,932		7
University of Illinois - Urbana-Champaign		84,599	90,756	118,925	116,601		8
Michigan State University	X	133,661	119,229	93,115	79,596		9
Florida State University	X	68,962	61,075	57,842	63,711		10
Pennsylvania State University - University Park	X	21,452	16,289	29,476	37,080		11
University of Connecticut - Storrs	X	30,613	33,273	37,752	29,842		12
<b>Arizona State University</b>		<b>46,705</b>	<b>66,720</b>	<b>49,362</b>	<b>29,823</b>	<b>49,264</b>	<b>13</b>
Ohio State University - Columbus	X	29,815	23,891	25,252	17,065		14
University of Maryland - College Park		39,352					
University of Texas - Austin		234,216					
<b>Median</b>		<b>127,040</b>	<b>127,132</b>	<b>151,928</b>	<b>117,766</b>		

# Economic Development

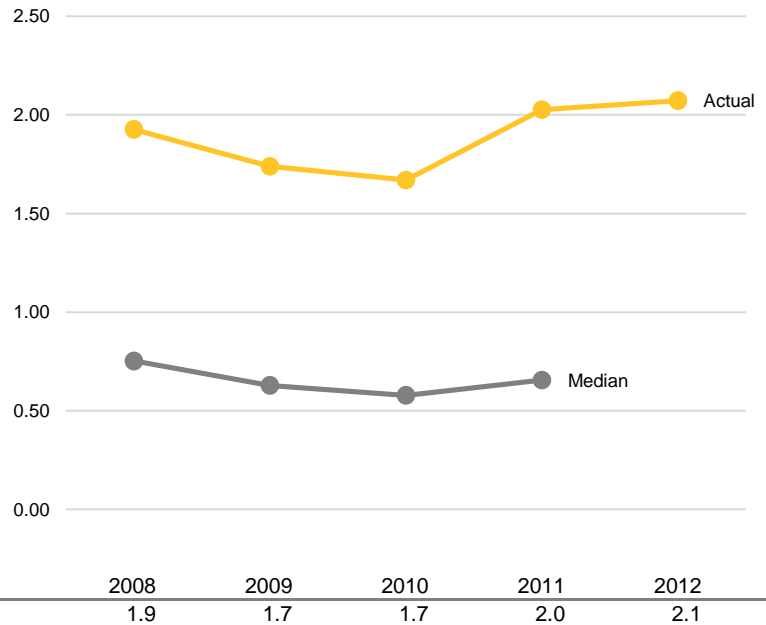
Licenses and Options Executed



		2008	2009	2010	2011	2012	
Actual		50	49	55	72	80	
<b>ABOR Peer Group</b>							<b>Rank</b>
University of Washington - Seattle	X	212	231	196	194		1
University of Minnesota - Twin Cities	X	63	53	73	113		2
<b>Arizona State University</b>		<b>50</b>	<b>49</b>	<b>55</b>	<b>72</b>	<b>80</b>	<b>3</b>
Rutgers the State University of NJ - New Brunswick	X	89	79	73	68		4
University of Wisconsin - Madison	X	75	57	62	62		5
University of Illinois - Urbana-Champaign		43	33	40	55		6
University of California - Los Angeles	X	38	37	52	46		7
Michigan State University	X	25	44	31	40		8
Ohio State University - Columbus	X	23	27	35	25		9
University of Iowa	X	22	21	21	24		10
Pennsylvania State University - University Park	X	23	18	21	20		11
Indiana University - Bloomington	X	11	11	10	14		12
Florida State University	X	11	10	6	10		13
University of Connecticut - Storrs	X	8	8	7	4		14
University of Maryland - College Park		12					
University of Texas - Austin		56					
<b>Median</b>		<b>32</b>	<b>35</b>	<b>38</b>	<b>43</b>		

# Economic Development

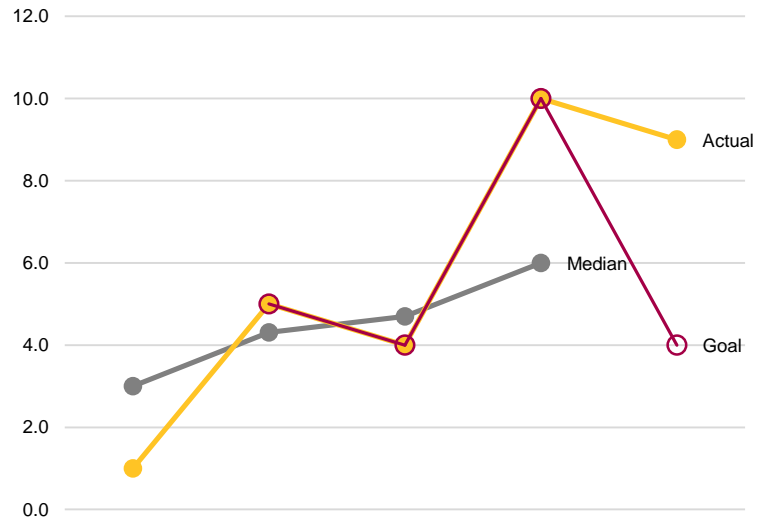
Licenses and Options Executed per \$10 Million in Total Research Expenditures



			2008	2009	2010	2011	2012	
Actual			1.9	1.7	1.7	2.0	2.1	
	Med. Sch.	NSF Adj.						
		AUTM Adj.						
<b>ABOR Peer Group</b>			<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>Rank</b>
Arizona State University			1.9	1.7	1.7	2.0	2.1	1
University of Washington - Seattle	X		2.8	3.0	1.9	1.7		2
Rutgers the State University of NJ - New Brunswick		X X	3.0	2.5	1.7	1.6		3
University of Minnesota - Twin Cities	X		0.9	0.7	0.9	1.3		4
University of Illinois - Urbana-Champaign			0.9	0.6	0.8	1.0		5
Michigan State University	X		0.7	1.2	0.7	0.9		6
Indiana University - Bloomington		X X	0.8	0.7	0.5	0.8		7
University of Wisconsin - Madison	X		0.9	0.6	0.6	0.6		8
University of Iowa	X		0.7	0.6	0.5	0.5		9
University of California - Los Angeles	X		0.4	0.4	0.6	0.5		10
Florida State University	X		0.6	0.5	0.3	0.4		11
Ohio State University - Columbus	X		0.3	0.4	0.5	0.3		12
Pennsylvania State University - University Park		X X	0.4	0.3	0.3	0.3		13
University of Connecticut - Storrs		X X	0.8	0.6	0.5	0.3		14
University of Maryland - College Park			0.3					
University of Texas - Austin			1.1					
<b>Median</b>			<b>0.8</b>	<b>0.6</b>	<b>0.6</b>	<b>0.7</b>		

# Economic Development

## Startup Companies

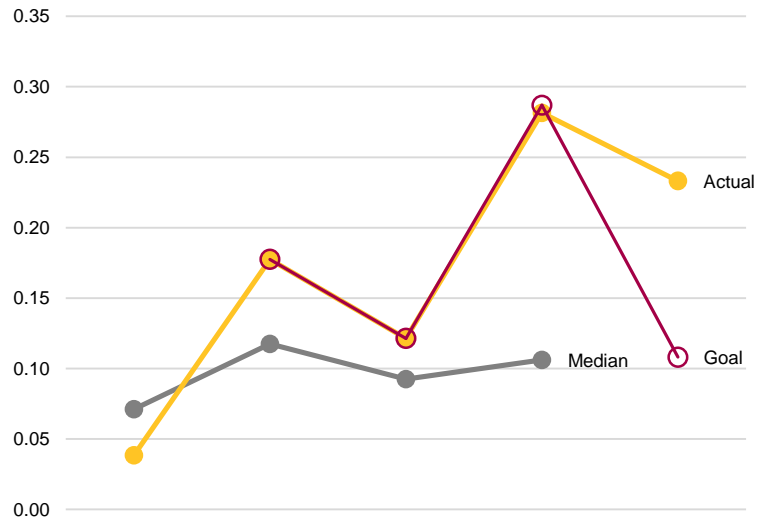


ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	1	5	4	10	9
Goal		5	4	10	4
Difference		0	0	0	5

ABOR Peer Group	Med. Sch. AUTM Adj.	2008	2009	2010	2011	2012	Rank
University of California - Los Angeles	X		22	27	19		1
University of Illinois - Urbana-Champaign		6	6	5	12		2
<b>Arizona State University</b>		<b>1</b>	<b>5</b>	<b>4</b>	<b>10</b>	<b>9</b>	<b>3</b>
University of Minnesota - Twin Cities	X	1	3	8	9		4
University of Washington - Seattle	X	9	10	7	9		4
Rutgers the State University of NJ - New Brunswick	X	2	5	7	7		6
Ohio State University - Columbus	X	5	7	8	6		7
Pennsylvania State University - University Park	X	1	3	4	4		8
Florida State University	X	3	2	2	4		9
University of Wisconsin - Madison	X	6	1	5	4		9
Indiana University - Bloomington	X	1	2	1	2		11
University of Iowa	X	0	3	3	2		12
Michigan State University	X	3		0	1		13
University of Connecticut - Storrs	X	1	4	3			
University of Maryland - College Park		3					
University of Texas - Austin		10	22				
<b>Median</b>		<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>		

# Economic Development

Startup Companies per \$10 Million in Total Research Expenditures

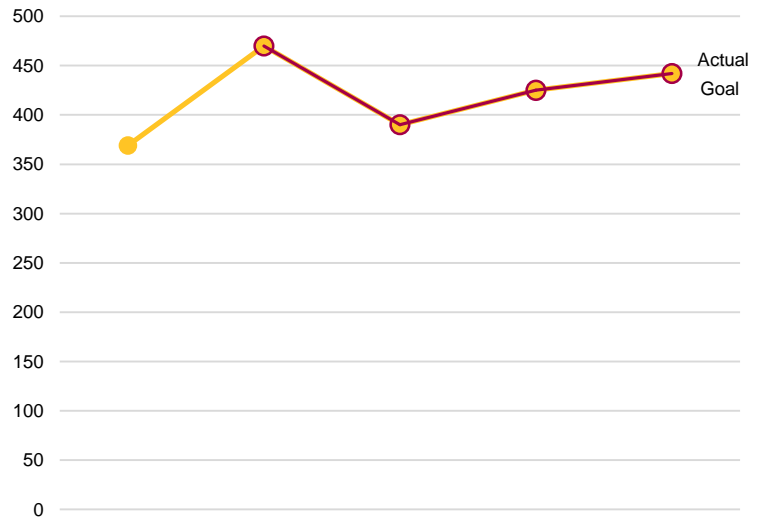


ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	0.0	0.2	0.1	0.3	0.2
Goal		0.2	0.1	0.3	0.1
Difference		0.0	0.0	0.0	0.1

ABOR Peer Group	Med. Sch.	NSF Adj.	AUTM Adj.	2008	2009	2010	2011	2012	Rank
Arizona State University				0.0	0.2	0.1	0.3	0.2	1
University of Illinois - Urbana-Champaign				0.1	0.1	0.1	0.2		2
University of California - Los Angeles	X				0.2	0.3	0.2		3
Florida State University	X			0.2	0.1	0.1	0.2		4
Rutgers the State University of NJ - New Brunswick		X	X	0.1	0.1	0.2	0.2		5
Indiana University - Bloomington		X	X	0.0	0.1	0.1	0.1		6
University of Minnesota - Twin Cities	X			0.0	0.0	0.1	0.1		7
University of Washington - Seattle	X			0.1	0.1	0.1	0.1		8
Ohio State University - Columbus	X			0.1	0.1	0.1	0.1		9
Pennsylvania State University - University Park		X	X	0.0	0.0	0.1	0.1		10
University of Iowa	X			0.0	0.1	0.1	0.0		11
University of Wisconsin - Madison	X			0.1	0.0	0.0	0.0		12
Michigan State University	X			0.1		0.0	0.0		13
University of Connecticut - Storrs		X	X	0.1	0.3	0.3			
University of Maryland - College Park				0.1					
University of Texas - Austin				0.2	0.4				
<b>Median</b>				<b>0.1</b>	<b>0.1</b>	<b>0.1</b>	<b>0.1</b>		

# Economic Development

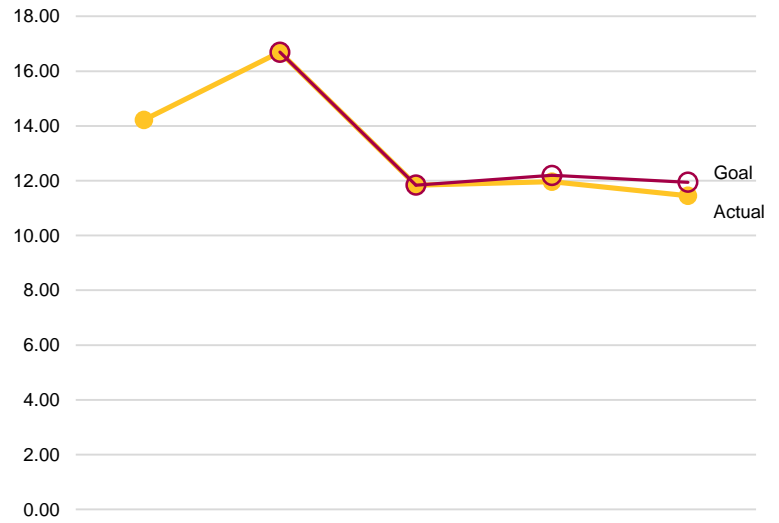
Ph.D. Degrees Conferred



ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	369	470	390	425	442
Goal		470	390	425	442
Difference		0	0	0	0

# Economic Development

Ph.D. Degrees Conferred per \$10 Million in Total Research Expenditures



ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	14.2	16.7	11.8	12.0	11.5
Goal		16.7	11.8	12.2	11.9
Difference		0.0	0.0	-0.2	-0.5

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**Leadership and Recognition**

# Leadership and Recognition

## Introduction

ASU's outstanding faculty members have received local, national, and international recognition for significant contributions to their fields and their impact on society.

- **Dr. Sander van der Leeuw**, dean of ASU's School of Sustainability, was named one of the 2012 United Nations Champions of the Earth. He was recognized for his research in human-environment relations and the scientific study of innovation as a societal process in the science and innovation category.
- **Dr. Lawrence Krauss**, a renowned theoretical physicist and Foundation Professor in the School of Earth and Space Exploration and the Department of Physics was awarded the 2012 Public Service Award from the National Science Board (NSB). The award honors individuals and groups that have made substantial contributions to increasing public understanding of science and engineering in the United States.
- **Dr. Stephen Bokenkamp**, professor of Chinese in the School of International Letters and Cultures and professor of religious studies in the School of Historical, Philosophical and Religious Studies, was honored as a member of the 2012 cohort of Guggenheim Fellows. The award allows Bokenkamp to complete a translation of the "Zhen'gao" of "Declarations of the Perfected," a sixth century CE Chinese book of celestially-revealed material.
- **Dr. Luc Anselin**, the Walter Isard chair and founding director of the School of Geographical Sciences and Urban Planning, was elected a member of the American Academy of Arts and Sciences, one of the nation's most prestigious honorary societies and a leading center of independent policy research.
- **Dr. Roy Levy**, assistant professor in the School of Social and Family Dynamics in the College of Liberal Arts and Sciences, was awarded a Presidential Early Career Award for Scientists and Engineers, the highest honor bestowed by the U.S. government on science and engineering professionals in the early stages of their research careers. Levy is developing new analytical tools which ensure that assessment tests measure and accurately record a person's knowledge of subjects.
- **Dr. Rosa Krajmalnik-Brown**, an assistant professor in the School of Sustainable Engineering and the Built Environment and in the Swette Center Environmental Biotechnology at the Biodesign Institute and an NSF CAREER award winner, was named to the 2012 "40 Under 40" list in the *Phoenix Business Journal*. The list honors young leaders in the Phoenix metropolitan area. Krajmalnik-Brown was recognized for her research on the roles of microscopic organisms to clean water, produce energy, and positively impact human health.



- **Dr. Sudhir Kumar**, professor in the School of Life Sciences and director of the Center for Evolutionary Medicine and Informatics at the Biodesign Institute, was one of three finalists for the 2011 Innovator of the Year Award for Academia, part of the Arizona Governor's Celebration of Innovation. Kumar and his research team have pioneered tools to aid in the large-scale analysis of DNA from humans and much of life on Earth.
- **Dr. Elizabeth Hayes**, Delbert & Jewell Lewis Chair in Reading and Literacy and professor in Arizona State University's Teachers College and affiliate faculty in the Department of English, was named a "Champion of Change" by the White House for her work to increase girls' skills and interests in science, technology, engineering, and math.
- **Dr. Cheryl Nickerson**, professor in School of Life Sciences and researcher in the Center for Infectious Diseases and Vaccinology at the Biodesign Institute, was one of four finalists for the Arizona Bioindustry Award for Research Excellence. Nickerson's nomination recognizes her research into the responses of cells to the unique microgravity environment of spaceflight. In FY11, Nickerson received the Exceptional Scientific Achievement Medal, which is NASA's most prestigious award for outstanding contributions to science.

ASU also continued its strategic recruitment efforts, attracting national talent to ensure our success in key research areas.

- **Dr. Keith Lindor**, former dean of the Mayo Clinic Medical School in Rochester, MN joined ASU in January as dean of the College of Health Solutions. The College of Health Solutions is a new, multi-disciplinary strategic initiative to build a new model for health education. It includes the School of Nutrition and Health Promotion, the Department of Biomedical Informatics, the School of the Science of Health Care Delivery, and the Doctor of Behavioral Health Program.
- **Dr. Ken Galluppi** will lead the Decision Theater as its new director. He joins ASU from the University of North Carolina where he was a senior research scientist. He has extensive experience in decision science and informatics.

## Leadership and Recognition

### *Selected Accomplishments*

- Numerous prestigious honors have been bestowed on ASU faculty members over the years for their outstanding achievements. This includes election to national academies and other major awards including:
  - American Academy of Arts and Sciences, 11 members;
  - National Academy of Engineering, 9 members;
  - National Academy of Sciences, 12 members;
  - Institute of Medicine, 2 members;
  - National Academy of Education, 4 members;
  - National Academy of Public Administration, 3 members;
  - Presidential Early Career Awards for Scientists and Engineers, 8 awards
  - Early Career Awards (NSF, DOE, Army), 86 awards.
  - American Association for the Advancement of Science, 65 fellows
- The 2012 edition of *U.S. News & World Report* ranks ASU in the top tier of national universities for the sixth consecutive year. ASU is ranked 139<sup>th</sup> among over 1,500 four-year colleges and universities that *U.S. News* assesses. ASU is also named one of the top “2013 Up-and-Comers” among national universities in the “2013 Best Colleges” guidebook. 2012 is also the fifth year that ASU has been named as a “school to watch.”
- ASU is among the top 100 schools in *Washington Monthly* magazine’s 2012 national rankings of universities contributing to public good. This recognition demonstrates the impact of ASU research and its graduates beyond the university. ASU placed 45<sup>th</sup> in the rankings, up from 132<sup>nd</sup> place last year. Rankings are based on social mobility through recruiting and graduating low-income students, research that produces cutting-edge scholarship and doctoral graduates, and service that encourages students to give back to their country.
- ASU has been named one of the top producers of Fulbright award scholars, to research and teach abroad. In FY12, eight faculty members traveled to six different countries to carry out their work. The grants placed ASU third in the nation for Fulbright Scholar awards, behind Pennsylvania State University at University Park and the University of Kansas.

# Leadership and Recognition

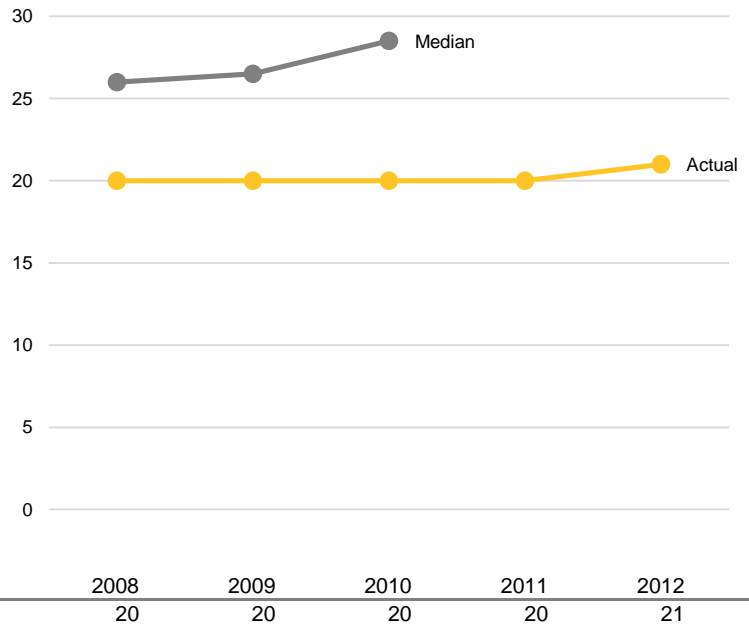
## Selected Accomplishments

- ASU faculty have won 86 Early Career development awards from NSF, DOE, and the United States Army. These awards are extremely competitive and recognize the high quality work of the junior faculty. These awards reflect ASU's investment in recruiting and nurturing exceptional talent, ensuring continued success as these faculty members advance in their fields.
- ASU's Consortium for Science, Policy and Outcomes (CSPO) was again recognized by the Global Go-To Think Tanks Report. CSPO was ranked fourth internationally among science and technology think tanks – and first among university-based think tanks. This is notable recognition as it ranked tenth in 2010.
- ASU was selected as one of 15 higher education institutions by the American College and University Presidents' Climate Commitment (ACUPCC) for its Celebrating Sustainability series. Recognized by ACUPCC for its cutting-edge work in promoting sustainability, ASU earned this distinction in large part because of its commitments to apply solar power in meeting its energy needs. Currently, ASU is home to the largest single-university solar installation in the country.



# Leadership and Recognition

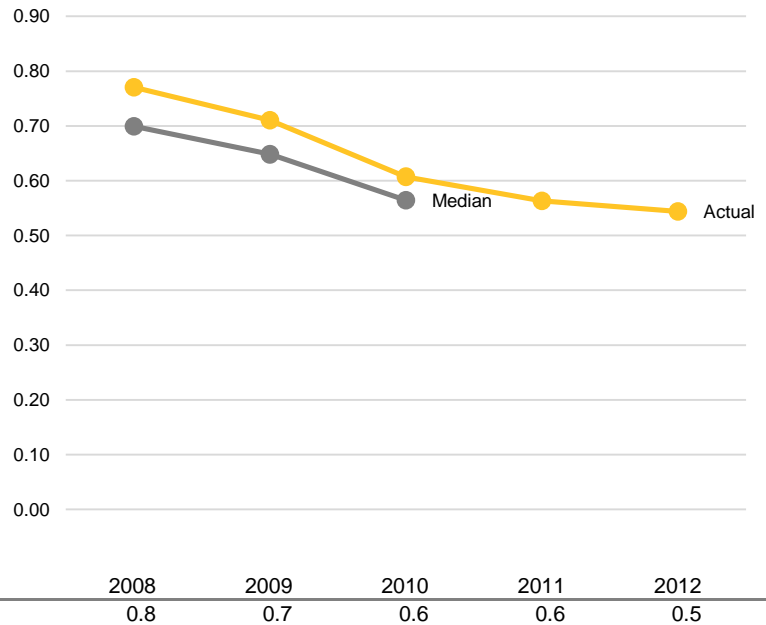
National Academy Members



		2008	2009	2010	2011	2012	
Actual		20	20	20	20	21	
	Med. Sch.						Rank
<b>ABOR Peer Group</b>							
University of Washington - Seattle	X	102	101	102			1
University of California - Los Angeles	X	81	85	91			2
University of Wisconsin - Madison	X	73	71	71			3
University of Texas - Austin		63	65	67			4
University of Illinois - Urbana-Champaign		57	55	59			5
University of Minnesota - Twin Cities	X	34	39	41			6
Rutgers the State University of NJ - New Brunswick		35	36	36			7
University of Maryland - College Park		27	27	30			8
Ohio State University - Columbus	X	24	26	27			9
Pennsylvania State University - University Park		25	24	24			10
University of Iowa	X	21	21	22			11
<b>Arizona State University</b>		<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>21</b>	<b>12</b>
Indiana University - Bloomington		10	11	10			13
Florida State University	X	7	7	7			14
Michigan State University	X	8	7	7			14
University of Connecticut - Storrs		3	1	1			16
<b>Median</b>		<b>26</b>	<b>27</b>	<b>29</b>			

# Leadership and Recognition

National Academy Members per \$10 Million in Total Research Expenditures



	2008	2009	2010	2011	2012
Actual	0.8	0.7	0.6	0.6	0.5

ABOR Peer Group	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
University of Illinois - Urbana-Champaign		1.1	1.0	1.1			1
University of Texas - Austin		1.3	1.3	1.1			2
University of Washington - Seattle	X	1.3	1.3	1.0			3
University of California - Los Angeles	X	0.9	1.0	1.0			4
Rutgers the State University of NJ - New Brunswick	X	1.1	1.0	0.8			5
University of Wisconsin - Madison	X	0.8	0.7	0.7			6
University of Maryland - College Park		0.7	0.7	0.7			7
<b>Arizona State University</b>		<b>0.8</b>	<b>0.7</b>	<b>0.6</b>	<b>0.6</b>	<b>0.5</b>	<b>8</b>
University of Minnesota - Twin Cities	X	0.5	0.5	0.5			9
University of Iowa	X	0.7	0.6	0.5			10
Ohio State University - Columbus	X	0.3	0.4	0.4			11
Pennsylvania State University - University Park	X	0.4	0.3	0.3			12
Florida State University	X	0.4	0.4	0.3			13
Indiana University - Bloomington	X	0.2	0.2	0.2			14
Michigan State University	X	0.2	0.2	0.2			15
University of Connecticut - Storrs	X	0.1	0.0	0.0			16
<b>Median</b>		<b>0.7</b>	<b>0.6</b>	<b>0.6</b>			

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## **Technology Transfer**

AzTE is the exclusive IP management and technology transfer organization for Arizona State University. Established in 2003, AzTE is a wholly-owned subsidiary of the ASU Foundation. Since FY09, based on annual licensing surveys by the Association of University Technology Managers (AUTM), ASU, through the activities of AzTE, has been one of the top-performing universities in the country in terms of IP inputs (inventions disclosed to AzTE by ASU researchers) and outputs (licensing deals, option agreements, and start-ups based on university IP) relative to the size of the university's research enterprise. When published next year, the AUTM licensing survey for FY12 will likely rank ASU again in the top ten universities on these metrics per \$10 million in research expenditures.

In the last decade, AzTE's venture development activities have led to the formation of 55 companies based on university IP. Many of these companies currently operate in Arizona and employ ASU graduates. These Arizona-based companies contribute to the local economy and tax base through job creation and commercial transactions in the Greater Phoenix area. Additionally, based on available information, start-up companies that have licensed ASU IP have attracted more than \$300 million in funding from venture capital firms and other investors, with much of this financing achieved during the last five years. In FY12, these companies closed on over \$55 million in venture capital and other financing.



The following are updates on selected ASU start-up ventures founded in previous years:

- Axon Technologies Corporation is a start-up company established in 1996 by Dr. Michael Kozicki, ASU professor in the School of Electrical, Computer and Energy Engineering, based on groundbreaking memory technology covered by more than 30 issued patents. The first commercial product, a 1-Mbit serial EEPROM semiconductor memory chip, was introduced in FY12 through its sublicensee, Adesto Technologies, which has more than 30 employees and is supported by \$55 million in financing.
- Fluidic Energy, an energy company founded in 2007 by Dr. Cody Friesen, professor in the School for Engineering of Matter, Transport and Energy, continues to develop and commercialize rechargeable metal-air battery technology that could offer lower costs, higher energy density, and longer run times. The company has already received two significant rounds of venture capital funding as well as several millions of dollars in non-dilutive funding through DOE ARPA-E. In FY12, the company achieved its first commercial product revenue. Fluidic has R&D and manufacturing facilities in North Scottsdale.

- Health *Tell*, Inc., an early-stage company founded in 2011 by Drs. Stephen Johnston and Neal Woodbury, co-directors of the Center for Innovations in Medicine at ASU's Biodesign Institute, is developing powerful new tools to help individuals monitor their health status. The test is simple and inexpensive, and can be performed with a single drop of blood. Instead of trying to measure the pathogen directly, Health *Tell* measures the body's unique response (or its "immunosignature") to a given disease or disease state. By understanding immunosignatures and how they change over time, the company can provide a broad menu of highly accurate tests that can detect diseases much earlier and less invasively than is possible today. In June 2012, ASU received a \$30.7 million contract from the DOD to develop a diagnostic tool to protect military personnel against bioterrorism, utilizing technology being developed by Health *Tell*. The company is planning to expand its operations to the Innovations Incubator in Chandler and is one of the finalists for the *Start-up Company* award to be announced at Arizona Technology Council's 2012 Governor's Celebration of Innovation. (A previous winner of an Innovation award, in November 2010, was then ASU Assistant professor William Tyler, who founded the medical device company SynSonix, LLC based on ultrasound, neuromodulation technology developed at ASU and licensed from AzTE in 2008. The company has since been acquired by Neurotrek, Inc. with Series A venture financing from Khosla Ventures, a top-tier venture capital firm in Silicon Valley.)
- Heliae Development, LLC is an algae biofuels and nutraceutical development company launched in 2008 to develop a technically viable, scalable, end-to-end process based on ASU IP to produce algae-based solutions for the food, fertilizer, pharmaceutical, fuels, green chemicals and cosmetic industries. As recently noted by Dan Simon, CEO of Heliae: "Our relationship with ASU has been instrumental in realizing the successes that we've achieved since launch. Through AzTE, ASU has been a critical partner as the company progressed from start-up to becoming a significant employer in Gilbert with nearly 80 employees and over \$50 million in private capital invested. We are currently actively searching for areas we can expand and deepen our relationship with ASU in pursuit of new strains, applications and/or technologies which improve our ability to drive profitable full scale algae production." Many of the company's employees are ASU graduates with advanced degrees in microbiology, engineering, and other technical fields.



The continuous growth of ASU's research expenditures has resulted in a strong flow of invention disclosures, increasing the depth and breadth of the university's key patent portfolios in the life and physical sciences, including healthcare, nanotechnology, education, and energy innovations. AzTE continues to build strong and synergistic relationships with faculty and staff. This is reflected, in part, by the record number of invention disclosures submitted to AzTE in FY12. Licensing deals, industry-sponsored research dollars, ASU spinouts, and patent activity through AzTE remained robust in FY12.

# Technology Transfer

## Statistical Exhibits

Technology Transfer Activities	2008	2009	2010	2011	2012
Invention Disclosures Transacted	147	164	187	170	239
Invention Disclosures Transacted Year/Year Percentage Change		12%	14%	-9%	41%
New Patent Applications	87	126	99	93	105
New Patent Applications Year/Year Percentage Change		45%	-21%	-6%	13%
U.S. Patents Issued	16	20	17	18	26
U.S. Patents Issued Year/Year Percentage Change		25%	-15%	6%	44%
Licenses and Options Executed	50	49	55	72	80
Licenses and Options Executed Year/Year Percentage Change		-2%	12%	31%	11%
Other Major Agreements	78	53	108	126	160
Other Major Agreements Year/Year Percentage Change		-32%	104%	17%	27%

Licensing and Other Revenue	2008	2009	2010	2011	2012
Licensing Revenue (Including Options)	1,212,021	1,878,749	1,625,716	1,059,372	1,901,407
Licensee Legal Reimbursements	508,710	661,986	1,111,111	1,205,679	1,274,577
Other Revenue	4,978	65,367	5,021	41,945	540,000
Total	1,725,709	2,606,102	2,741,848	2,306,996	3,715,984

Sponsored Research Facilitated	2008	2009	2010	2011	2012
Total	15,626,906	7,215,259	5,623,534	8,945,930	9,601,072

Royalty Distribution	2008	2009	2010	2011	2012
Inventors	-275,885	-359,299	-281,466	-242,493	-210,800
Laboratories and Units	-332,210	-347,918	-313,358	-208,090	-180,287
University	-245,188	-297,424	-235,699	-138,557	-124,835
Undistributed	221,980	12,979	548,128	169,983	100,694

- M06-028L, US Patent No. 8,126,649: “Methods for Generating a Distribution of Optimal Solutions to Nondeterministic Polynomial Optimization Problems.” This patent covers a significant improvement of the DNA-based computer that uses DNA, biochemistry, and molecular biology, rather than traditional silicon-based, electronic computer technologies. A DNA computer is a massively-parallel computer which is uniquely suited to several types of calculations where an electronic computer would be larger and/or slower. It can also solve certain problems that are unsolvable by other means. In particular, this DNA computer has demonstrated the unique ability to solve problems in fields such as transportation engineering and supply chain management. The technology was developed by Dr. Wayne Frasch, ASU Professor in the School of Life Sciences.
- M06-149P, US Patent No. 8,133,802: “Silicon-Germanium Hydrides and Methods for Making and Using the Same.” This technology is exclusively licensed to Voltaix, Inc. The patent describes new gaseous compounds that can be used to deposit silicon-germanium materials used in microelectronic, photonic, and photovoltaic devices. Presently, producing these materials at sufficiently high quality for real-world applications requires complicated high-temperature growth techniques. The new “precursor” gases simplify the growth process to form (or deposit) electronic and optoelectronic grade materials. The technology was developed by Dr. John Kouvetakos, ASU Professor in the Department of Chemistry and Biochemistry.
- M08-095P, US Patent No. 8,168,337: “Electrochemical Cell, and Particularly A Metal Fueled Cell with Non-Parallel Flow.” This technology is exclusively licensed to Fluidic Energy. The patent describes new device architecture for electrochemical cells, such as metal-air batteries. This newly-developed device eliminates the need for membrane layers that are traditionally required in many electrochemical cells. It also allows for the use of metal fuels, which have high energy densities. The new device is therefore expected to operate over a broader range of environmental conditions and with higher energy and power densities than traditional electrochemical cells. This technology was developed by Dr. Cody Friesen, ASU Associate Professor in the School for Engineering of Matter, Transport and Energy.
- M04-099L, US Patent No. 8,197,395: “Pacemaker for Treating Physiological System Dysfunction.” This is a pacemaker device for controlling epilepsy, although it may have uses in treating related brain dynamical disorders, such as strokes, sleep apneas, migraine attacks, and Parkinsonian tremors. This device identifies the chaotic electrical signals known to be responsible for seizure activity, and applies an automatically-generated feedback signal that reinforces the brain’s natural feedback mechanisms. In this way, the device detects the early onset of seizures, applies a signal to help prevent their occurrence, continuously modifies this signal for maximum efficacy, and minimizes their duration and severity. This technology was developed by Drs. Leonidas Jassemidis, ASU Associate Professor in the School of Biological and Health Systems Engineering, and Konstantinos Tsakalis, ASU Professor in the School of Electrical, Computer and Energy Engineering.

- Translucent  
Translucent is owned by Silex, a public company based in Australia. Previously, AzTE and Translucent entered into an exclusive option agreement to license a portfolio of solar-related technologies. Translucent decided to exercise its option and signed an exclusive license agreement for this revolutionary technology that eliminates the use of costly germanium as a substrate for concentrating solar devices, instead utilizing a buffer layer deposited directly onto silicon substrates. This reduces cost while increasing device reliability and efficiency. In FY12, Translucent also signed an additional option agreement for a separate technology related to improved LED lighting devices, and has recently expressed interest in executing an exclusive license for this technology as well.
- Roche/IBM  
As part of its drive to achieve single-molecule DNA sequencing, Roche created a joint venture with IBM that has licensed six ASU technologies developed by or under the direction of Dr. Stuart Lindsay at ASU's Biodesign Institute. In addition, the joint venture is funding research in Dr. Lindsay's laboratory. New intellectual property already has been generated as a result of this work, and the collaboration will likely be extended when it comes up for renewal in February 2013. The core technology involves translocating a single molecule of DNA through a nanopore and sequencing it upon exit.
- Medicago  
Medicago is a Canadian company specializing in vaccine development. In FY12, the company licensed technology developed in the laboratory of Drs. Charles Arntzen and Hugh Mason at the Biodesign Institute for high-level expression of heterologous proteins in plants. They are continuing development of this technology, and first product introduction is anticipated in 2015. The technology involves the use of virus-derived gene vectors and regulatory elements.
- Universal Display Corporation (UDC)  
Universal Display Corporation is a world leader in the development of innovative organic light emitting diode (OLED) technology for use in flat panel displays, lighting, and organic electronics. UDC has one of the largest OLED patent portfolios. In FY2012, UDC entered into an exclusive license agreement for a portfolio of eight OLED innovations that dramatically improve the efficiency and reliability of OLED materials while reducing costs. In addition to the executed license agreement, UDC also has provided ASU with over \$500,000 of research funding to further develop the technology. Under this research program, a new technology has already been discovered, which AzTE licensed to UDC.

- ArbSource, LLC  
ArbSource is commercializing an innovative wastewater treatment technology. The technology utilizes a novel microbial fuel cell treatment process for a variety of industries including food and beverage and manufacturing.
- Moved by Reading, LLC  
Moved by Reading is an educational learning company created to develop and market technologies for teaching English reading comprehension.
- Heart in Your Hand, LLC  
Heart in Your Hand produces personalized three-dimensional cardiac models. These models are used as training aids for cardiac surgeons for surgical intervention in cardiovascular malformation, including congenital heart defects, coronary artery disease, and valvular heart disease.
- TF Health Corp  
TF Health is commercializing novel sensor technologies for health and fitness applications. The company utilizes a proprietary design process that enables detection of highly sensitive levels of targeted agents.
- Family Transitions  
Programs That Work, LLC – Family Transitions delivers prevention program training and related materials to community agencies that seek to provide effective prevention programs to families going through stressful transitions such as separation, divorce, or bereavement due to the death of a parent.
- IPM Innovations, LLC  
IPM Innovations is commercializing a use-inspired educational tool developed through a unique collaboration between researchers and teachers to ensure that all educators have an easy and effective way to plan, communicate, and monitor daily instruction.
- GreenCave Productions, LLC  
GreenCave Productions is developing computer-game math educational products for the K-8 market through the conversion of manual tools to automated learning games.
- Sonoran BioSciences, Inc.  
Sonoran BioSciences has developed novel antibiotic-delivering polymer gels for the surgical industry. The gels are a drug-releasing coating that is used on the exterior of implants to help prevent infections associated with limb and joint replacement.
- NanoVoltaix, Inc.  
NanoVoltaix is developing next-generation materials technology based on proprietary nano-porous composition that can be used for manufactured products requiring lightweight flexible components.

- ASU Venture Catalyst

A joint effort between the ASU Office of Knowledge Enterprise Development (OKED) and AzTE, the Venture Catalyst has evolved into a robust platform that supports high-potential start-ups from the Greater Phoenix area as well as national and international start-ups.

ASU Venture Catalyst equips high potential start-ups for success. It assists university students, faculty and staff, as well as local and global entrepreneurs, with launching start-ups or accelerating existing ventures. Based at ASU SkySong, Venture Catalyst offers investor connections, technology road maps, go-to-market strategy consulting, mentoring opportunities, and several other programs and services designed to identify and develop investment-grade quality companies.

In FY2012, Venture Catalyst began a new 12-module program that bridges the gap between student and university start-ups and external high potential start-ups. Rapid Start-up School was designed to be a “pracademic” approach to teaching entrepreneurship, focused not on the theory behind entrepreneurship but the practicality of actually getting a start-up business developed and funded. The objective is to stimulate start-up activity and provide graduate students, doctoral students, and postdoctoral researchers with an understanding of commercialization.

- Arizona Furnace

AZ Furnace is an innovative start-up accelerator conceived and designed by the ASU Venture Catalyst team to incubate and launch new companies created by licensing intellectual property developed at Arizona research institutions. Partners now include Dignity Health Systems, Northern Arizona University, The University of Arizona, and Thunderbird School of Global Management. This statewide initiative is designed to expose high-value technologies to entrepreneurs around the country in an effort to bring these technologies to market through new start-up companies based in Arizona. Furnace is an intensive, six-month accelerator that provides winners with a minimum of \$25,000 seed funding, office space, and access to top industry mentors.

The AZ Furnace program is a competitive process that encourages serial entrepreneurs, alumni, researchers, faculty, and postdocs to look at Arizona technologies in a new way. The university and research institution inventions have been amassed in a user-friendly database to promote competition among entrepreneurs interested in commercializing those technologies.



- Entrepreneur-in Residence Network

AzTE has convened a number of venture capital and investor events, including the *Head Start(Up)* event in Palo Alto with Caltech, UCLA, and USC in May 2011. Based on the success of these events, AzTE decided to partner with Columbia University and Osage University Partners, a venture fund focused on university IP, to launch an initiative to identify venture-fundable entrepreneurs and connect them with start-up opportunities from select schools. As of FY2012, member institutions include ASU, Caltech, Carnegie Mellon, Columbia, Duke, University of Florida, University of Illinois, John Hopkins, Lawrence Berkeley, University of Michigan, University of Minnesota, New York University, University of Pennsylvania, Princeton, Scripps, UC Berkeley, UC San Diego, UC San Francisco, UC Santa Barbara, USC, UT-Dallas, University of Utah, and Yale. A pilot launch of the EIR Network was announced in August 2012 with the participation of several venture capital firms representing a broad range of investment sectors and geographies.

- Student Venture Development

Programs and initiatives at ASU and AzTE to support student venture activity have transformed ASU into a leading university for entrepreneurship. The FY2012 cohort was the most successful year yet. More than 340 individual venture applications were received for the *Edson* initiative, representing more than 1200 students from across all university disciplines. The FY2012 *Edson* companies have brought in over \$300,000 in grants, cash prizes, and in-kind funds. Accolades for this group include:

- 1st place winners of the Microsoft *Imagine Cup* competition were ASU teams in 2011 and 2012
- *Entrepreneur* magazine 'College Entrepreneur of the Year' in the USA: Three out of five finalists (1st time) and overall winner
- Top 5 Small Business Facebook Presence: One out of twenty internationally (1st time)
- The *Cleantech Open* competition: One winner of the Rocky Mountain Regional final (1st time)
- *Inc. Magazine's* 'Coolest College Startup in America': 2 finalists – first and second place overall (1st time)

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## **Strategic Initiatives**

# Strategic Initiatives

## Summary

University research remains vital to the advancement of knowledge, economic prosperity, and workforce development, all of which are essential components of ASU's vision as a New American University. Strategic investments in research, faculty leadership hires, and infrastructure are planned and will sustain the momentum that ASU has created in its research enterprise.

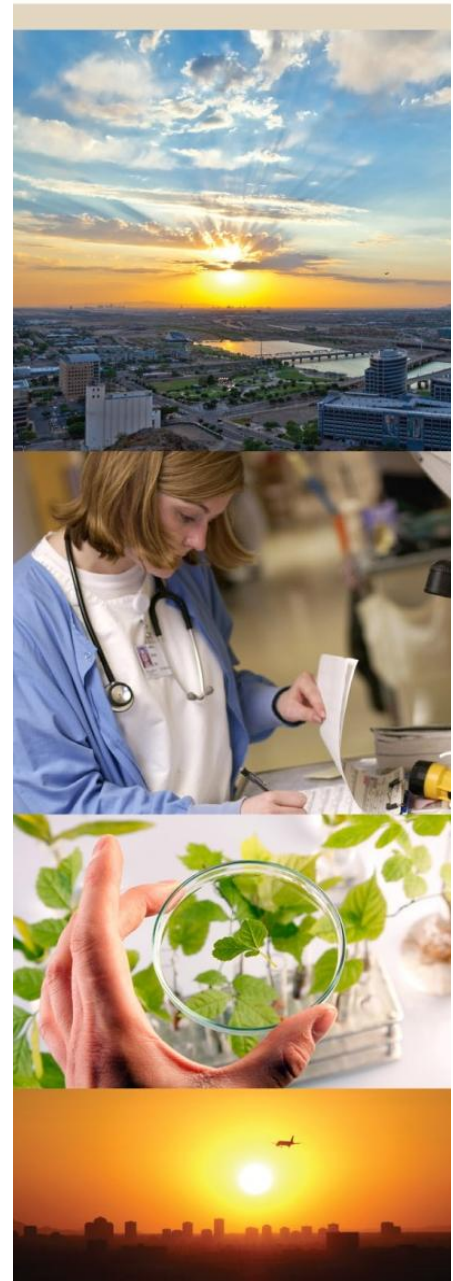
ASU's future plans for the growth and direction of the research enterprise include:

- **Accelerate research growth**

Growing ASU's research enterprise will include continued investment in and expansion of the established strategic research focus areas of Improving Health; National Security Systems; and Water, Environment and Energy Solutions. These focus areas represent Technology Research Initiative Fund (TRIF) investments at the university and include a diverse portfolio of initiatives such as the Biodesign Institute, the Security and Defense Systems Initiative, the Flexible Display Center and LightWorks.

Complementary to the growth of established research is the development of emerging research initiatives, such as complex adaptive systems and learning sciences. Expansion of these programs, creation of new initiatives or acquisition of research centers in emerging research areas that bring new capacity and leverage ASU strengths will be carefully evaluated.

ASU is also positioning itself to grow its enterprise and create opportunities by engaging new sponsors and increasing our involvement in larger strategic grant and contract opportunities. This includes supporting potential winning teams for large competitions, increasing engagement with contracting agencies such as USAID, developing pathways for increased foundation and international support and growing industry-sponsored research.



- **Attract and retain the best experts in their respective fields to lead ASU's institutes and initiatives**

Exceptional leadership ensures the success of ASU's institutes and initiatives. ASU will continue to pursue top experts in their fields to provide leadership. These experts come from the private, not-for-profit, government, and academic sectors and enrich the institutes and initiatives. Recent experts that ASU has attracted include:

- Dr. Anna Barker, the past deputy director for strategic initiatives at the National Cancer Institute at the NIH, joined ASU to direct the Transformative Healthcare Networks and co-direct the emerging initiative, Complex Adaptive Systems.. She is also a professor of practice within the School of Life Sciences in the College of Liberal Arts and Sciences.
- Dr. Kenneth H. Buetow, a human geneticist and former director of the Center for Biomedical Informatics and Information Technology at the National Cancer Institute, joined ASU as the director of computational sciences and informatics in the Complex Adaptive Systems Initiative at ASU.

- **Anticipate and respond to research space and facility needs**

As the ASU research enterprise continues to advance, addressing our space and facility needs is of critical importance. This includes the renovation of existing space and construction and acquisition of new space to meet the current and expected research needs. Careful planning ensures efficient use of space and removes constraints that could limit growth.

As we move toward our goal, ASU will continue to build on its foundation of established research while also expanding into new areas. This growth will be enabled through deliberate planning, strategic investments, and ASU's unique institutional qualities which include the university's trans-disciplinary, collaborative, and entrepreneurial culture.



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**Annual Research Report - FY2012**

Northern Arizona University is pleased to provide this summary of our research activity for FY2012 and to report our progress toward achieving our 2020 Enterprise research goals.

The past few years have been challenging yet rewarding. Like many of our direct peer institutions, we have experienced a decline in tenured and tenure-track faculty numbers while being pressed to grow our sponsored projects portfolio and level of research expenditures. Our faculty has risen to the challenge by doing more while maintaining the highest standards for their research and scholarship. Still, we must find innovative ways to increase our research expenditures while making plans to increase the number of new faculty at NAU.



To this end, in FY2012 we initiated an internal grant program, funded by TRIF, through which research-active faculty can hire post-doctoral scholars, bringing new research expertise to the university, for 2-year appointments. In an environment where our faculty have been asked to teach more, we know that post-docs can help to increase the capacity of our research programs because they can manage existing extramurally-funded research projects, write grants and supervise graduate students and research staff—all key components of their post-doctoral training. We expect to hire up to 18 post-doctoral scholars through this program in FY2013 and should realize the benefits of these hires—in the form of increased grant proposals and research outcomes—in FY2014 and 2015.

In addition, realizing that interdisciplinary research centers and institutes generate a high volume of research activity, NAU has developed plans to establish new research centers that will incentivize high performers in ways not currently possible through the traditional departmental structure. In FY2013 we expect to establish two research centers under this new policy. Meanwhile, through our academic departments we are hiring new tenure track faculty to enhance our competitive position with respect to research productivity.

Finally, NAU is committed to developing a new research dimension by significantly strengthening our applied computer sciences and informatics research capabilities in the coming five years. The goal in focusing on informatics-driven research is to build a 21<sup>st</sup> century platform for research across a number of disciplines and to promote collaborations with other universities—including UA and ASU—on large, federally-funded grant projects.

While Northern Arizona University may be the smallest of the three Arizona state universities, we are, nonetheless, a High Research university with a very active, diverse and growing research portfolio and high expectations. Through our research enterprise we make unique contributions to the Arizona university system and to the state.



William Grabe  
Vice President for Research



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**Enterprise Size**

Over the past 40 years, NAU's research enterprise has grown broad and deep. While we are perhaps most well-known for research that has a regional focus, we are not limited to this focus. Research activities at NAU generate outcomes having local, national, and global impact. In fact, our research enterprise activities result in new discoveries and knowledge that generate outcomes having local, national and global impact. Our research enterprise is the mechanism through which our faculty participate in national and global discussions with networks of scientists and scholars. In addition, research conducted by NAU faculty naturally enhances undergraduate and graduate education. We take pride in knowing that NAU Research has both regional and wide-reaching impact. Through its Research Enterprise, Northern Arizona University expands the boundaries of knowledge and improves lives.

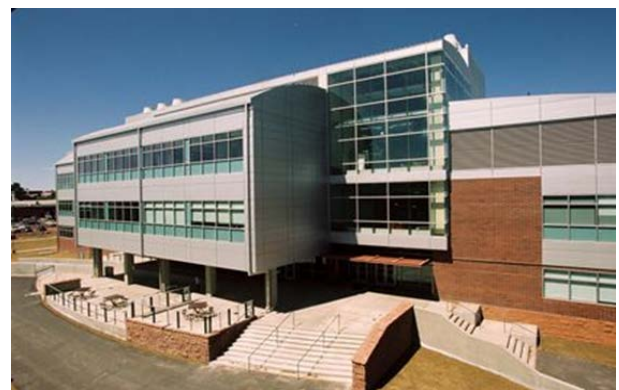
## Total and Federal Research Expenditures

Northern Arizona University's peer institutions range greatly in the size of the research enterprise (as reflected in total research expenditures), from the University of Maine (greater than \$100M) to Bowling Green State (less than \$10M). With research expenditures ranging between \$25M and \$30M each year, we are below the median for our peer group. Yet our growth has been steady over the past five years. However, while our FY2012 research expenditures fell approximately 9% from FY2011, we expect to remain at the same rank relative to our peers, in part because only 4 of our peers had any increase at all in the number of faculty between FY2011 and FY2012, and those increases were, for the most part, minimal. Like most of our peer institutions, we have experienced a steady decrease in the number of research-active faculty, and this is reflected in the reduction in FY2012 research expenditures. We expect that when we have FY2012 research expenditure data for our peers, we will see similar declines reflected for those institutions who show a similar decline in faculty numbers.

## Research Space

While we remain well below the median of our peer group with regard to research space (ranking 12 in the group of 16), we are squarely in the middle range of the peer group in terms of R&D expenditures per square foot of research space, which indicates that we are relatively efficient with the use of our research space. We continue to invest in renovating and using more efficiently some of the facilities not originally designed for modern research activities (e.g., Engineering).

Additionally, we have added new space over the past few years (the new Science Laboratory Facility for biological sciences and chemistry) and recognize that



The Science Lab building on north campus at Northern Arizona University

**Factoid:** According to the Carnegie Foundation, there are 4,634 institutions of higher education in the United States, 207 (5%) of which constitute the country's most active research universities. As a designated "High Research" university, Northern Arizona University falls within that 5%.

## Faculty Numbers and Research Personnel

Northern Arizona University is ranked toward the bottom of its peer group with respect to numbers of tenured/tenure track faculty members. We recognize that in order to reach our 2020 research goals, we will need to reverse what has been a downward trend in our faculty numbers. However, while research expenditures per faculty member fell in FY2012, the data shows that we are still 7% above FY2010 performance; furthermore, the overall increase in the effectiveness of our tenured/tenure-track faculty (research expenditures per faculty member) has increased 27% over the past five years. Over the past fiscal year, we have implemented programs and policies that recognize the importance of Research (non-tenure-track, soft-money) Faculty and postdoctoral associates to maintain strength in research and mentor graduate students. Having few PhD-granting degree programs on campus also limits the ability of faculty to pursue funded research in some disciplines, and we are addressing this as well. During FY2011 a new Ph.D. program in interdisciplinary earth and environmental science was approved, which will add substantially to the research capacity of some of our most talented and competitive faculty and assist us in faculty recruiting efforts in a number of disciplines.

## Enterprise Size

### Selected Accomplishments

- Regents' Professor **Thomas Whitham**, who serves as the Executive Director of NAU's Merriam-Powell Center for Environmental Research, received a four-year, \$2.5 million grant from the National Science Foundation to create the Southwest Experimental Garden Array (SEGA), a system of ten experimental gardens across northern Arizona that will include habitat types from desert to alpine forests. The gardens will be used to examine how climate change will affect the ecology and evolution of individual plant species, plant communities and ecosystems. Whitham's research group expects to work with collaborators in other parts of the U.S. and internationally to eventually create arrays in almost every type of habitat on the planet.



The weather instruments shown above are located at the Merriam-Powell Elevation Gradient site, a SEGA prototype.

- **Apichai Tuanyok**, assistant research professor at the Center for Microbial Genetics and Genomics, received a grant from the Battelle Memorial Institute for the project titled "Establishing *Burkholderia Pseudomallei* Index Strains and Animal Hosts for testing of Medical Countermeasures (MCMs) Against Human Melioidosis" in the amount of \$1.1 million. The goals of the study are to provide and characterize reference *Burkholderia pseudomallei* strains in a master cell bank to support animal model research at Battelle Memorial Institute.



*B. pseudomallei* grown on sheep's blood.

- Associate Professor **Ann Huffman**, Psychology, received an award for her project titled "The Wellbeing of Army Personnel in Dual Military Marriages." The award from the Department of the Army Medical Research Acquisition Activity in the amount of \$650,000 funds Huffman's examination into the influence of stressors and benefits related to work and family on dual-military marriage wellbeing.
- **Jeff Foster**, research assistant professor in Biological Sciences and Associate Director of the Center for Microbial Genetics & Genomics received a \$1.4 million grant from the Department of Defense for the project titled "Next Generation Sequencing for the Clinical Diagnostics Setting." With this funding, Foster will develop a rapid diagnostic that fully characterizes a range of infectious diseases using next-generation sequencing technologies, with a focus on biothreat agents and diseases relevant to military personnel.

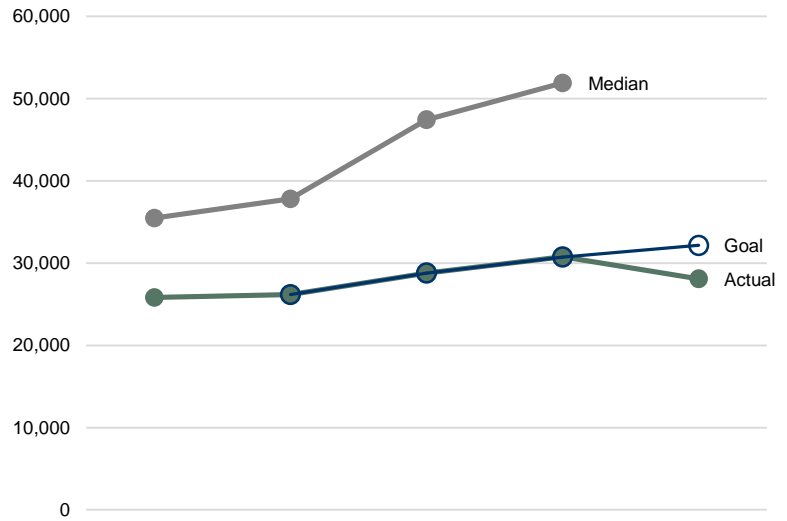


Foster sees whole genome sequencing as the future of clinical diagnostics.

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# Enterprise Size

Total Research Expenditures (in Thousands)



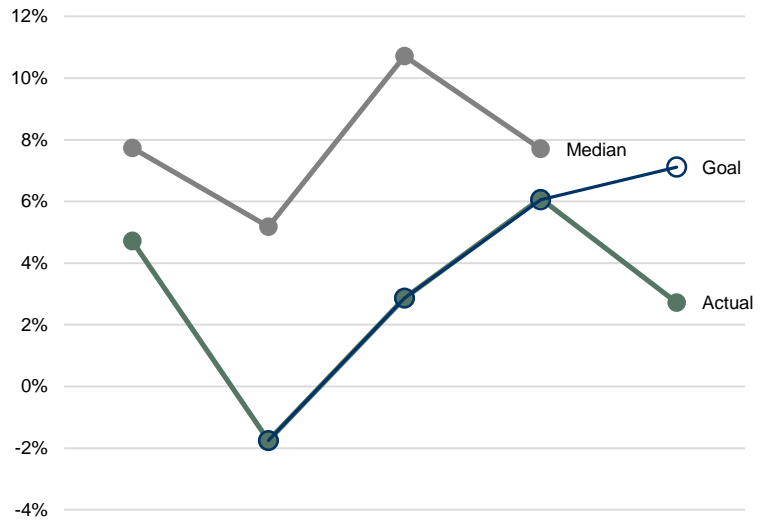
ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	25,820	26,183	28,803	30,785	28,100
Goal		26,183	28,803	30,751	32,160
Difference		0	0	34	-4,060

ABOR Peer Group	Med. Sch. NSF Adj.	2,008	2,009	2,010	2,011	2,012	Rank
University of Maine		95,042	100,580	111,282	111,600		1
Old Dominion University		66,538	71,909	97,176	102,192		2
Georgia State University		77,709	60,557	81,015	92,725		3
George Mason University		72,542	78,487	84,120	88,089		4
Southern Illinois University - Carbondale	X	67,094	66,316	69,924	71,130		5
University of Akron		27,182	34,507	52,884	65,536		6
Ohio University	X	38,108	41,256	50,440	57,643		7
University of Alabama		32,846	36,508	40,762	53,633		8
Wichita State University		47,853	65,988	51,524	50,194		9
University of Nevada - Las Vegas		50,775	39,148	44,457	39,526		10
<b>Northern Arizona University</b>		<b>25,820</b>	<b>26,183</b>	<b>28,803</b>	<b>30,785</b>	<b>28,100</b>	<b>11</b>
Kent State University - Kent		23,293	25,050	26,331	27,455		12
University of North Carolina - Greensboro		7,876	10,394	22,436	26,121		13
Western Michigan University		14,617	13,301	26,391	25,051		14
Northern Illinois University		14,948	20,644	27,036	21,748		15
Bowling Green State University		10,712	8,396	8,124	8,999		16
<b>Median</b>		<b>35,477</b>	<b>37,828</b>	<b>47,449</b>	<b>51,914</b>		



# Enterprise Size

Average Growth Rate in Total Research Expenditures Over 3 Years

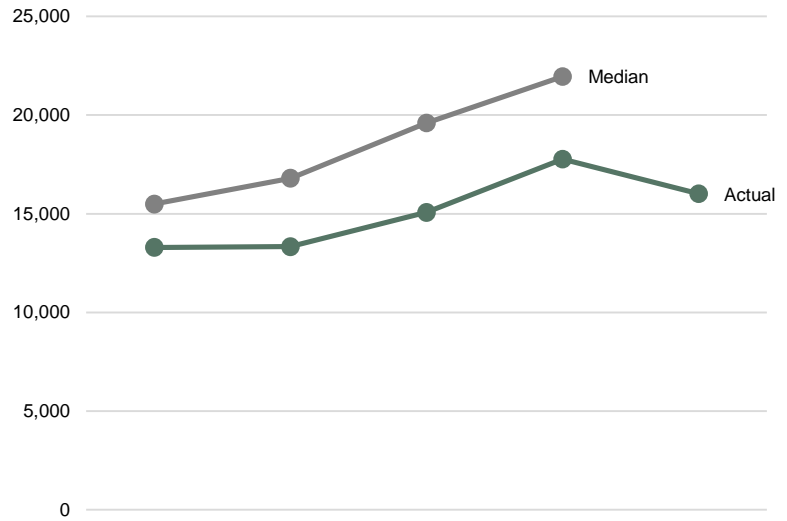


ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	4.7%	-1.8%	2.9%	6.1%	2.7%
Goal		-1.8%	2.9%	6.1%	7.1%
Difference		0	0.0%	0.0%	-4.4%

ABOR Peer Group	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
University of North Carolina - Greensboro		18.3%	20.5%	58.8%	54.8%		1
University of Akron		0.5%	7.5%	26.8%	34.7%		2
Western Michigan University		-5.6%	-9.5%	24.8%	28.1%		3
University of Alabama		-1.5%	1.7%	4.4%	18.1%		4
Northern Illinois University		12.6%	9.4%	19.5%	16.5%		5
Old Dominion University		12.8%	13.3%	23.6%	16.1%		6
Ohio University	X	-3.9%	2.9%	9.7%	14.9%		7
Georgia State University		17.9%	8.9%	21.0%	8.7%		8
George Mason University		19.4%	16.1%	13.3%	6.7%		9
<b>Northern Arizona University</b>		<b>4.7%</b>	<b>-1.8%</b>	<b>2.9%</b>	<b>6.1%</b>	<b>2.7%</b>	<b>10</b>
Kent State University - Kent		31.5%	33.9%	11.7%	5.6%		11
University of Maine		8.7%	2.6%	5.1%	5.6%		12
Wichita State University		15.7%	29.2%	5.6%	4.5%		13
Southern Illinois University - Carbondale	X	6.8%	-3.5%	2.7%	2.0%		14
Bowling Green State University		3.7%	-4.1%	-2.5%	-4.7%		15
University of Nevada - Las Vegas		2.3%	-11.3%	-6.2%	-6.8%		16
<b>Median</b>		<b>7.7%</b>	<b>5.2%</b>	<b>10.7%</b>	<b>7.7%</b>		

# Enterprise Size

Federally Financed Research Expenditures (in Thousands)

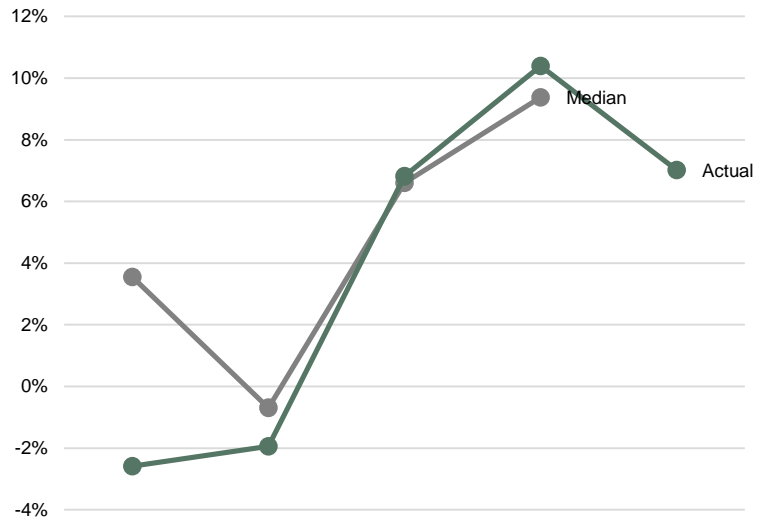


	2008	2009	2010	2011	2012
Actual	13,298	13,333	15,070	17,765	16,015

ABOR Peer Group	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
George Mason University		50,392	55,678	63,011	65,301		1
University of Maine		40,931	47,280	50,163	59,800		2
Old Dominion University		28,298	27,644	34,687	39,534		3
University of Alabama		23,394	23,944	26,364	32,999		4
University of Nevada - Las Vegas		41,505	31,270	32,441	30,457		5
Georgia State University		26,257	24,038	27,073	28,210		6
Southern Illinois University - Carbondale	X	17,499	19,223	22,209	23,696		7
Ohio University	X	18,204	16,508	18,466	23,051		8
University of North Carolina - Greensboro		6,336	8,542	19,477	20,868		9
Western Michigan University		8,591	8,084	19,738	18,736		10
<b>Northern Arizona University</b>		<b>13,298</b>	<b>13,333</b>	<b>15,070</b>	<b>17,765</b>	<b>16,015</b>	<b>11</b>
Kent State University - Kent		12,476	13,282	14,586	15,085		12
Wichita State University		13,485	12,241	13,751	12,972		13
University of Akron		9,272	10,966	12,107	12,130		14
Northern Illinois University		11,566	17,098	17,334	11,807		15
Bowling Green State University		5,918	4,285	4,963	6,164		16
<b>Median</b>		<b>15,492</b>	<b>16,803</b>	<b>19,608</b>	<b>21,960</b>		

# Enterprise Size

Average Growth Rate in Federally Financed Research Expenditures Over 3 Years

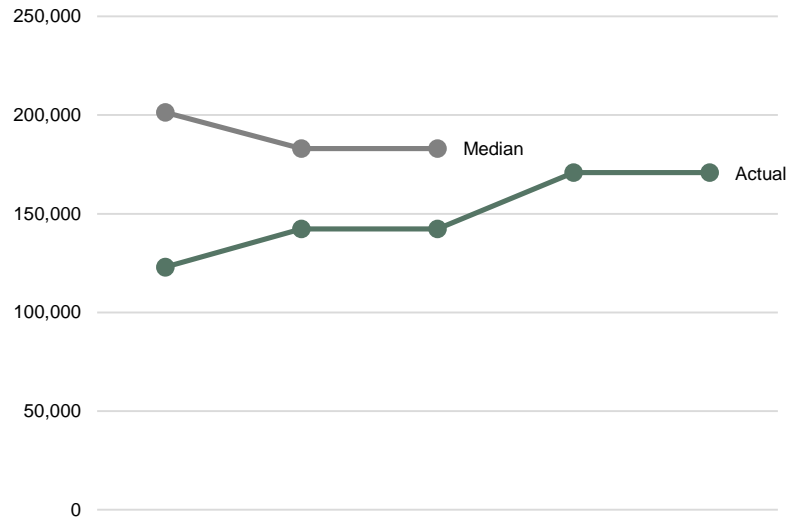


	2008	2009	2010	2011	2012
Actual	-2.6%	-1.9%	6.8%	10.4%	7.0%

	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
<b>ABOR Peer Group</b>							
University of North Carolina - Greensboro		18.6%	18.7%	61.1%	56.7%		1
Western Michigan University		-10.4%	-10.2%	40.7%	44.4%		2
University of Maine		14.0%	4.8%	6.4%	13.6%		3
University of Alabama		-0.2%	2.7%	-1.1%	12.5%		4
Old Dominion University		5.3%	0.4%	11.1%	12.4%		5
Southern Illinois University - Carbondale	X	1.8%	-1.1%	8.0%	10.7%		6
<b>Northern Arizona University</b>		<b>-2.6%</b>	<b>-1.9%</b>	<b>6.8%</b>	<b>10.4%</b>	<b>7.0%</b>	<b>7</b>
University of Akron		-2.6%	-0.3%	3.8%	9.6%		8
Ohio University	X	-4.2%	-5.5%	0.1%	9.1%		9
George Mason University		12.1%	16.1%	10.6%	9.1%		10
Kent State University - Kent		18.1%	17.8%	14.5%	6.6%		11
Northern Illinois University		16.1%	16.0%	12.6%	5.8%		12
Bowling Green State University		-1.8%	-5.7%	-5.9%	4.1%		13
Georgia State University		1.4%	-1.1%	3.7%	2.8%		14
Wichita State University		18.5%	-7.9%	-7.4%	-0.9%		15
University of Nevada - Las Vegas		6.0%	-8.5%	-11.8%	-9.0%		16
<b>Median</b>		<b>3.6%</b>	<b>-0.7%</b>	<b>6.6%</b>	<b>9.4%</b>		

# Enterprise Size

Net Assignable Square Feet

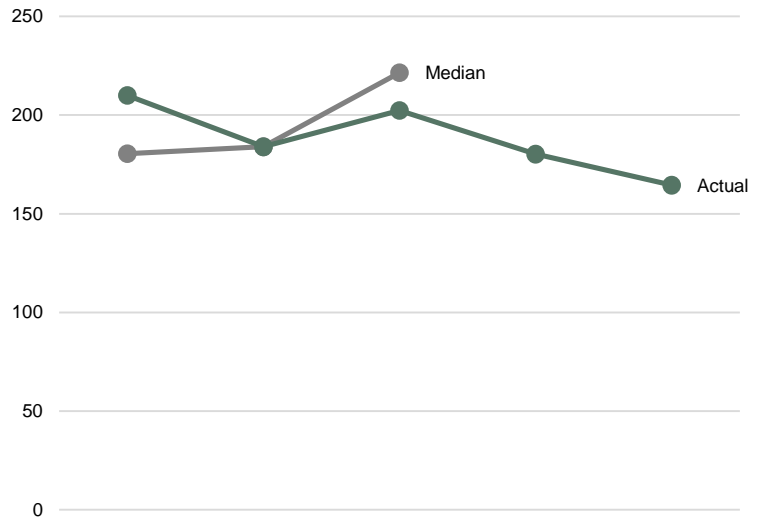


	2008	2009	2010	2011	2012
Actual	122,955	142,340	142,340	170,831	170,831

ABOR Peer Group	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
University of Maine		614,399	643,390	643,390			1
Ohio University	X	321,719	331,694	331,694			2
Southern Illinois University - Carbondale	X	335,086	328,265	328,265			3
Old Dominion University		223,237	263,988	263,988			4
Wichita State University		216,294	220,272	220,272			5
Georgia State University		198,532	198,532	198,532			6
University of Alabama		204,331	183,990	183,990			7
Kent State University - Kent			183,065	183,065			8
University of Nevada - Las Vegas		126,918	181,955	181,955			9
Bowling Green State University		173,816	170,600	170,600			10
George Mason University		125,414	161,103	161,103			11
<b>Northern Arizona University</b>		<b>122,955</b>	<b>142,340</b>	<b>142,340</b>	<b>170,831</b>	<b>170,831</b>	<b>12</b>
Northern Illinois University		279,758	122,986	122,986			13
University of North Carolina - Greensboro		111,868	97,658	97,658			14
Western Michigan University		93,353	83,055	83,055			15
University of Akron							
<b>Median</b>		<b>201,432</b>	<b>183,065</b>	<b>183,065</b>			

# Enterprise Size

Total Research Expenditures per Net Assignable Square Foot

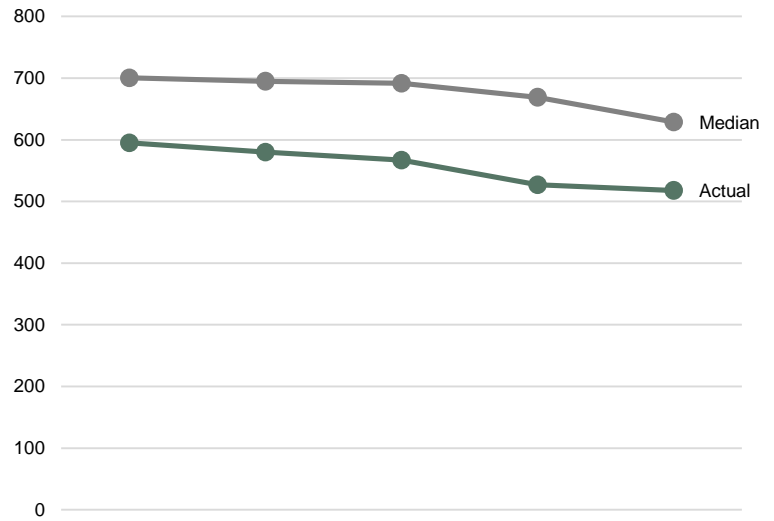


	2008	2009	2010	2011	2012
Actual	210	184	202	180	164

	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
<b>ABOR Peer Group</b>							
George Mason University		578	487	522			1
Georgia State University		391	305	408			2
Old Dominion University		298	272	368			3
Western Michigan University		157	160	318			4
University of Nevada - Las Vegas		400	215	244			5
Wichita State University		221	300	234			6
University of North Carolina - Greensboro		70	106	230			7
University of Alabama		161	198	222			8
Northern Illinois University		53	168	220			9
Southern Illinois University - Carbondale	X	200	202	213			10
<b>Northern Arizona University</b>		<b>210</b>	<b>184</b>	<b>202</b>	<b>180</b>	<b>164</b>	<b>11</b>
University of Maine		155	156	173			12
Ohio University	X	118	124	152			13
Kent State University - Kent			137	144			14
Bowling Green State University		62	49	48			15
University of Akron							
<b>Median</b>		<b>180</b>	<b>184</b>	<b>222</b>			

# Enterprise Size

Total Faculty Population

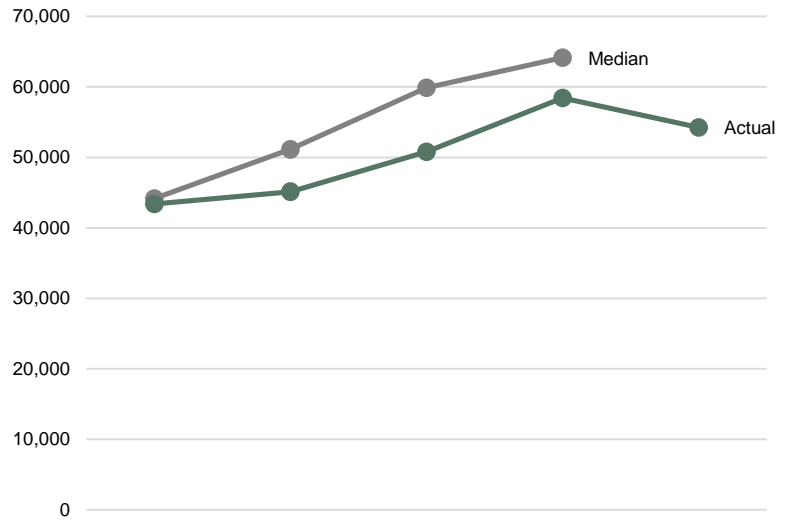


	2008	2009	2010	2011	2012
Actual	595	580	567	527	518

	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
<b>ABOR Peer Group</b>							
George Mason University		856	877	885	882	888	1
University of Alabama		830	803	823	848	845	2
Ohio University	X	919	881	898	886	833	3
Western Michigan University		805	819	828	829	808	4
Southern Illinois University - Carbondale	X	836	853	860	841	795	5
Georgia State University		735	746	739	736	745	6
Northern Illinois University		745	758	758	732	714	7
Kent State University - Kent		677	684	684	666	642	8
University of Akron		605	619	636	636	616	9
University of Nevada - Las Vegas		724	706	699	672	616	9
University of North Carolina - Greensboro		546	553	573	593	583	11
Old Dominion University		516	528	525	553	567	12
Bowling Green State University		596	557	533	508	527	13
<b>Northern Arizona University</b>		<b>595</b>	<b>580</b>	<b>567</b>	<b>527</b>	<b>518</b>	<b>14</b>
University of Maine		486	480	466	449	447	15
Wichita State University		402	401	378	360	361	16
<b>Median</b>		<b>701</b>	<b>695</b>	<b>692</b>	<b>669</b>	<b>629</b>	

# Enterprise Size

Total Research Expenditures per Faculty



	2008	2009	2010	2011	2012
Actual	43,395	45,143	50,799	58,416	54,247

ABOR Peer Group	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
University of Maine		195,560	209,542	238,803	248,552		1
Old Dominion University		128,950	136,191	185,097	184,796		2
Wichita State University		119,037	164,559	136,307	139,428		3
Georgia State University		105,727	81,176	109,628	125,985		4
University of Akron		44,929	55,746	83,151	103,044		5
George Mason University		84,745	89,495	95,051	99,874		6
Southern Illinois University - Carbondale	X	80,256	77,744	81,307	84,578		7
Ohio University	X	41,467	46,829	56,169	65,060		8
University of Alabama		39,573	45,465	49,529	63,246		9
University of Nevada - Las Vegas		70,131	55,450	63,601	58,818		10
<b>Northern Arizona University</b>		<b>43,395</b>	<b>45,143</b>	<b>50,799</b>	<b>58,416</b>	<b>54,247</b>	<b>11</b>
University of North Carolina - Greensboro		14,425	18,796	39,155	44,049		12
Kent State University - Kent		34,406	36,623	38,496	41,224		13
Western Michigan University		18,158	16,241	31,873	30,218		14
Northern Illinois University		20,064	27,235	35,668	29,710		15
Bowling Green State University		17,973	15,074	15,242	17,715		16
<b>Median</b>		<b>44,162</b>	<b>51,140</b>	<b>59,885</b>	<b>64,153</b>		

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**Discovery and Scholarly Impact**

Discovery and scholarship can be measured in a number of ways. Some indicators are traditionally captured through technology transfer metrics—for example, the number of invention disclosures made by campus inventors or the number of patents issued. At a more basic level, however, the ability of faculty and students to publish their work in peer-reviewed settings, and the recognition or citation of that work by others, directly measures the impact that university researchers are having on the community of scholars.

## Invention Disclosures and Patents Issued

The starting point for the commercialization and translation of university research is the disclosure of innovations as “inventions.” As more and more NAU researchers learn to identify the commercial potential of their research, and as they become more familiar with the process of commercialization, the numbers of invention disclosures have climbed. The university began implementation of a technology transfer “in-reach” program in FY2011—a plan to meet with every faculty member/principal investigator performing funded research at the Mountain Campus. The purpose of these meetings was to inform ourselves on the research programs of our faculty and to educate them about the potential commercial applications of their work. In FY2012, these in-reach activities proved very successful, resulting in a significant number of invention disclosures from researchers who had never before disclosed intellectual property (65% of the total disclosures submitted). We are happy to be able to report that we have exceeded our goal for this metric in FY2012.





Of course, not all discoveries move forward in the tech transfer process to the patent application stage, and of those that do make it that far, not all result in patents issued. Because the amount of time between the submission of a provisional patent application and issuance of a final patent is easily between five and eight years, we are just now seeing the results of invention disclosures submitted and decisions (about whether or not to commercialize those discoveries) made five or more years ago. However, we remain enthusiastic about our technology transfer program; although no patents issued this year, we have a number of mature patent applications pending, some of which will issue in FY2013. In a few short years, NAU patents should be issuing on a regular basis, to reflect the regular inflow of invention disclosures that we have generated beginning in FY2009. While we may currently lag behind the best performers in our peer group in this arena, it's important to note that some of the 16 institutions in our peer group do not even report technology transfer activity to the Association of University Technology Managers (AUTM), reflecting minimal attention to these metrics.

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## Discovery and Scholarly Impact

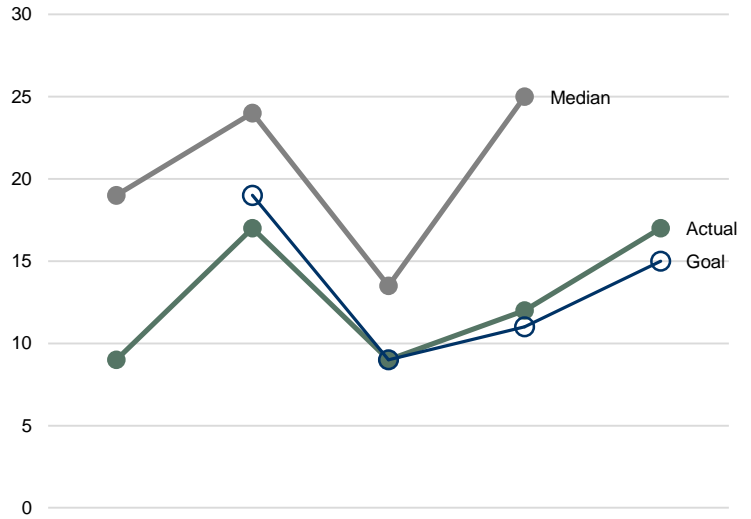
### *Selected Accomplishments*

- In FY2012, NAU hired Greg Caporaso, a bioinformaticist studying the human microbiome—the genetic elements and environmental interactions of microbes that live in the human body. Caporaso is a pioneer in this emerging field; while a post-doctoral scholar at Colorado State University, Caporaso co-developed Qiime, Quantitative Insights into Microbial Ecology, an open source software package used by researchers to compare and analyze these microbial communities. In FY2012, Nature published the results of Caporaso’s study, “Human gut microbiome viewed across age and geography,” which compared bacterial species from 531 individuals from the Amazonas of Venezuela, rural Malawi and US metropolitan areas.  
  
Greg Caporaso: A champion of bioinformatics
- An international team of researchers discovered new evidence that a cosmic impact may have coincided with the extinction of mammoths and giant ground sloths. The 18-member team, which included NAU geologist **Ted Bunch** and **James Wittke**, NAU geologic materials analyst, had its findings published in the Proceedings of the National Academy of Sciences.
- Northern Arizona University undergraduate **Bret Clawson** is engaged in research to track the plague in prairie dog populations to better understand the bacterium’s persistence and prevent widespread outbreaks. His research, which builds on the work of Drs. Paul Keim and David Wagner of NAU’s Center for Microbial Genetics and Genomics, helps county health officials determine if insecticidal dustings are necessary and when to treat areas to minimize the likelihood of an outbreak.” Clawson was selected to present his findings at the National Conference on Undergraduate Research held at Weber State University in Ogden, Utah in Spring, 2012. Clawson also earned the award for best undergraduate poster at the American Society for Microbiology’s Arizona and Nevada chapter conference.  
  
NAU undergraduate Bret Clawson working at NAU’s Center for Microbial Genetics and Genomics
- **Alice Gibb and her research team were studying the evolution of the feeding behavior of** a small, amphibious fish. While working with one particular fish, it jumped out of the net and back into the water—not quite like your average trout caught in a fishing net, but with a very purposeful tail-flip driven jump clearly designed to get the fish from point A to point B. So what began as a study on the evolution of feeding behavior was shifted to a study of how fish behave when stranded on land. The study was published as the paper, “Like a Fish out of Water: Terrestrial Jumping by Fully Aquatic Fishes,” that appears online in the Journal of Experimental Zoology Part A: Ecological Genetics and Physiology.

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# Discovery and Scholarly Impact

Invention Disclosures Transacted

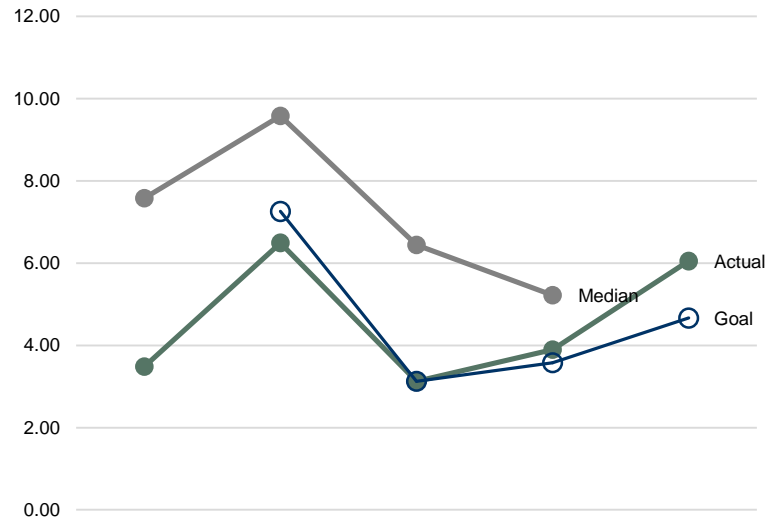


ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	9	17	9	12	17
Goal		19	9	11	15
Difference		-2	0	1	2

ABOR Peer Group	Med. Sch. AUTM Adj.	2008	2009	2010	2011	2012	Rank
University of Akron		46	58	38	82		1
George Mason University		55	55	61	46		2
University of Alabama		38	41	31	30		3
University of North Carolina - Greensboro		19	16	12	30		3
Southern Illinois University - Carbondale	X	35			25		5
Kent State University - Kent		20	24	15	18		6
<b>Northern Arizona University</b>		<b>9</b>	<b>17</b>	<b>9</b>	<b>12</b>	<b>17</b>	<b>7</b>
Northern Illinois University		13	6	11	7		8
Bowling Green State University		8	12	9	2		9
Georgia State University		8					
Ohio University	X	24	39				
Old Dominion University							
University of Maine							
University of Nevada - Las Vegas							
Western Michigan University		15					
Wichita State University		16					
<b>Median</b>		<b>19</b>	<b>24</b>	<b>14</b>	<b>25</b>		

# Discovery and Scholarly Impact

Invention Disclosures Transacted per \$10 Million in Total Research Expenditures

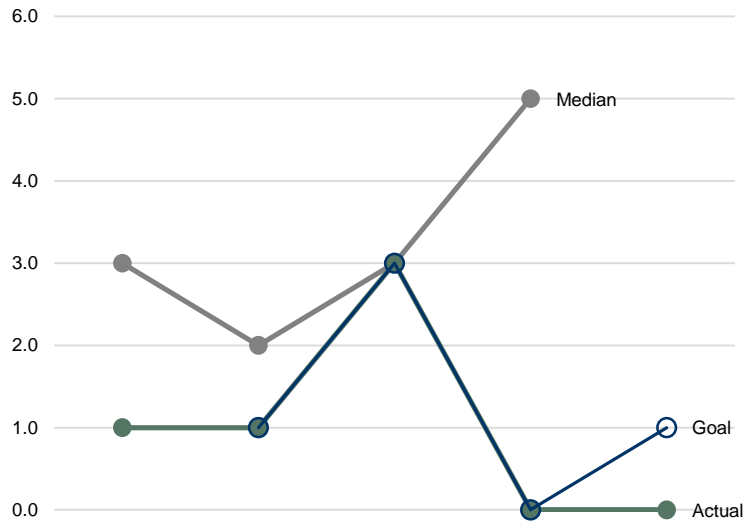


ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	3.5	6.5	3.1	3.9	6.0
Goal		7.3	3.1	3.6	4.7
Difference		-0.8	0.0	0.3	1.4

ABOR Peer Group	Med. Sch. NSF Adj. AUTM Adj.	2008	2009	2010	2011	2012	Rank
University of Akron		16.9	16.8	7.2	12.5		1
University of North Carolina - Greensboro		24.1	15.4	5.3	11.5		2
Kent State University - Kent		8.6	9.6	5.7	6.6		3
University of Alabama		11.6	11.2	7.6	5.6		4
George Mason University		7.6	7.0	7.3	5.2		5
<b>Northern Arizona University</b>		<b>3.5</b>	<b>6.5</b>	<b>3.1</b>	<b>3.9</b>	<b>6.0</b>	<b>6</b>
Southern Illinois University - Carbondale	X	5.2			3.5		7
Northern Illinois University		8.7	2.9	4.1	3.2		8
Bowling Green State University		7.5	14.3	11.1	2.2		9
Georgia State University		1.0					
Ohio University	X	6.3	9.5				
Old Dominion University							
University of Maine							
University of Nevada - Las Vegas							
Western Michigan University		10.3					
Wichita State University		3.3					
<b>Median</b>		<b>7.6</b>	<b>9.6</b>	<b>6.4</b>	<b>5.2</b>		

# Discovery and Scholarly Impact

U.S. Patents Issued



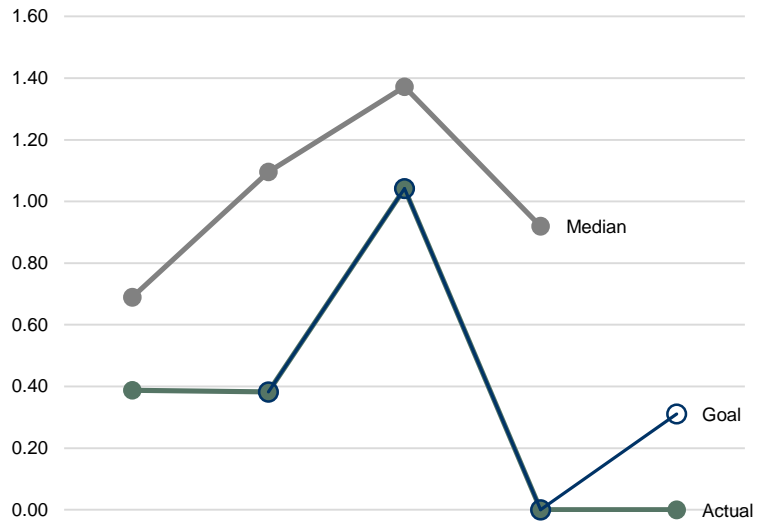
ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	1	1	3	0	0
Goal		1	3	0	1
Difference		0	0	0	-1

ABOR Peer Group	Med. Sch. AUTM Adj.	2008	2009	2010	2011	2012	Rank
George Mason University		5	7	24	29		1
Kent State University - Kent		8	3	8	10		2
University of Akron		4	8	9	10		2
Bowling Green State University		0	1	3	5		4
Southern Illinois University - Carbondale	X	3			5		4
University of Alabama		4	4	1	3		6
Northern Illinois University		0	2	1	2		7
<b>Northern Arizona University</b>		<b>1</b>	<b>1</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>8</b>
University of North Carolina - Greensboro		2	2	0	0		8
Georgia State University		8					
Ohio University	X	5	2				
Old Dominion University							
University of Maine							
University of Nevada - Las Vegas							
Western Michigan University		0					
Wichita State University		0					
<b>Median</b>		<b>3</b>	<b>2</b>	<b>3</b>	<b>5</b>		



# Discovery and Scholarly Impact

U.S. Patents Issued per \$10 Million in Total Research Expenditures



ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	0.4	0.4	1.0	0.0	0.0
Goal		0.4	1.0	0.0	0.3
Difference		0.0	0.0	0.0	-0.3

ABOR Peer Group	Med. Sch. NSF Adj. AUTM Adj.	2008	2009	2010	2011	2012	Rank
Bowling Green State University		0.0	1.2	3.7	5.6		1
Kent State University - Kent		3.4	1.2	3.0	3.6		2
George Mason University		0.7	0.9	2.9	3.3		3
University of Akron		1.5	2.3	1.7	1.5		4
Northern Illinois University		0.0	1.0	0.4	0.9		5
Southern Illinois University - Carbondale	X	0.4			0.7		6
University of Alabama		1.2	1.1	0.2	0.6		7
<b>Northern Arizona University</b>		<b>0.4</b>	<b>0.4</b>	<b>1.0</b>	<b>0.0</b>	<b>0.0</b>	<b>8</b>
University of North Carolina - Greensboro		2.5	1.9	0.0	0.0		8
Georgia State University		1.0					
Ohio University	X	1.3	0.5				
Old Dominion University							
University of Maine							
University of Nevada - Las Vegas							
Western Michigan University		0.0					
Wichita State University		0.0					
<b>Median</b>		<b>0.7</b>	<b>1.1</b>	<b>1.4</b>	<b>0.9</b>		

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## **Economic Development**

As a regional research university, Northern Arizona University's research mission is intimately tied to the economic vitality of its community partners and neighbors. An important aspect of NAU's contribution to economic development in Arizona is the direct impact of public service activities (many of these research-based) on rural communities across the state. More than one-quarter of the university's sponsored projects portfolio is awards for public service projects, and we are focusing on increasing these dollars as much as R&D funding. These dollars, just like research dollars, contribute to the "bottom line" of the university's direct impact as an economic entity—an impact that is all the more important to the rural regions and small metropolitan areas we serve.

Technology transfer activity, translating university innovations into commercial impacts and business activity, is another important element of the university's economic impact. The university has radically improved and rebuilt its Technology Transfer operation over the past two years; we now have in-house support and infrastructure to enhance the identification, development and movement of university innovation into the private sector. In-house staff has been able to stimulate an increase in invention disclosures; we expect to reap the fruits of those efforts in the coming years.

Meanwhile NAU Ventures, LLC, provides an explicit mechanism for working seamlessly with startup enterprises; this collaboration with the NAU Foundation adds an exciting dimension to our repertoire.



## Licensing and Intellectual Property Income

Numbers of (and revenues from) licensing agreements do not yet reflect NAU's increased emphasis on technology transfer since FY2011. While our performance lags that of the best of our peers, it is competitive in the peer group overall.

## Startup Companies

Only about half of our peer institutions report any startup company activity over the past few years. The maturing of our technologies is anticipated to increase our modest number of university-affiliated startups over the next few years.

## Doctoral Degrees Granted

Northern Arizona University offers relatively few (six) PhD-granting degree programs, and numbers of doctoral graduates are therefore modest relative to most of our peer institutions. We have not seen substantive growth in number of graduates over the past five years. However, the approval of a new interdisciplinary PhD in earth and environmental science during FY2011 opens the door to new students and productivity in one of the university's core strengths; we expect the graduates of this program to be reflected in our metrics beginning in FY2015-16.

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## Economic Development

### *Selected Accomplishments*

- Northern Arizona University sponsored the *Four Corners Sustainable Economic Development Summit*, a two-day gathering in Flagstaff focused on sustainable economic development on Navajo and Hopi tribal lands. The summit was the result of extensive research conducted by NAU's Landsward Institute and funded by TRIF. Among the participants at the Nov. 3-4 summit were Charles Galbraith, White House intergovernmental affairs officer; Dallas Tonsager, USDA undersecretary; LeRoy Shingoitewa, chairman of the Hopi Tribe; Ben Shelly, president of the Navajo Nation; and Regent Fred DuVal.



NAU President John Haeger, Joe Martin, his adviser on Native American issues, and Bill Harris, president and CEO of Science Foundation Arizona, at the Four Corners Sustainable Economic Development Summit at NAU in November, 2011. Photo by Charlie McCallie.

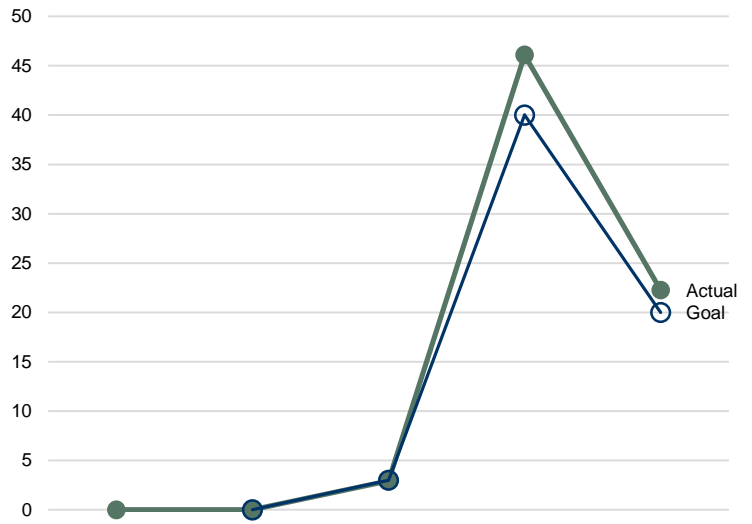
- LaunchBox, the student incubator managed by NACET and sponsored jointly with NAU, incubated two student companies in FY2012. The first, Snag A Note, is an online service that allows students to share notes, download study aids and socially network in order to develop better study habits. The second is SMS Snacks, a company that delivers concessions to stadium patrons so that they don't have to leave their seats and miss part of the event. SMS Snacks also tested late-night delivery to dorms on campus.
- Northern Arizona University was awarded a seven-year, \$30 million grant to expand the Arizona GEAR UP program to include new schools and serve more students statewide. [GEAR UP](#), or Gaining Early Awareness and Readiness for Undergraduate Programs, is a national program intended to help low-income students graduate from high school prepared to succeed in college. The program is based on research that has shown the effectiveness of early, long-term intervention and awareness. Under this program, NAU will work with approximately 4,000 seventh graders in select schools in rural, low-income areas of the state starting in July 2012 and will continue serving these students for seven years, through their freshman year of college.
- Northern Arizona University's Institute for Tribal Environmental Professionals (ITEP) received multiple grants to assist tribal professionals in protecting their communities from environmental hazards associated with solid waste management.



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# Economic Development

Intellectual Property Income (in Thousands)

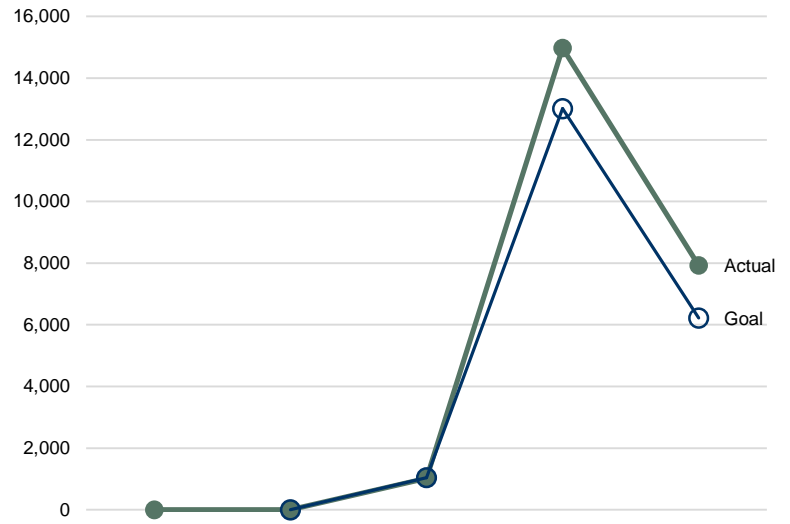


ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	0	0	3	46	22
Goal		0	3	40	20
Difference		0	0	6	2



# Economic Development

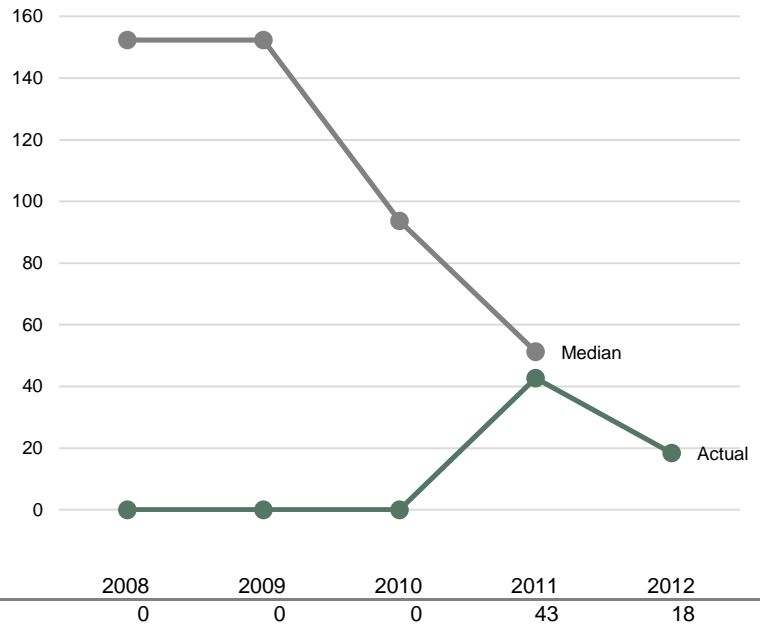
Intellectual Property Income per \$10 Million in Total Research Expenditures



ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	0	0	1,018	14,974	7,928
Goal		0	1,042	13,008	6,219
Difference		0	-24	1,966	1,709

# Economic Development

Licenses and Options Income (in Thousands)

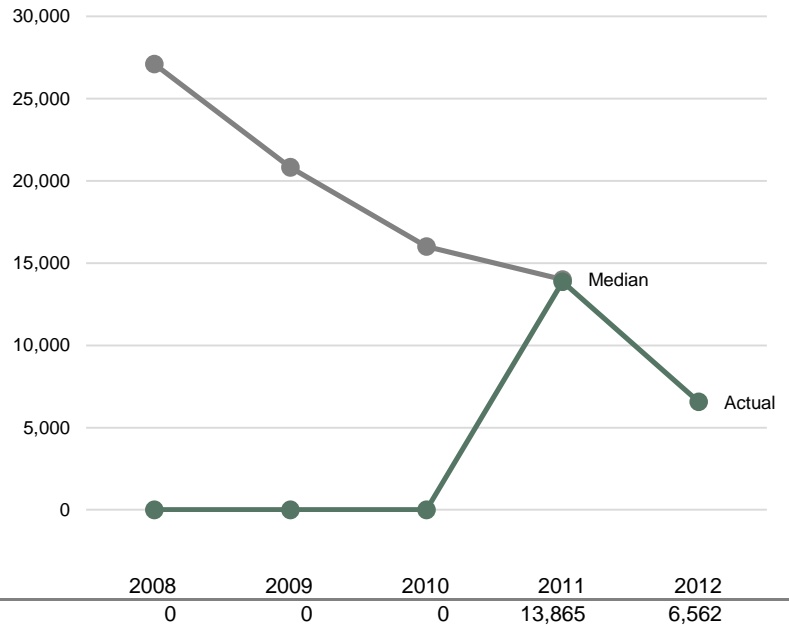


Actual

	Med. Sch. AUTM Adj.	2008	2009	2010	2011	2012	Rank
<b>ABOR Peer Group</b>							
Southern Illinois University - Carbondale	X	776		401	677		1
Kent State University - Kent		352	339		360		2
University of Akron		1,123	455	202	279		3
George Mason University		104	163	110	123		4
University of North Carolina - Greensboro		201	152	121	51		5
<b>Northern Arizona University</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>43</b>	<b>18</b>	<b>6</b>
Northern Illinois University		36	20	10	30		7
University of Alabama		38	5	77	9		8
Bowling Green State University		8	11	6	2		9
Georgia State University		233					
Ohio University	X	5,872	6,875				
Old Dominion University							
University of Maine							
University of Nevada - Las Vegas							
Western Michigan University							
Wichita State University		0					
<b>Median</b>		<b>152</b>	<b>152</b>	<b>94</b>	<b>51</b>		

# Economic Development

Licenses and Options Income per \$10 Million in Total Research Expenditures

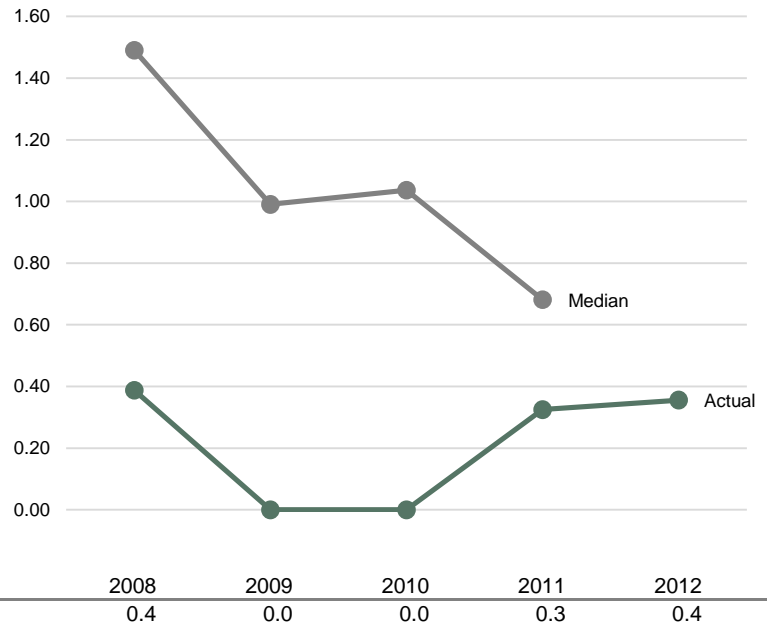


Actual	2008	2009	2010	2011	2012	Rank			
	0	0	0	13,865	6,562				
<b>ABOR Peer Group</b>	<b>Med. Sch.</b>	<b>NSF Adj.</b>	<b>AUTM Adj.</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>Rank</b>
Kent State University - Kent				150,981	135,507	152,380	131,137		1
Southern Illinois University - Carbondale	X			115,674			95,207		2
University of Akron				413,097	131,749	38,240	42,518		3
University of North Carolina - Greensboro				254,881	146,579	53,719	19,629		4
George Mason University				14,337	20,824	13,121	14,005		5
Northern Illinois University				24,214	9,446	3,839	13,966		6
<b>Northern Arizona University</b>				<b>0</b>	<b>0</b>	<b>0</b>	<b>13,865</b>	<b>6,562</b>	<b>7</b>
Bowling Green State University				7,468	12,506	7,798	2,545		8
University of Alabama				11,619	1,371	18,903	1,602		9
Georgia State University				29,984					
Ohio University	X			1,540,887	1,666,441				
Old Dominion University									
University of Maine									
University of Nevada - Las Vegas									
Western Michigan University									
Wichita State University				0					
<b>Median</b>				<b>27,099</b>	<b>20,824</b>	<b>16,012</b>	<b>14,005</b>		



# Economic Development

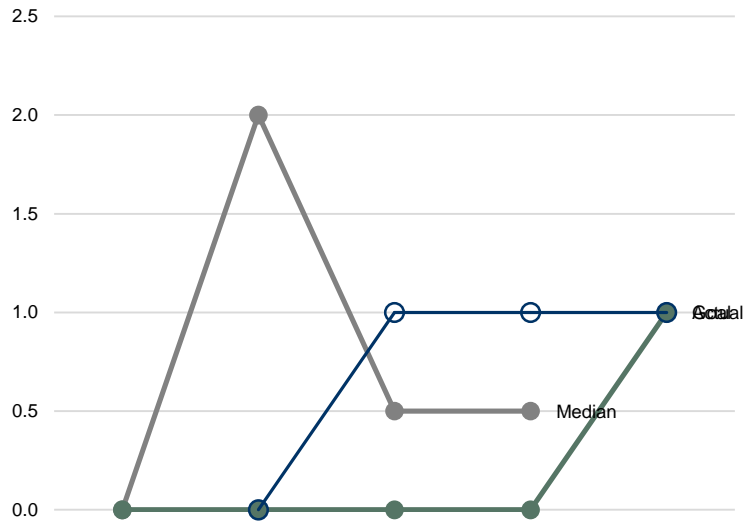
Licenses and Options Executed per \$10 Million in Total Research Expenditures



		2008	2009	2010	2011	2012	Rank
<b>Actual</b>		0.4	0.0	0.0	0.3	0.4	
		0.4	0.0	0.0	0.3	0.4	
		1.5	1.0	1.0	0.7	0.4	
<b>ABOR Peer Group</b>							
University of North Carolina - Greensboro		6.3	7.7	1.3	1.1		1
Kent State University - Kent		2.6	2.4	3.0	1.1		2
University of Akron		3.7	1.2	1.9	0.8		3
Southern Illinois University - Carbondale	X	1.5			0.7		4
George Mason University		1.8	0.5	0.7	0.7		5
University of Alabama		1.5	0.8	0.7	0.6		6
<b>Northern Arizona University</b>		<b>0.4</b>	<b>0.0</b>	<b>0.0</b>	<b>0.3</b>	<b>0.4</b>	<b>7</b>
Bowling Green State University		1.9	3.6	2.5	0.0		8
Northern Illinois University		0.0		0.0	0.0		8
Georgia State University		0.0					
Ohio University	X	0.8	0.2				
Old Dominion University							
University of Maine							
University of Nevada - Las Vegas							
Western Michigan University		0.7					
Wichita State University		0.0					
<b>Median</b>		<b>1.5</b>	<b>1.0</b>	<b>1.0</b>	<b>0.7</b>	<b>0.4</b>	

# Economic Development

## Startup Companies

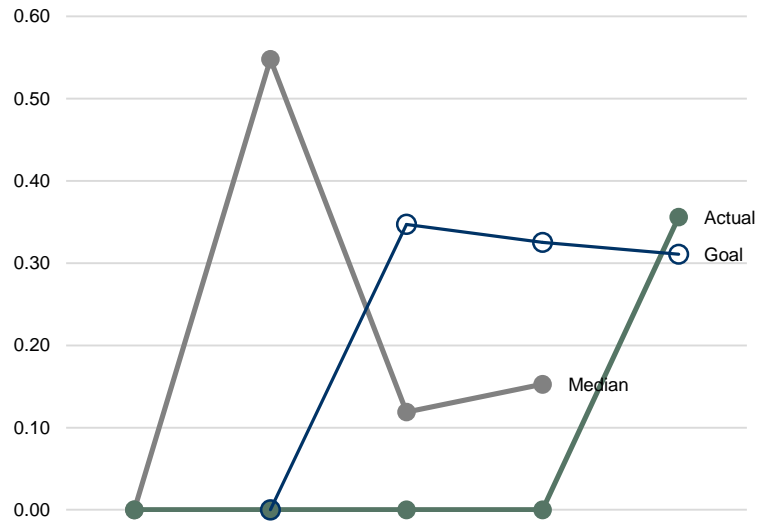


ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	0	0	0	0	1
Goal		0	1	1	1
Difference		0	-1	-1	0

ABOR Peer Group	Med. Sch. AUTM Adj.	2008	2009	2010	2011	2012	Rank
George Mason University		5	2	2	4		1
Kent State University - Kent		0	1	0	2		2
University of Akron		5	4	2	2		2
University of North Carolina - Greensboro		2	2	1	1		4
Bowling Green State University		0	1	1	0		5
<b>Northern Arizona University</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>5</b>
Northern Illinois University		0		0	0		5
University of Alabama		3	2	0	0		5
Georgia State University		1					
Ohio University	X	3					
Old Dominion University							
Southern Illinois University - Carbondale	X						
University of Maine		0					
University of Nevada - Las Vegas							
Western Michigan University		0					
Wichita State University		0					
<b>Median</b>		<b>0</b>	<b>2</b>	<b>1</b>	<b>1</b>		

# Economic Development

Startup Companies per \$10 Million in Total Research Expenditures

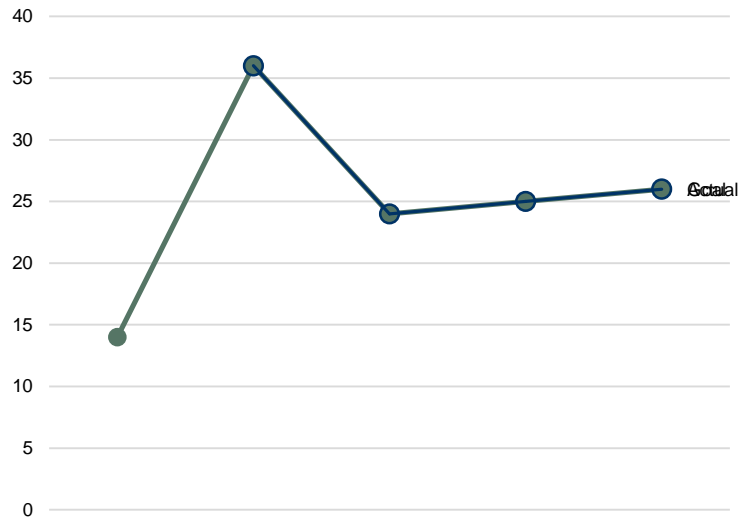


ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	0.0	0.0	0.0	0.0	0.4
Goal		0.0	0.3	0.3	0.3
Difference		0.0	-0.3	-0.3	0.0

ABOR Peer Group	Med. Sch. NSF Adj. AUTM Adj.	2008	2009	2010	2011	2012	Rank
Kent State University - Kent		0.0	0.4	0.0	0.7		1
George Mason University		0.7	0.3	0.2	0.5		2
University of North Carolina - Greensboro		2.5	1.9	0.4	0.4		3
University of Akron		1.8	1.2	0.4	0.3		4
Bowling Green State University		0.0	1.2	1.2	0.0		5
<b>Northern Arizona University</b>		<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.4</b>	<b>5</b>
Northern Illinois University		0.0		0.0	0.0		5
University of Alabama		0.9	0.5	0.0	0.0		5
Georgia State University		0.1					
Ohio University	X	0.8					
Old Dominion University							
Southern Illinois University - Carbondale	X						
University of Maine		0.0					
University of Nevada - Las Vegas							
Western Michigan University		0.0					
Wichita State University		0.0					
<b>Median</b>		<b>0.0</b>	<b>0.5</b>	<b>0.1</b>	<b>0.2</b>		

# Economic Development

Ph.D. Degrees Conferred

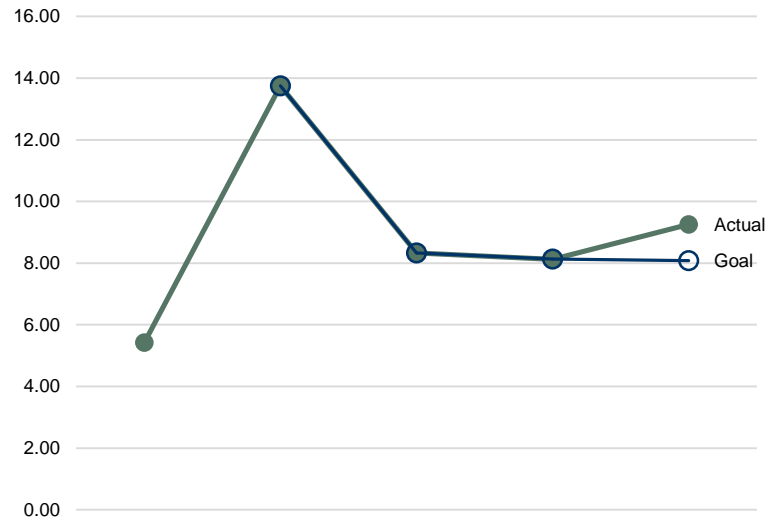


ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	14	36	24	25	26
Goal		36	24	25	26
Difference		0	0	0	0



# Economic Development

Ph.D. Degrees Conferred per \$10 Million in Total Research Expenditures



ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	5.4	13.7	8.3	8.1	9.3
Goal		13.7	8.3	8.1	8.1
Difference		0.0	0.0	0.0	1.2

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**Leadership and Recognition**

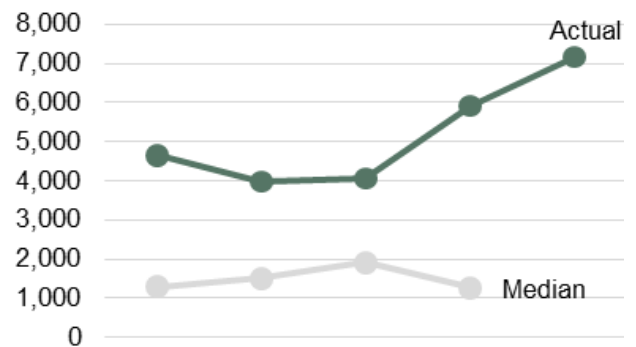
Northern Arizona University seeks to provide regional and (in selected disciplines) national and international leadership through the activities and outcomes of its researchers. The metrics typically used by the nation's largest research institutions rarely provide useful insights for our peer group, but we do track our relative performance in specific fields. Ultimately, publication and citation in the research community are as important as research funds in reflecting the quality and impact of university scholarship.

## National Academy Members

As reported last year, we do not currently have members of the National Academies of Science or of Engineering on our faculty. This is the case for most of our peer group as well. Still, the university is home to a number of distinguished and accomplished faculty researchers. National and international recognition of our faculty contributes to our continued success in competing for funding, as well as enhancing the quality of the student experience. Our faculty (even the “stars”) virtually all maintain active teaching roles and incorporate many undergraduate students into their research groups; undergraduates frequently report how motivating and helpful it is for their own development to work directly with individuals they know to be “leaders” in the field.

## National Research University Rankings and Research Expenditure Rankings

Instead of using the National Research University rankings of CMUP to assess the performance at Northern Arizona University, we track our rankings in select areas of the NSF R&D expenditures survey. Although our overall ranking in 2010 was 236 (11th of our peer group), in funding for environmental science, where we aim to be competitive, our overall ranking was 99, 15 positions better than in 2009. We are 5<sup>th</sup> among our peers in environmental science, up from 7<sup>th</sup> in 2009. It is quite an accomplishment to be in the top 100 for this field of science considering our ranking in total expenditures.



2007-2011 Environmental Research Expenditures

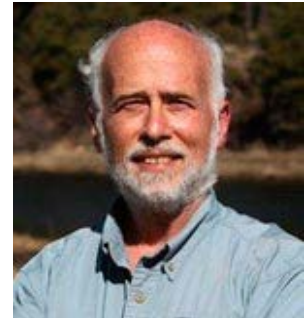
A key indication of the quality and competitiveness of our research is the pattern of funding for agricultural and biological science. In biology, Northern Arizona University ranked first in its group of 16 peer institutions in 2010 (the latest year for which we have peer data) and has been ranking first since 2008. Just like in 2009, Northern Arizona University ranked 3<sup>rd</sup> among our peers in funding for agriculture in 2010, indicating the continued strong performance of our forestry program.

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## Leadership and Recognition

### *Selected Accomplishments*

- In FY2011-2012, NAU was ranked—along with UC Berkeley, Cornell, and Columbia, to name a few—in the top 21 research institutions producing Fulbright Scholars.
- The Arizona Board of Regents approved the promotion of three faculty members from Northern Arizona University to Regents' professors, bringing the number of Regents' professors at NAU up to 15.
  - **Paul Beier** (School of Forestry) focuses his research on the observation and modeling of animal movement and the design and implementation of wildlife corridors, connectivity and conservation planning. He has received international recognition as a scholar for his studies of animal movement, and for his models that identify areas most suitable as wildlife corridors. Beier conducted the first systematic review showing how and when corridors can work in conservation.
  - **Edith Copley** (School of Music) joined the NAU music faculty in 1990. She has conducted internationally during a high-profile career that includes invitations to serve as all-state or all-region clinician, honor choir conductor and workshop presenter. She has taken NAU's select Shrine of the Ages Choir on statewide, national and international performance tours to Carnegie Hall, Austria, Germany, New Zealand, Australia and South Africa. Copley also holds leadership positions in state, regional and national choral organizations.
  - **Darrell Kaufman** (School of Earth Sciences and Environmental Sustainability) has developed a major research program aimed at using geologic evidence of past climate variability to help understand current and future climate change. Kaufman also uses both biological and physical properties of lake sediment to interpret the history of environmental and climate change over thousands of years. Kaufman is a highly recognized scholar with an international reputation; his peer-reviewed publications are the second highest at NAU for the past 5 years.



## Leadership and Recognition

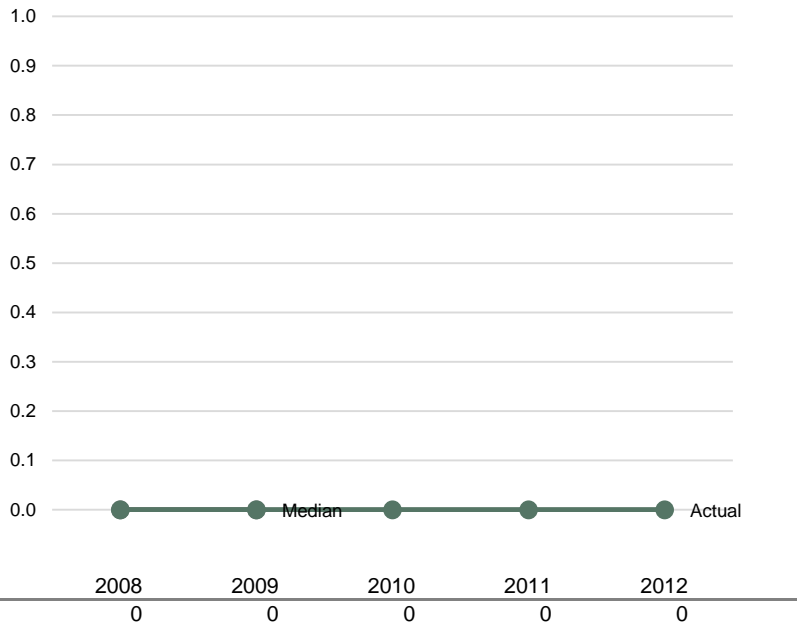
*Selected Accomplishments*

- **Tom Sisk**, professor of ecology and founder of the university's Lab of Landscape Ecology and Conservation Biology, is the first holder of the Charles Olajos and Ted Goslow Chair of Environmental Science and Policy for the Southwest. This is a \$1.5 million endowment gift from alumna Marcey Olajos. Sisk will be housed initially in NAU's College of Engineering, Forestry and Natural Sciences to support interdisciplinary work linking scientific research and public policy. Sisk is the sixth endowed chair at NAU. Sisk noted that the endowment will help link NAU's long history of excellence in ecology and environmental conservation to new and ongoing efforts that safeguard our land, water, and natural resources during this period of rapid environmental change.
- **Deborah Huntzinger** (School of Earth Sciences and Environmental Sustainability) was named a Bisgrove Scholar award winner by Science Foundation Arizona. She will apply the funding to her research with a waste byproduct of cement manufacturing, addressing a "small piece" of reducing global CO2 emissions, as she puts it, but one with implications for climate change. Her undergraduate and graduate training in geological engineering and sustainability took place at the Michigan Technological Institute and the Colorado School of Mines.
- **Denise Helm**, associate dean of the College of Health and Human Services at Northern Arizona University, has been named a 2012-13 Fellow by the American Council on Education. Helm will spend an academic year working with a college or university president at a host institution. The ACE Fellows Program is designed to prepare promising senior faculty and administrators for responsible positions in college and university administration.



# Leadership and Recognition

National Academy Members



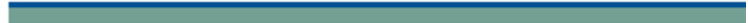
Actual

	Med. Sch.	2008	2009	2010	2011	2012	Rank
<b>ABOR Peer Group</b>							
Northern Arizona University		0	0	0	0	0	1
Bowling Green State University		0	0				
George Mason University		3	3				
Georgia State University		0	0				
Kent State University - Kent		1	1				
Northern Illinois University		0	0				
Ohio University	X	0	0				
Old Dominion University		0	0				
Southern Illinois University - Carbondale	X	0	0				
University of Akron		2	2				
University of Alabama		0	0				
University of Maine		2	2				
University of Nevada - Las Vegas		0	0				
University of North Carolina - Greensboro		0	0				
Western Michigan University		0	0				
Wichita State University		0	0				
<b>Median</b>		<b>0</b>	<b>0</b>				





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## **Technology Transfer**

At NAU, technology transfer is becoming more and more an important tool in carrying out our institutional research agenda. More than just a mechanism for disseminating the outcomes of research, technology transfer at NAU is aimed at helping investigators recognize potential commercial applications for their work, building research partnerships with established companies who may be interested in funding their work as well as commercializing university intellectual property, and providing financial support to pursue the development of new ideas. Recognizing the interconnectedness of these efforts with other research enterprise initiatives, in FY2011 we began taking steps to bring our technology transfer operation in-house. We continued this trend in FY2012, conducting these activities out of the Office of the Vice President for Research (OVPR) in partnership with the Northern Arizona Center for Entrepreneurship and Technology (NACET) and NAU Ventures. In FY2012, we branded the combination of activities (conducted through the OVPR) which comprise research development and technology transfer “*NAU Innovations.*”



Increases in technology transfer staffing enabled NAU to have a presence at two major technology conferences in FY2012—AZBio Expo 2012, held at Grand Canyon University in May, and BIO2012, sponsored by the Biotechnology Industry Organization (BIO), the world’s largest biotechnology trade association. Having a booth at these and similar events is an important aspect of marketing the NAU *Innovations* “brand” as well as for seeking industry research support and potential licensees for specific technologies.

In FY2011 the university began implementation of a technology transfer “in-reach” program—a plan to meet with every faculty member/principal investigator performing funded research at the Mountain Campus. In doing so, we intended to keep current on the research programs of our faculty and to educate them about the potential commercial applications of their work. In FY2012, these in-reach activities proved very successful, resulting in a significant number of invention disclosures from researchers who had not previously disclosed any intellectual property (65% of the total disclosures submitted).

### Training the Innovators

An important aspect of the mission of NAU Innovations is to educate faculty, students, and staff about university intellectual property policies, patenting, licensing, and commercialization through “spin-outs.” To this end, in June of FY2012, NAU held its first **Innovation Bootcamp**, a two-day workshop designed to provide training to the university’s most active inventors in marketing their research, inventions, and spin-out companies. This hands-on workshop was delivered by successful entrepreneurs in health and education technology services, public relations, and marketing. The twelve attendees learned how to ‘tell their story’ anytime, anywhere, and to anyone; how to talk to the media; and how to prepare and deliver the perfect presentation. They heard from an ex-NAU faculty member who told his story about how he took an idea and turned it into several successful companies.

## RAPIDLab

In order to move ideas past the conceptual stage, and to apply for and obtain patent protection, we have to demonstrate that the invention “works”—that the device will function the way we say it will. Until recently, there was no facility, commercial or otherwise, available locally to NAU inventors to assist them with fabricating and testing parts, which is a key part of reducing to practice many types of inventions. Therefore, in FY2012, NAU Innovations partnered with the Department of Mechanical Engineering to re-envision the university’s RAPIDLab (Realization of Advanced Products and Innovative Designs), a facility that supports both research and educational activities associated with prototype design and development. Funding from the Governor’s Office on Economic Recovery received in FY2011 as well as TRIF funds allowed us to purchase state-of-the-art design and fabrication equipment such as 3-D printers, a CNC Lathe, a CNC Milling Center and other instruments commonly used in fabricating prototypes. This facility is currently directed by Associate Professor John Tester and is staffed by two students (one graduate and one undergraduate) who are receiving valuable training and skills not only in the use of this equipment but also in understanding how to manage a project for a customer. The lab will be managed as a university Service Center, performing services for fees, to campus researchers and to NACET clients effective July 1, 2013.



Stratasys Fortus 400MC 3D Printer, which has the ability to create prototypes and production-grade parts using high-performance thermoplastics.

# Technology Transfer

## Statistical Exhibits



Technology Transfer Activities	2008	2009	2010	2011	2012
Invention Disclosures Transacted	9	17	9	12	17
Invention Disclosures Transacted Year/Year Percentage Change		89%	-47%	33%	42%
New Patent Applications	10	12	5	5	2
New Patent Applications Year/Year Percentage Change		20%	-58%	0%	-60%
U.S. Patents Issued	1	1	3	0	0
U.S. Patents Issued Year/Year Percentage Change		0%	200%	-100%	
Licenses and Options Executed	1	0	0	1	1
Licenses and Options Executed Year/Year Percentage Change		-100%			0%
Other Major Agreements			2	1	1
Other Major Agreements Year/Year Percentage Change				-50%	0%

Licensing and Other Revenue	2008	2009	2010	2011	2012
Licensing Revenue (Including Options)	0	0	0	42,684	18,439
Licensee Legal Reimbursements	0	0	2,931	3,414	3,838
Other Revenue	0	0	0	0	0
Total	0	0	2,931	46,098	22,277

Sponsored Research Facilitated	2008	2009	2010	2011	2012
Total	0	0	0	0	0

Royalty Distribution	2008	2009	2010	2011	2012
Inventors	885	0	0	0	0
Laboratories and Units	0	0	0	0	0
University	885	0	0	0	0
Undistributed	0	0	0	0	0

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## Technology Transfer

*Selected Licenses and Options Executed*



- In FY2012, Northern Arizona University licensed a web-based software platform, ***Online Training and Certification Program***, to a start-up company, Holistic Technology Services, LLC. The platform was developed by Northern Arizona University employees Galen Collins, Cheryl Cothran, Tim Foster, and Jason Karcz at the Arizona Hospitality Research and Resource Center. This license was executed and will be managed by NAU Ventures, LLC.



## Technology Transfer

*Selected Startup Companies*

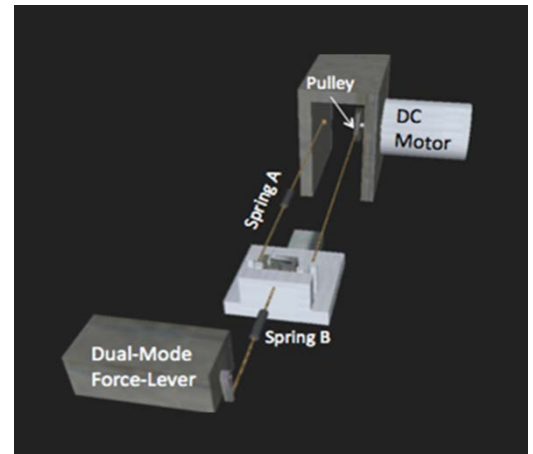


- **Holistic Technology Services, LLC** is a Colorado-based niche start-up company established to provide online training services for the hospitality industry (such as for food handling, customer service and leadership). The company was established by Jason Karcz who was a full-time NAU employee and the primary developer of the *Online Training and Certification Program* web-based software.

## Technology Transfer

### Other Notable Activities

- For the first time, Northern Arizona University had a booth (in the Arizona Pavilion) at BIO2012 in Boston, June 17-21, 2012. BIO is the world's largest, annual biotechnology trade association conference, attended by thousands of research universities and other research performing organizations, pharmaceutical companies, biotech companies and even governments.
- Northern Arizona University's RAPIDLab (Realization of Advanced Products and Innovative Designs), a facility funded through TRIF and the Governor's Office on Economic Recovery, began operation in FY2012, producing prototypes of university-owned intellectual property and for a NACET client.
- Dr. John Tester, Associate Professor of Mechanical Engineering, and Dr. Kiisa Nishikawa, Regents' Professor of Biological Sciences, received a \$600,000 grant from the National Science Foundation to continue development of a motor spring actuator—intellectual property owned by the university. The actuator (bench model pictured at right) mimics the winding properties of the large protein, titin, the driver behind spring-like properties of muscles. This discovery may lead to advances in prosthetics, neuroscience, and bionics. The grant funds a collaboration between NAU and two commercial entities—iWalk of Boston and Electric Torque Machines (formerly Motor Excellence) of Flagstaff.



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## **Strategic Initiatives**

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In FY2012, NAU invested TRIF research funds under two initiatives: Water, Energy and Environmental Solutions (WEES) and Improving Health: Investing in Biotechnology and Bioengineering. The outcomes of these programs are intended to enable the translation of research into applications and solutions that address health, technology and sustainability in ways that affect individuals across Arizona and the nation. In FY2012, TRIF investments at NAU supported interdisciplinary research and innovation in biosciences and biotechnology, provided quality undergraduate and graduate training, generated external funds to retain and expand the university's intellectual capacity, fostered developments in forest restoration and health, and developed alternative energy technologies suited to develop Arizona's economy. Selected FY2012 TRIF accomplishments are listed below.

- Leveraged more than \$529,000 in funding for alternative energy research and technical assistance with communities around the state, including projects with the US Department of Energy, APS, and Salt River Project.
- Created the Kane and Two Mile Ranches Research and Stewardship Partnership between the landscape and ecosystems conservation institute and Grand Canyon Trust, US Forest Service, Bureau of Land Management, Department of Arizona Game and Fish, US Geological Survey, and University of Arizona.
- Established a partnership with Pioneer Associates, the recipient of the largest-ever stewardship contract (forest thinning) from the U.S. government. The wood from the 300,000 acres to be cleared over the next ten years will feed a wood products plant opening in Winslow by the Fall of 2012 and is expected to create 600 new jobs. In FY12, NAU's Ecological Restoration Institute began working with the contractor to provide assistance in workforce training and biomass development.
- Recruited Dr. Jason Sahl to NAU/TGen to enhance bioinformatics capabilities, provide expertise in infectious disease research and train students.
- Funded a student capstone project under a partnership with a NACET client that resulted in the development of university-owned intellectual property. The NACET client company expressed interest in hiring 2 or more of these students after graduation.
- Leveraged \$600,000 from the National Science Foundation under the Partners for Innovation program for the continued development of a motor spring actuator—intellectual property created with TRIF support. The NSF grant funds continued work at NAU in partnership with two companies—iWalk and Electric Torque Machines (formerly Motor Excellence)—one of which will option the university-owned intellectual property in FY2013.

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**Annual Research Report - FY2012**

I am delighted to bring you this report on the University of Arizona's research activity through fiscal year 2012. In this report we present key highlights of the UA research enterprise as well as specific performance metrics.

We continue to embrace the concept of **Bold Ideas**, the catalysts for scientific advancement. Bold ideas, nurtured with creativity and passion, can lead to unexpected breakthroughs that forever change the way we collectively address and resolve our problems, from the mundane to the extraordinary.

Bold ideas lead to **Outstanding Achievement**. We retained our #1 national ranking for research expenditures in Astronomy and Planetary Science; astronomer Olivier Guyon was recognized with a MacArthur Foundation "genius grant" and two UA Regents' Professors--Roy Parker and Marcia J. Rieke--were elected to the National Academy of Sciences. Whether improving health, sustaining our communities, or exploring the cosmos, UA investigators continued to lead with groundbreaking research and innovative technology development. In 2012, UA research and development expenditures totaled \$625M for projects including a study of the childhood origins of adult airway disease, development of remediation technologies for Superfund sites, the construction of mirrors for the world's largest telescope, and improving the effectiveness of juvenile drug courts.



Research undertaken at the University of Arizona furthers and fulfills all components our institution's mission, "To discover, educate, serve, and inspire." Every dollar spent on research is returned several-fold in benefits to the university, the community, and future generations. The economic return on investment in research and development is estimated to be greater than 30 percent—a bonanza in today's economic climate. But the real returns—improving quality of life, extending lifetimes, enriching imaginations, building sustainable communities—have the truest impacts.

We appreciate your continued interest in the **Bold Research** being undertaken at the University of Arizona.

Sincerely,

A handwritten signature in black ink that reads "Leslie P. Tolbert".

Leslie P. Tolbert  
Senior Vice President for Research

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**Enterprise Size**

# Enterprise Size

## Introduction

The University of Arizona continued its path of robust growth in research activity, despite a challenging economic environment. Many of the research areas that have historically been strong at the UA represent strategic target areas to increase our overall performance. Building on the strength of these target areas allows us to build the potential for significant external funding, impact, and recognition. They are:

- Space sciences
- Translational biomedical research
- Environmental science, engineering, and policy
- Collaborative projects in the arts, humanities, and social sciences

A robust infrastructure that facilitates cutting-edge research, and a smooth pathway for innovations to reach the marketplace, are also critical for a robust research enterprise. The UA is also focusing on the following enabling resources:

- High-tech shared facilities
- Technology translation and launch



Optical Sciences building on the UA main mall.

A key indicator in attaining the ABOR 2020 goal of “increasing the research capabilities and performance of the Arizona University System to a level of competitive prominence with peer rankings of top American research universities” is increasing research expenditures. For FY 2012, the UA had \$625M in total research expenditures, an increase of \$14M over FY 2011. The UA retained a ranking in the top 20 public universities and in the top 30 for all universities nationwide in research expenditures, based on the latest available National Science Foundation rankings.

In an economic climate in which federal support for university research is at flat levels, non-defense funds are decreasing, and private sector investment is not heavily focused on basic research, the UA is embracing a two-pronged strategy of pursuing excellence by **investing to remain a top performer** in our traditional strength area of physical sciences and **expanding our emphasis into growth areas**, including biomedicine, defense and homeland security, public-private partnerships, and technology transfer. Over half of our research expenditures—\$332M in FY 2012—are funded via a vigorous

# Enterprise Size

## Introduction

range of activity in obtaining federal grants and contracts. The last three years have seen strong growth as high as 6% annually and a three-year average growth of 5%.

The space available at UA for research is low in absolute terms compared to UA's ABOR-approved peer institutions, yet UA faculty make very efficient use of it, with total UA research expenditures per net assignable square feet exceeding the median. This suggests that UA faculty will be very productive with additional square footage. 2012 saw the beginning of construction for the new Tree Ring Laboratory (a \$9M facility), planning of ENRB2 progressed, and planning was initiated for new Bioresearch and Engineering buildings.

A high priority is being given to the development of a coordinated and robust research infrastructure for biomedical research in Tucson and in Phoenix. In a collaboration involving the Arizona Board of Regents, Northern Arizona University, and the University of Arizona, the Phoenix Biomedical Campus has added a new \$135 million Health Sciences Education Building (HSEB). The building expands facilities for the UA College of Medicine – Phoenix as well as the UA Colleges of Pharmacy and the Mel and Enid Zuckerman College of Public Health, further promoting the integration of education, health care, and research and development. In 2012, plans were also under way for a new Cancer Center facility in Phoenix.

Although the total number of faculty is low at UA compared to its ABOR peer institutions, our total research expenditures per faculty is at the median, showing that our faculty are already very good at attracting and expending research dollars. Through the strategy of focusing additional research-intensive faculty hires in its emphasis areas, the UA maximizes its potential to increase its enterprise size, promote collaborative research, and increase overall achievements in research and scholarship. UA is committed to continued investment in recruitment, development, and retention of top research faculty and faculty teams.



Bryant Bannister Tree-Ring Building



HSEB at Phoenix Biomedical Campus

## Enterprise Size

### Selected Accomplishments

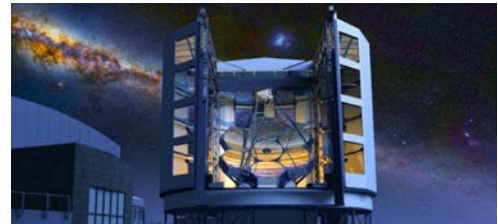
- At \$625M, research expenditures in FY 2012 again exceeded \$600M, a milestone reached for the first time in 2011. UA is now ranked **#19 nationally** in R&D expenditures among all public universities and **#30** among all private and public institutions. UA continued, since 1998, to maintain its **#1 ranking in the nation** for R&D expenditures in Astronomy and Planetary Sciences.

- New grants to UA researchers will allow **advances in understanding and preventing disease**. A \$4.87M grant from the National Cancer Institute (NCI) to Principal Investigator Patricia Carino is funding a clinical trial on the use of selenium supplements to prevent the recurrence of colorectal adenomas, the precursors of **colorectal cancer**. The Chemo-prevention of Skin Cancer Program, led by David Alberts and Timothy Bowden, received \$6.89M in new funding from NCI to develop novel technologies and therapeutic strategies to reduce the incidence of **squamous cell carcinoma** of the skin. A \$4.5M grant from the National Heart, Lung, and Blood Institute to BIO5 Director Fernando Martinez will allow him to continue the landmark Children's Respiratory Study, a 30-year study of childhood origins of adult **airway diseases** such as asthma and chronic obstructive pulmonary disease (COPD).



Dr. Fernando Martinez studies childhood origins of airway

- The UA is a founding partner in an international consortium of scientific institutions and universities that are creating what will be the **world's largest telescope—the Giant Magellan Telescope**—with construction set to begin in Chile in 2014. GMT will have seven 8.4-meter mirrors created by the UA's Steward Observatory Mirror Laboratory. With adaptive optics, a technology also pioneered by the UA, the GMT is expected to produce images ten times sharper than those obtained by the Hubble Space Telescope. The Mirror Lab completed the first mirror for GMT in 2012; the second mirror has been cast; two more are already in the works.



Artist's rendition of the GMT.  
(Image: Todd Mason/Mason Productions and GMTO Inc.)

- A new \$1.29 million grant to Principal Investigator Sally Stevens, director of the **Southwest Institute for Research on Women (SIROW)**, will support a multi-year evaluation of the combined effects of the two principal programs used in juvenile drug courts across the United States. The work will identify changes to improve efficiencies and cost effectiveness of these programs, where juvenile residents have a high co-occurrence of trauma, mental health problems, and substance abuse.
- Sequestered for years deep within the UA football stadium, the UA **Laboratory of Tree-Ring Research**—the largest repository of archaeological tree-ring samples in the world—gained a beautiful new campus home in 2012, funded entirely from gifts. The collection provides



## Enterprise Size

Selected Accomplishments

- unparalleled data for archaeological studies of Southwestern prehistoric sites and for studies that examine fire, climate, and water change through time. A new \$1.5M project funded by the National Science Foundation will study Southwestern ponderosa pine forests fire regimes, with potential to significantly inform forest management.



Disassembly of a giant sequoia slab.

- Three complementary grants in **environmental health**, supported by the National Institute of Environmental Health Sciences, focus on health issues and risks of particular concern to residents of Arizona. The **\$13.5M Superfund Basic Research Program**, under director Raina Maier, provides risk assessment of hazardous waste and develops innovative water remediation technologies. Principal investigator Serrine Lau obtained renewed funding to continue and expand the work of the **\$7.95M Southwest Environmental Health Sciences Center**, which addresses through research and outreach hazardous environmental exposures and environmental lung disease common to the U.S./Mexico border area. The next generation of interdisciplinary environmental scientists are trained through the graduate student/postdoctoral **training program in Environmental Toxicology of Complex Diseases**; \$2.4M was awarded through FY 2012.

- **OSIRIS-REx** is a bold \$800M mission led by UA that will send a spacecraft to rendezvous with and observe a near-Earth asteroid, retrieve a sample from it, and return a sample to earth. The project is expected to create an influx of \$200M to Southern Arizona over its lifetime, with anticipated award amounts of \$60M in FY2012. Work is commencing on the OSIRIS-REx Operations Center, the Camera Suite Phase B/C/D, and the return mission planning.

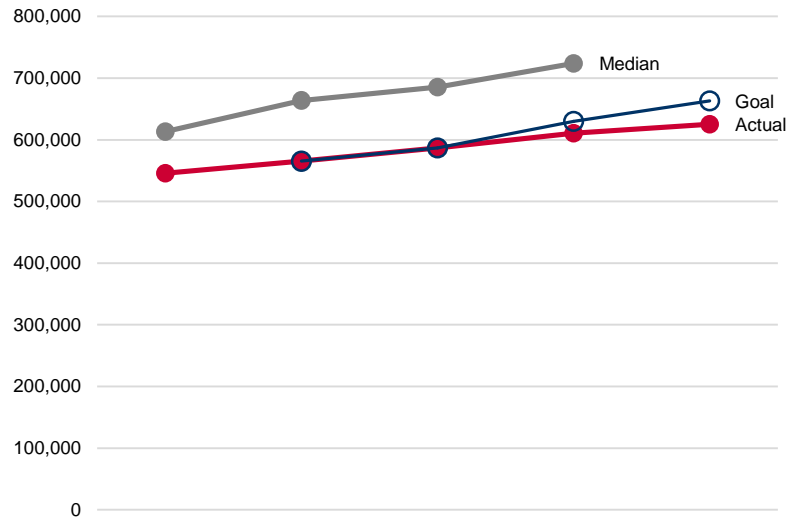
- **New faculty cluster hires** in 2012 built on areas of particular institutional strength. Hires in the area of **environmental sciences** in 2012 brought new research expertise including areas of wildlife ecology, environmental and energy economics, environmental risk policy, science communication, and sustainable cities. In **biosciences**, the UA recruited 15 new physician-scientists and translational researchers, who conduct research in areas including sudden cardiac death, lymphoma, diabetes, complementary medicine, and Parkinson's disease and bioinformatics.



2012 hire Dr. Jill Tardiff specializes in sudden cardiac death.

# Enterprise Size

Total Research Expenditures (in Thousands)

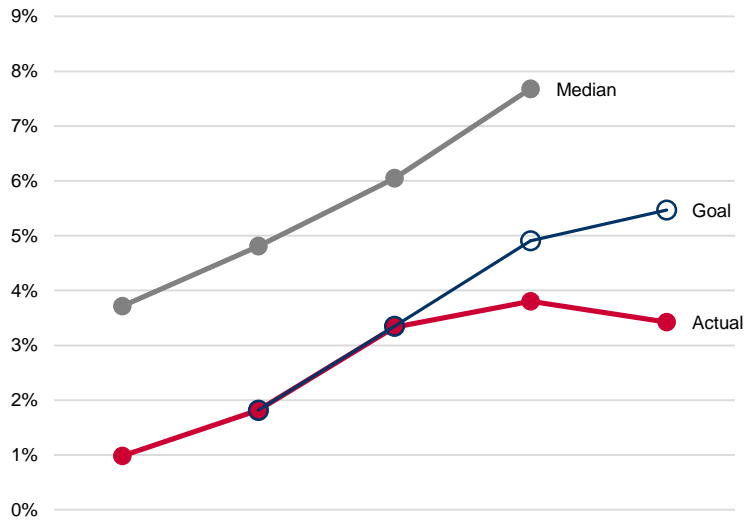


ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	545,869	565,292	586,647	610,565	625,365
Goal		565,292	586,932	630,000	663,000
Difference		0	-285	-19,435	-37,635

ABOR Peer Group	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
University of Washington	X	765,135	778,046	1,022,740	1,148,533		1
University of Wisconsin - Madison	X	881,777	952,119	1,029,295	1,111,642		2
University of California - Los Angeles	X	871,478	889,995	936,995	982,357		3
University of Minnesota	X	682,662	740,980	786,074	847,419		4
The Ohio State University	X	702,592	716,461	755,194	832,126		5
Pennsylvania State University, All Campuses	X	701,130	753,358	770,449	794,846		6
University of North Carolina - Chapel Hill	X	525,843	646,011	755,284	767,450		7
University of Florida	X	584,170	592,082	681,548	739,931		8
University of California - Davis	X	642,519	681,618	679,915	707,896		9
Texas A&M University		662,052	714,286	689,624	705,720		10
University of Texas - Austin		493,294	506,369	589,502	632,171		11
<b>The University of Arizona</b>	<b>X</b>	<b>545,869</b>	<b>565,292</b>	<b>586,647</b>	<b>610,565</b>	<b>625,365</b>	<b>12</b>
University of Illinois - Urbana - Champaign		501,279	563,710	515,133	545,669		13
University of Maryland - College Park		395,037	409,190	451,415	495,382		14
Michigan State University	X	356,767	373,184	431,373	454,248		15
University of Iowa	X	293,564	329,901	444,034	443,893		16
<b>Median</b>		<b>613,345</b>	<b>663,815</b>	<b>685,586</b>	<b>723,914</b>		

# Enterprise Size

Average Growth Rate in Total Research Expenditures Over 3 Years

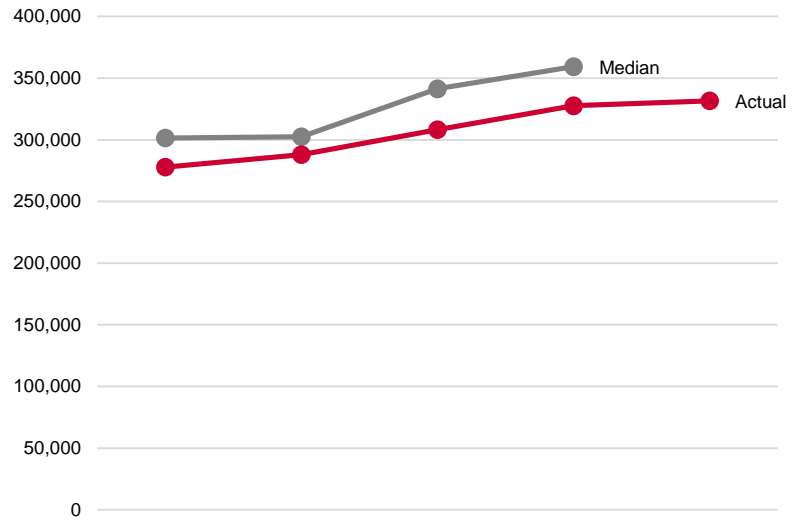


ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	1.0%	1.8%	3.3%	3.8%	3.4%
Goal		1.8%	3.3%	4.9%	5.5%
Difference		0	0.0%	-1.1%	-2.0%

ABOR Peer Group	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
University of Iowa	X	-3.6%	-0.6%	9.3%	15.6%		1
University of Washington	X	2.8%	0.0%	11.4%	15.1%		2
University of North Carolina - Chapel Hill	X	6.1%	13.5%	16.7%	13.8%		3
University of Texas - Austin		6.3%	5.5%	9.8%	8.8%		4
Michigan State University	X	2.3%	1.4%	6.4%	8.5%		5
University of Florida	X	3.3%	1.6%	5.0%	8.3%		6
University of Wisconsin - Madison	X	3.4%	4.6%	7.0%	8.0%		7
University of Maryland - College Park		5.3%	5.0%	7.9%	7.9%		8
University of Minnesota	X	7.6%	7.6%	8.0%	7.5%		9
The Ohio State University	X	5.0%	3.3%	1.6%	5.9%		10
Pennsylvania State University, All Campuses	X	3.9%	5.4%	5.7%	4.3%		11
University of California - Los Angeles	X	3.5%	3.1%	4.4%	4.1%		12
<b>The University of Arizona</b>	<b>X</b>	<b>1.0%</b>	<b>1.8%</b>	<b>3.3%</b>	<b>3.8%</b>	<b>3.4%</b>	<b>13</b>
University of California - Davis	X	5.5%	6.0%	4.3%	3.3%		14
University of Illinois - Urbana - Champaign		0.2%	5.9%	3.2%	3.3%		15
Texas A&M University		6.2%	7.9%	3.6%	2.3%		16
<b>Median</b>		<b>3.7%</b>	<b>4.8%</b>	<b>6.0%</b>	<b>7.7%</b>		

# Enterprise Size

Federally Financed Research Expenditures (in Thousands)

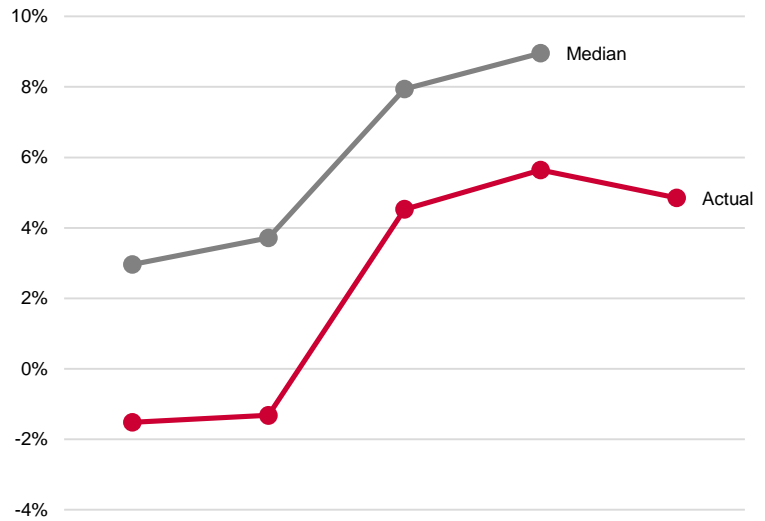


	2008	2009	2010	2011	2012
Actual	277,897	287,889	308,157	327,565	331,578

ABOR Peer Group	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
University of Washington	X	614,069	619,353	829,885	948,976		1
University of Wisconsin - Madison	X	474,440	507,898	545,189	593,633		2
University of California - Los Angeles	X	471,932	467,505	538,521	563,560		3
University of North Carolina - Chapel Hill	X	373,098	431,837	545,993	561,708		4
The Ohio State University	X	335,121	339,820	399,942	493,130		5
University of Minnesota	X	364,137	390,602	426,359	489,480		6
Pennsylvania State University, All Campuses	X	406,528	439,193	464,750	468,705		7
University of California - Davis	X	268,957	295,924	332,325	362,976		8
University of Texas - Austin		324,287	309,125	350,308	355,437		9
University of Maryland - College Park		236,417	246,985	297,896	338,780		10
<b>The University of Arizona</b>	<b>X</b>	<b>277,897</b>	<b>287,889</b>	<b>308,157</b>	<b>327,565</b>	<b>331,578</b>	<b>11</b>
University of Illinois - Urbana - Champaign		266,912	288,013	303,852	323,454		12
University of Florida	X	230,999	232,737	279,649	306,349		13
Texas A&M University		278,651	288,475	288,173	291,812		14
University of Iowa	X	229,903	252,336	282,465	283,627		15
Michigan State University	X	152,907	164,198	214,134	240,837		16
<b>Median</b>		<b>301,469</b>	<b>302,525</b>	<b>341,317</b>	<b>359,207</b>		

# Enterprise Size

Average Growth Rate in Federally Financed Research Expenditures Over 3 Years

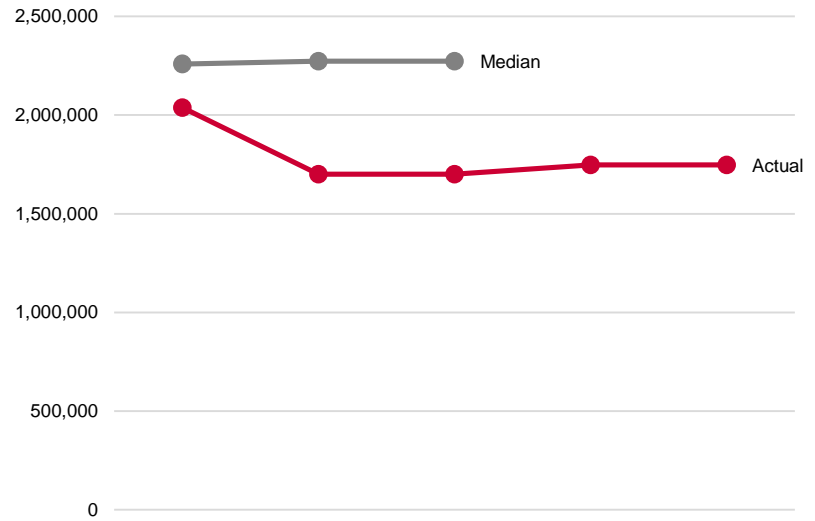


	2008	2009	2010	2011	2012
Actual	-1.5%	-1.3%	4.5%	5.6%	4.9%

ABOR Peer Group	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
Michigan State University	X	-0.5%	-0.7%	9.2%	16.8%		1
University of Washington	X	0.5%	-1.6%	11.3%	16.4%		2
University of North Carolina - Chapel Hill	X	5.2%	9.6%	16.6%	15.0%		3
The Ohio State University	X	4.5%	2.5%	8.7%	14.1%		4
University of Maryland - College Park		6.5%	5.6%	11.0%	12.9%		5
University of California - Davis	X	3.9%	6.1%	9.0%	10.5%		6
University of Minnesota	X	4.5%	6.2%	8.1%	10.4%		7
University of Florida	X	0.0%	-2.1%	5.6%	10.2%		8
University of Wisconsin - Madison	X	-0.2%	1.2%	5.2%	7.8%		9
University of Iowa	X	2.1%	5.3%	8.3%	7.4%		10
University of Illinois - Urbana - Champaign		-2.6%	3.0%	6.2%	6.6%		11
University of California - Los Angeles	X	0.2%	-1.1%	3.6%	6.3%		12
<b>The University of Arizona</b>	<b>X</b>	<b>-1.5%</b>	<b>-1.3%</b>	<b>4.5%</b>	<b>5.6%</b>	<b>4.9%</b>	<b>13</b>
Pennsylvania State University, All Campuses	X	4.3%	6.2%	7.8%	4.9%		14
University of Texas - Austin		8.4%	4.4%	6.9%	3.4%		15
Texas A&M University		4.4%	6.1%	3.1%	1.6%		16
<b>Median</b>		<b>3.0%</b>	<b>3.7%</b>	<b>7.9%</b>	<b>9.0%</b>		

# Enterprise Size

Net Assignable Square Feet

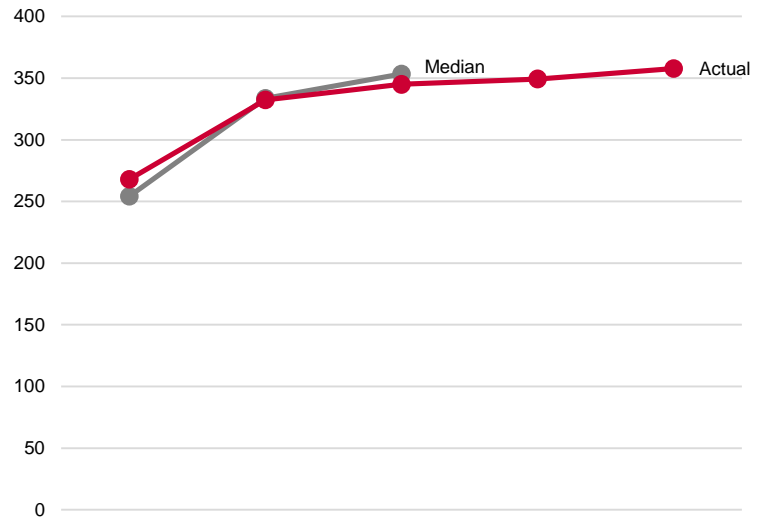


	2008	2009	2010	2011	2012
Actual	2,037,788	1,700,749	1,700,749	1,748,037	1,748,037

ABOR Peer Group	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
University of Illinois - Urbana - Champaign		4,319,500	4,561,500	4,561,500			1
University of Minnesota	X	3,678,316	3,684,378	3,684,378			2
University of Florida	X	2,877,352	3,081,524	3,081,524			3
Pennsylvania State University, All Campuses	X	2,913,138	2,997,579	2,997,579			4
University of Wisconsin - Madison	X		2,844,272	2,844,272			5
University of California - Davis	X	2,809,365	2,660,052	2,660,052			6
University of California - Los Angeles	X	2,229,683	2,496,563	2,496,563			7
Michigan State University	X	2,289,100	2,324,423	2,324,423			8
Texas A&M University			2,222,041	2,222,041			9
University of Washington	X	1,791,869	1,795,359	1,795,359			10
<b>The University of Arizona</b>	<b>X</b>	<b>2,037,788</b>	<b>1,700,749</b>	<b>1,700,749</b>	<b>1,748,037</b>	<b>1,748,037</b>	<b>11</b>
University of North Carolina - Chapel Hill	X	1,135,045	1,662,923	1,662,923			12
The Ohio State University	X	1,540,443	1,487,468	1,487,468			13
University of Texas - Austin		2,862,918	1,480,462	1,480,462			14
University of Maryland - College Park		987,352	712,085	712,085			15
University of Iowa	X	760,591	616,700	616,700			16
<b>Median</b>		<b>2,259,392</b>	<b>2,273,232</b>	<b>2,273,232</b>			

# Enterprise Size

Total Research Expenditures per Net Assignable Square Foot

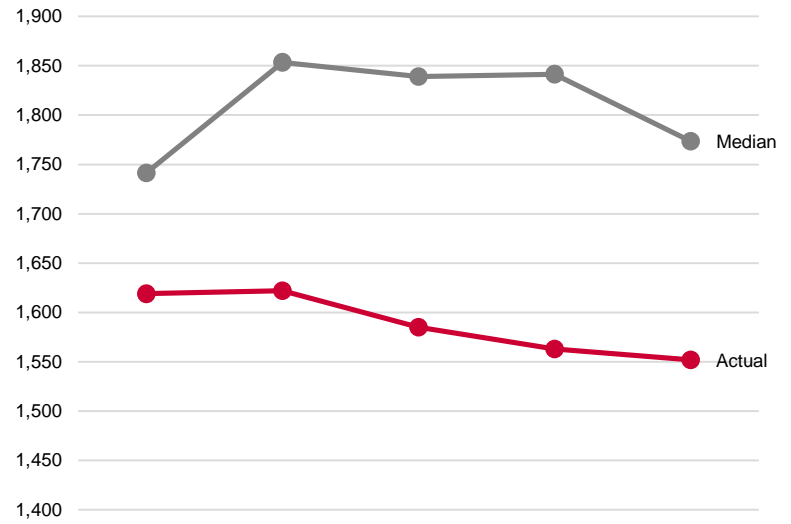


	2008	2009	2010	2011	2012
Actual	268	332	345	349	358

	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
<b>ABOR Peer Group</b>							
University of Iowa	X	386	535	720			1
University of Maryland - College Park		400	575	634			2
University of Washington	X	427	433	570			3
The Ohio State University	X	456	482	508			4
University of North Carolina - Chapel Hill	X	463	388	454			5
University of Texas - Austin		172	342	398			6
University of California - Los Angeles	X	391	356	375			7
University of Wisconsin - Madison	X		335	362			8
<b>The University of Arizona</b>	<b>X</b>	<b>268</b>	<b>332</b>	<b>345</b>	<b>349</b>	<b>358</b>	<b>9</b>
Texas A&M University			321	310			10
Pennsylvania State University, All Campuses	X	241	251	257			11
University of California - Davis	X	229	256	256			12
University of Florida	X	203	192	221			13
University of Minnesota	X	186	201	213			14
Michigan State University	X	156	161	186			15
University of Illinois - Urbana - Champaign		116	124	113			16
<b>Median</b>		<b>254</b>	<b>334</b>	<b>353</b>			

# Enterprise Size

Total Faculty Population



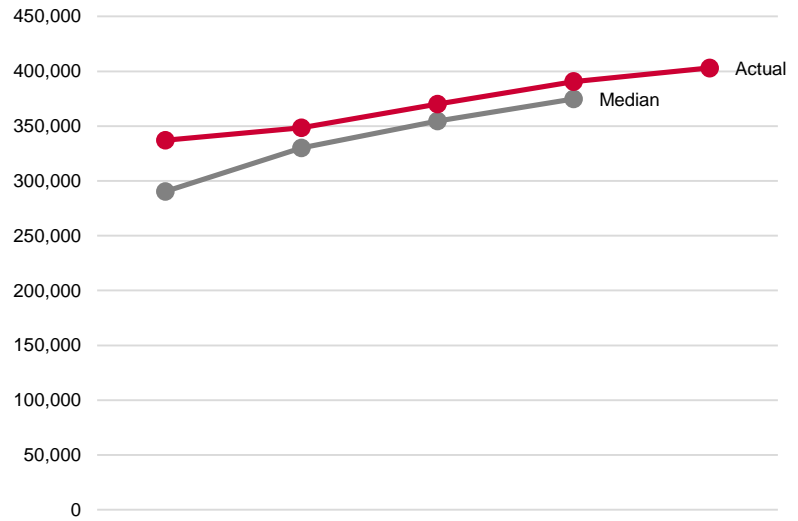
	2008	2009	2010	2011	2012
Actual	1,619	1,622	1,585	1,563	1,552

ABOR Peer Group	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
University of Florida	X	2,806	2,775	2,696	2,701	2,647	1
The Ohio State University	X	2,588	2,605	2,602	2,560	2,511	2
University of Minnesota	X	2,489	2,377	2,319	2,277	2,251	3
University of Wisconsin - Madison	X	2,064	2,053	2,047	2,057	2,014	4
University of Texas - Austin		1,887	1,913	1,981	1,954	1,910	5
Michigan State University	X	1,885	1,921	1,948	1,906	1,883	6
University of North Carolina - Chapel Hill	X	1,716	1,804	1,833	1,861	1,876	7
University of California - Los Angeles	X	1,753	1,829	1,840	1,822	1,776	8
Texas A&M University		1,730	1,878	1,838	1,871	1,771	9
Pennsylvania State University, All Campuses	X	1,711	1,757	1,748	1,759	1,763	10
University of Illinois - Urbana - Champaign		1,900	1,883	1,856	1,778	1,707	11
<b>The University of Arizona</b>	<b>X</b>	<b>1,619</b>	<b>1,622</b>	<b>1,585</b>	<b>1,563</b>	<b>1,552</b>	<b>12</b>
University of Iowa	X	1,549	1,599	1,572	1,527	1,538	13
University of Washington	X	1,607	1,568	1,548	1,536	1,525	14
University of Maryland - College Park		1,472	1,485	1,472	1,463	1,501	15
University of California - Davis	X	1,452	1,466	1,498	1,467	1,421	16
<b>Median</b>		<b>1,742</b>	<b>1,854</b>	<b>1,839</b>	<b>1,842</b>	<b>1,774</b>	



# Enterprise Size

Total Research Expenditures per Faculty



	2008	2009	2010	2011	2012
Actual	337,164	348,515	370,124	390,637	402,941

ABOR Peer Group	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
University of Washington	X	476,126	496,203	660,685	747,743		1
University of Wisconsin - Madison	X	427,218	463,770	502,831	540,419		2
University of California - Los Angeles	X	497,135	486,602	509,236	539,164		3
University of California - Davis	X	442,506	464,951	453,882	482,547		4
Pennsylvania State University, All Campuses	X	409,778	428,775	440,760	451,874		5
University of North Carolina - Chapel Hill	X	306,435	358,099	412,048	412,386		6
<b>The University of Arizona</b>	<b>X</b>	<b>337,164</b>	<b>348,515</b>	<b>370,124</b>	<b>390,637</b>	<b>402,941</b>	<b>7</b>
Texas A&M University		382,689	380,344	375,203	377,189		8
University of Minnesota	X	274,272	311,729	338,971	372,165		9
University of Maryland - College Park		268,368	275,549	306,668	338,607		10
The Ohio State University	X	271,481	275,033	290,236	325,049		11
University of Texas - Austin		261,417	264,699	297,578	323,527		12
University of Illinois - Urbana - Champaign		263,831	299,368	277,550	306,900		13
University of Iowa	X	189,518	206,317	282,464	290,696		14
University of Florida	X	208,186	213,363	252,800	273,947		15
Michigan State University	X	189,266	194,265	221,444	238,325		16
<b>Median</b>		<b>290,353</b>	<b>330,122</b>	<b>354,548</b>	<b>374,677</b>		

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THE UNIVERSITY  
OF ARIZONA®

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**Discovery and Scholarly Impact**

Discovery is central to the mission of the University of Arizona; it is an explicit and pivotal component of our endeavors. But research cannot exist in a vacuum nor its results be sequestered behind ivied walls.

As a first step, to be effective, **discoveries must be communicated** to wide public, professional, and research audiences. Faculty members have always communicated their research results in professional publications. According to Thomson Reuters Web of Science, in the past 5 years, University of Arizona investigators published an average of over 4,200 articles per year in high impact journals. And the UA knowledge transfer mission goes far beyond this.

Beyond publication of results, **inventions must be put to practical and beneficial use** through various processes of technology transfer and commercialization. As stated in its 5-Year Strategic Plan, the UA will advance research that creates new knowledge, enhances education, and addresses social, cultural, and economic needs. As one way to reach this goal, UA strives to expand its community engagement and workforce impact through partnerships and extension programs.

Through its research, UA addresses **critical regional problems and issues**, such as the sustainability of water resources in arid lands and the development and testing of treatments for snakebite and valley fever. UA also has a **global research reach**, leading international consortia on bold projects to explore our universe and build a global cyberinfrastructure. UA forges collaborations and partnerships with industry, business, government agencies, ranchers, farmers, NGOs, and tribal communities to help meet their research, data, and information needs, resolve problems, and inform sound policymaking.

A benchmark of our success in impacting the greater community pertains to the number of invention disclosures and patents made by our researchers. Disclosures totaled 142 in FY 2012, continuing the strong growth of the last 3 years. The number of patents issued was 21, representing an 11% increase over FY 2011. Yet another important benchmark is the number of major agreements for licenses and options; 47 were closed on in 2012 (see Tech Transfer section). One new patent, “**Artificial Diets for Honey Bees,**” for example, aims to provide a fully nutritious food for honey bees in easily digestible form. The diets support growth and development of honey bees, sustain brood rearing, and maintain hive vigor. The diets are particularly advantageous for providing nutrition sources for bees that are moved during commercial crop pollination or for other beekeeping uses. This patent will help mitigate colony collapse and other problems, improving the health of bee colonies, which in turn is essential to food production.



McGuire Entrepreneurship students work with faculty to facilitate UA technology transfer.

An important strategy that UA is employing to meet the ABOR 2008-2020 goal of utilizing “research, economic development, community engagement, and service contributions of the universities to ... strengthen Arizona’s economy and improve Arizona’s quality of life” is fostering interaction with

communities to provide more direct societal benefits. This is accomplished through a comprehensive program of knowledge dissemination and public programs aimed at health, environmental and regional stewardship, community and economic development, life-long learning, and access to arts and culture.

In many ways, the UA brings cutting-edge research directly to the people it can impact. Cutting-edge science is shared with the public at the UA Science Lecture Series. The 2012 lectures on Aging filled the 2,500-seat Centennial Hall to capacity. New treatments for disease are offered in clinical trials; this activity will increase with the expansion of biomedical facilities in Phoenix. The vast network of the UA's Cooperative Extension, with offices in all 15 Arizona counties and on five tribal reservations, puts the latest advances in agriculture and life sciences into the hands of Arizonans. And K-12 students throughout Arizona immerse themselves in research through programs such as Keep Engaging Youth in Science (KEYS), which teaches high school students research skills and matches them with top faculty in the BIO5 Institute and College of Pharmacy.



The KEYS internship program engages high school students in biomedical research.

# Discovery and Scholarly Impact

*Selected Accomplishments*

- Two UA professors were named Regents' Professors in 2012:
  - **Robert Glennon**, the Morris K. Udall Professor in the James E. Rogers College of Law, approaches issues of water sustainability through the perspective of law and policy. Glennon has been called “a globally influential intellectual leader on the issue of water resources, as well as one of the most eloquent and tireless spokespersons for a more sustainable water future, both for local communities and abroad.”
  - **Thomas Swetnam**, professor and director of the Laboratory of Tree-Ring Research, combines his expertise in geosciences and ecology to study historic and prehistoric forest disturbances and their relationship to land use and climate, using dendrochronology. An expert on wildfire history and ecology in pine and giant sequoia forests of the Western United States, Mexico, and South America, Swetnam investigates the links among forest fires, climate, and human history in the Southwestern United States and in central Siberia.



Regent's professors Robert Glennon (top) and Thomas

- UA water expert Wendell Ela, UA solar expert Ardeth Barnhart, a team of students, collaborators, specialists at the Arizona Bureau of Reclamation, and tribal officials are coming together to help make clean water available to the households in remote, arid regions of the Navajo Nation that lack basic infrastructure for water and energy (up to 40% of households). When drawing from unregulated water sources, they run a risk of exposure to high levels of arsenic, uranium and salinity. A pilot-scale project for a **solar-powered water membrane-distillation system** can purify groundwater for use by humans and livestock, using economically and culturally appropriate desalination technology with solar energy. The aim is to develop an economical and reproducible system with a lifespan of 30 to 40 years that can produce several thousand gallons of usable water per day and could provide safe drinking water in remote areas around the world.



A pilot project on the Navajo Reservation combines solar energy with desalination technology.

- An ambitious hillslope experiment is the flagship project of the **Landscape Evolution Observatory (LEO)** at Biosphere 2. Researchers have used this unique and vast venue to build three enormous landscapes to simulate how changing climatic conditions impact ecology and water availability. Each landscape weighs over 2 million pounds and contains a network of about 1,800 sensors and samplers to track the movement of water, energy, and carbon. Under controlled conditions, researchers can track how water moves over landscapes and through soils under different rain and drought conditions and investigate how carbon cycling, infiltration, runoff, and plants and microbes are affected.



One of three hillslopes in Biosphere 2's LEO project.

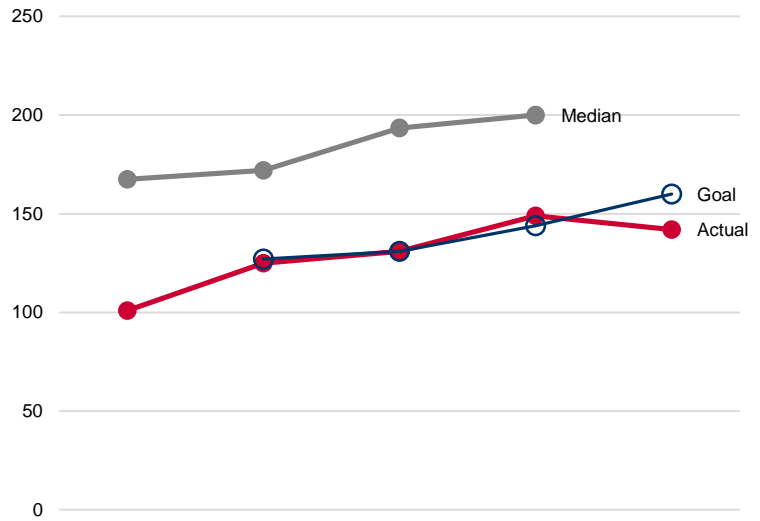
- The UA's **Confluence Center for Creative Inquiry** conducts and promotes innovative and interdisciplinary research and outreach by scholars in the humanities, social sciences, and arts to inform academic, professional, and public audiences. Through publications, presentations, and public lectures on and off campus, the Center expands individual perspectives of science, art, and social sciences by melding diverse disciplines. In 2012, CCCI events looked at a wide range of topics: from musical explorations of themes of love, loss, and war in the World Wars to the relationship of politics and religion; from ways that mythmaking and community discourse inform public health to the intersection of early modern empires of France and India; from the history and culture of Mexican food in the United States to multilingualism as seen from the disciplines of computational linguistics, anthropology, second language acquisition, comparative literature and translation studies.
- Susan Penfield, research coordinator for the UA's Confluence Center for Creative Inquiry and the Center for Educational Resources in Culture, Language and Literacy, is using her 40 years of experience working to preserve near-extinct languages through the Google-seeded **Endangered Languages Project**. An expert on the emerging use of technology in this effort, in 2012 Penfield was named as one of only twenty invited advisors to the project and helped to develop its website, a centralized hub for people around the globe working to document and preserve more than 3,000 languages.



Tribal members get technology training to work on their languages.  
Photo credit: Susan Penfield.

# Discovery and Scholarly Impact

Invention Disclosures Transacted



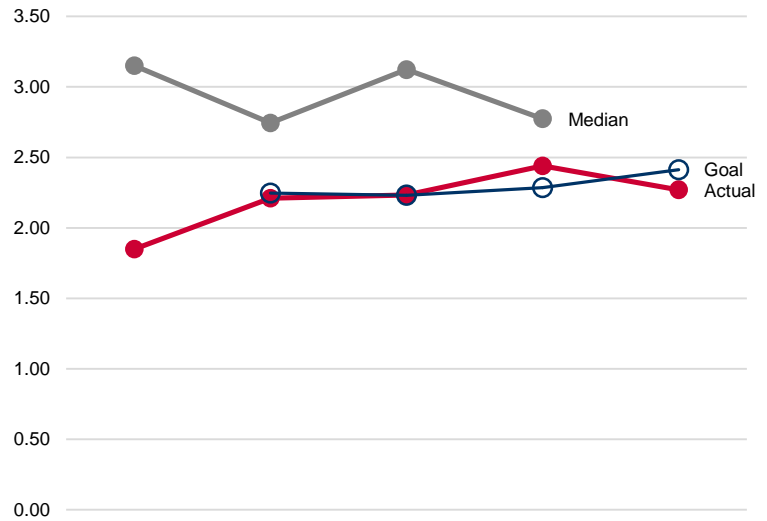
ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	101	125	131	149	142
Goal		127	131	144	160
Difference		-2	0	5	-18

ABOR Peer Group	Med. Sch. AUTM Adj.	2008	2009	2010	2011	2012	Rank
University of Wisconsin - Madison	X	381	333	356	357		1
University of Washington	X	349	349	354	356		2
University of Florida	X	299	304	295	322		3
University of California - Los Angeles	X	314	333	379	299		4
Texas A&M University		226	196	207	284		5
University of Minnesota	X	217	244	255	250		6
The Ohio State University	X	142	163	173	216		7
University of California - Davis	X	181	172	245	184		8
University of Illinois - Urbana - Champaign		243		180	182		9
<b>The University of Arizona</b>	<b>X</b>	<b>101</b>	<b>125</b>	<b>131</b>	<b>149</b>	<b>142</b>	<b>10</b>
Pennsylvania State University, All Campuses	X	143	119	133	144		11
University of North Carolina - Chapel Hill	X	122	137	125	142		12
Michigan State University	X	91	129	116	110		13
University of Iowa	X	68	70	70	68		14
University of Maryland - College Park		132					
University of Texas - Austin		154					
<b>Median</b>		<b>168</b>	<b>172</b>	<b>194</b>	<b>200</b>		



# Discovery and Scholarly Impact

Invention Disclosures Transacted per \$10 Million in Total Research Expenditures

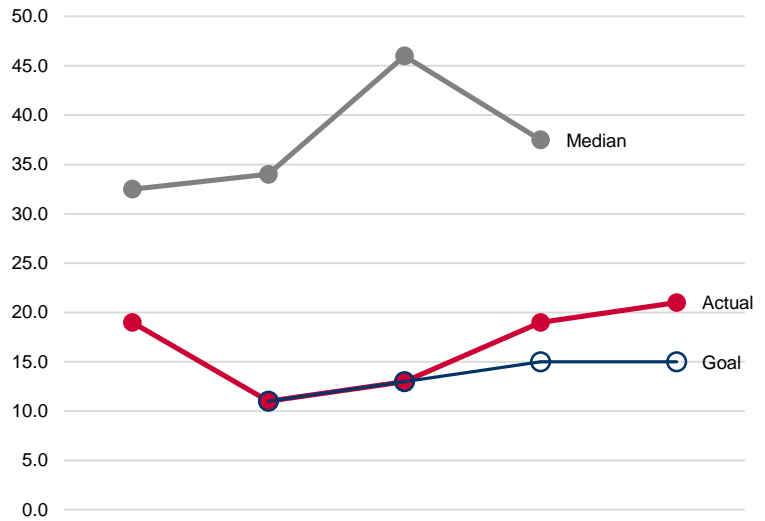


ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	1.9	2.2	2.2	2.4	2.3
Goal		2.2	2.2	2.3	2.4
Difference		0.0	0.0	0.2	-0.1

ABOR Peer Group	Med. Sch. NSF Adj. AUTM Adj.	2008	2009	2010	2011	2012	Rank
University of Florida	X	5.1	5.1	4.3	4.4		1
Texas A&M University		3.4	2.7	3.0	4.0		2
University of Illinois - Urbana - Champaign		4.8		3.5	3.3		3
University of Wisconsin - Madison	X	4.3	3.5	3.5	3.2		4
University of Washington	X	4.6	4.5	3.5	3.1		5
University of California - Los Angeles	X	3.6	3.7	4.0	3.0		6
University of Minnesota	X	3.2	3.3	3.2	3.0		7
University of California - Davis	X	2.8	2.5	3.6	2.6		8
The Ohio State University	X	2.0	2.3	2.3	2.6		9
<b>The University of Arizona</b>	<b>X</b>	<b>1.9</b>	<b>2.2</b>	<b>2.2</b>	<b>2.4</b>	<b>2.3</b>	<b>10</b>
Michigan State University	X	2.6	3.5	2.7	2.4		11
University of North Carolina - Chapel Hill	X	2.3	2.1	1.7	1.9		12
Pennsylvania State University, All Campuses	X	2.0	1.6	1.7	1.8		13
University of Iowa	X	2.3	2.1	1.6	1.5		14
University of Maryland - College Park		3.3					
University of Texas - Austin		3.1					
<b>Median</b>		<b>3.2</b>	<b>2.7</b>	<b>3.1</b>	<b>2.8</b>		

# Discovery and Scholarly Impact

U.S. Patents Issued

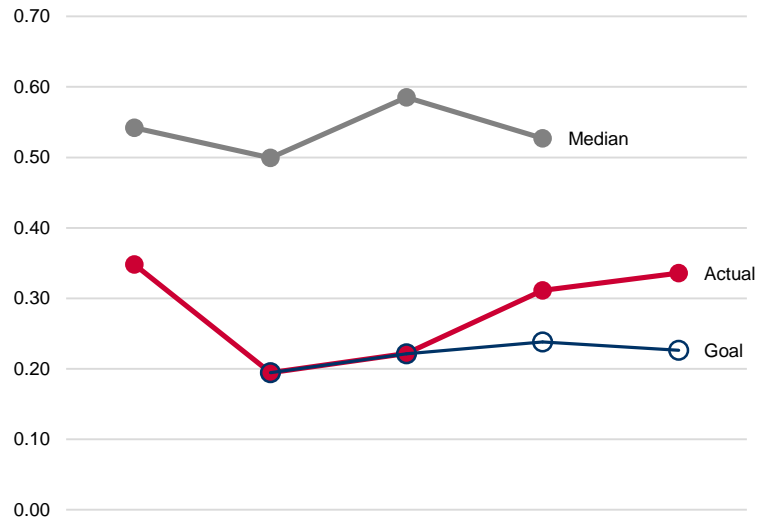


ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	19	11	13	19	21
Goal		11	13	15	15
Difference		0	0	4	6

ABOR Peer Group	Med. Sch. AUTM Adj.	2008	2009	2010	2011	2012	Rank
University of Wisconsin - Madison	X	98	119	133	156		1
University of Florida	X	52	73	59	86		2
University of Washington	X	56	40	69	70		3
University of Illinois - Urbana - Champaign		38			68		4
University of California - Los Angeles	X	42	60	47	56		5
University of Minnesota	X	37	37	46	41		6
Michigan State University	X	48	41	52	38		7
Pennsylvania State University, All Campuses	X	38	34	54	37		8
University of North Carolina - Chapel Hill	X	17	19	27	33		9
University of Iowa	X	24	30	32	31		10
The Ohio State University	X	15	20	38	30		11
University of California - Davis	X	21	24	29	23		12
<b>The University of Arizona</b>	<b>X</b>	<b>19</b>	<b>11</b>	<b>13</b>	<b>19</b>	<b>21</b>	<b>13</b>
Texas A&M University		28	20	33	18		14
University of Maryland - College Park		23					
University of Texas - Austin		25					
<b>Median</b>		<b>33</b>	<b>34</b>	<b>46</b>	<b>38</b>		

# Discovery and Scholarly Impact

U.S. Patents Issued per \$10 Million in Total Research Expenditures



ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	0.3	0.2	0.2	0.3	0.3
Goal		0.2	0.2	0.2	0.2
Difference		0.0	0.0	0.1	0.1

ABOR Peer Group	Med. Sch. NSF Adj. AUTM Adj.	2008	2009	2010	2011	2012	Rank
University of Wisconsin - Madison	X	1.1	1.2	1.3	1.4		1
University of Illinois - Urbana - Champaign		0.8			1.2		2
University of Florida	X	0.9	1.2	0.9	1.2		3
Michigan State University	X	1.3	1.1	1.2	0.8		4
University of Iowa	X	0.8	0.9	0.7	0.7		5
University of Washington	X	0.7	0.5	0.7	0.6		6
University of California - Los Angeles	X	0.5	0.7	0.5	0.6		7
University of Minnesota	X	0.5	0.5	0.6	0.5		8
Pennsylvania State University, All Campuses	X	0.5	0.5	0.7	0.5		9
University of North Carolina - Chapel Hill	X	0.3	0.3	0.4	0.4		10
The Ohio State University	X	0.2	0.3	0.5	0.4		11
University of California - Davis	X	0.3	0.4	0.4	0.3		12
<b>The University of Arizona</b>	<b>X</b>	<b>0.3</b>	<b>0.2</b>	<b>0.2</b>	<b>0.3</b>	<b>0.3</b>	<b>13</b>
Texas A&M University		0.4	0.3	0.5	0.3		14
University of Maryland - College Park		0.6					
University of Texas - Austin		0.5					
<b>Median</b>		<b>0.5</b>	<b>0.5</b>	<b>0.6</b>	<b>0.5</b>		

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THE UNIVERSITY  
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**Economic Development**



**Arizona**, and UA personnel play a significant role in two-thirds of them.

Most areas in which UA research is exceptionally strong are also those that draw on experts in diverse but complementary fields. Our UA interdisciplinary culture, almost unique when it first took hold, is now a model for other universities and the cornerstone of our ability to lead in positive change and economic development. UA researchers have embraced the interdisciplinary approach, finding that their intellectual views are broadened and stimulated by such collaborations. UA's many research centers and institutes provide nimble structures that enhance and support emerging interdisciplinary fields.

Moreover, this focus on interdisciplinarity bolsters UA's strategic goal of preparing Arizona's workforce for the knowledge economy. UA graduate students, who are preparing to be the future leaders of Arizona's research and technology economy, find a rich environment to hone their skills within these centers and institutes. Their research experiences are also enhanced by a variety of interdisciplinary training opportunities. From a popular entrepreneurship minor to training programs that include interdisciplinary research, clinical, and industry experiences, these students are being prepared to succeed in a complex modern environment—the "real world."

UA's **Graduate Interdisciplinary Programs** (GIDPs) provide another means of ensuring that research and education remain flexible and relevant to today's world. The twelve UA GIDPs bring together faculty with diverse affiliations to perform research and offer degrees in rapidly developing fields that defy conventional college boundaries. As news-breaking research advances, so does the focus of GIDPs.



Professor Walter Piegorsch illustrates a graph for students from the GIDP in statistics.

# Economic Development

Selected Accomplishments



- Two UA economic development projects that have had a significant impact on the Tucson region were awarded **Excellence in Economic Development Awards** by the International Economic Development Council (IEDC) in 2012. The awards recognize the world's best economic development programs and partnerships, marketing materials, and the year's most influential leaders

- o **The Bridges/UA Bio Park** was recognized as one of the top economic development projects in the United States, earning a silver award for Public-Private Partnerships. This master-planned, 350-acre mixed-use development in south central Tucson is anchored by the UA's 65-acre Bio Park, which is being developed and managed by the UA Office of University Research Parks.
- o **The Solar Zone at the UA Tech Park** was recognized as the best project for Sustainable & Green Development for communities with populations of greater than 500,000. The UA Tech Park, in partnership with Tucson Electric Power (TEP), created the Solar Zone to accelerate the growth and development of the solar industry in Southern Arizona.



UA BioPark (top) and The Solar Zone at UA Tech Park (bottom) were recently honored.

- **UA's 2012 Student Innovator of the Year**, Alexandra Armstrong, just completed her doctorate in Microbiology, but her vaccine research already has potential to reduce by thirty-fold the incidence of a common food-borne disease, Campylobacteriosis. The disease affects 2.4 million humans annually and is the second-most common bacterial food-borne disease in the United States. Armstrong is continuing her work in the laboratory of the late Dr. Lynn Joens following graduation to help get the vaccine on the market as soon as possible.

- A new study released in FY 2012 determined that the **UA Tech Park** had an **economic impact of \$2.67 billion** in Pima County, Arizona in 2009. This amount included \$1.81B in direct economic impacts such as wages paid and supplies and services purchased and \$861M in indirect and induced dollar impacts. The study, *University of Arizona Science and Technology Park: Economic Impact Calendar Year 2009*, was authored by regional economist Dr. Jaewon Lim. From 2009 to 2011, the number of tenants at the Park expanded from 50 to 52, and the number of total employees increased by nearly 500.



Business incubator AzCI dedicated its new facilities in 2012.

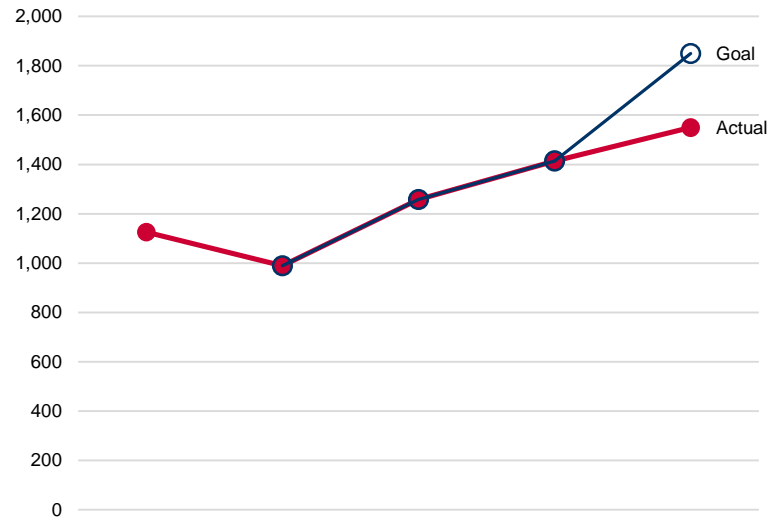
- **The Arizona Center for Innovation (AzCI)**, a nonprofit technology business incubator located at the UA Tech Park, **dedicated its new facilities** in January 2012, with the help of Governor Jan Brewer. AzCI helps local entrepreneurs and inventors transform their innovative ideas and



- discoveries into successful high technology companies. The new building includes a Collaboration Center for meetings, an expanded wet lab with new state-of-the art equipment, and flexible dry labs. The new facility expands AzCI's square footage from 2,300 to 18,000.
- **417 Ph.D. degrees were awarded** for 2011/2012 to UA students. An additional 433 other doctoral degrees (e.g. medicine, law, pharmacy) were awarded.
- *U.S. News and World Report* gave **top-10 national rankings** to the following UA graduate programs:
  - #1 in Geology (and #7 in the overall category of Earth Sciences)
  - #5 in Information Systems (up from #7 in 2011, ahead of Stanford and the Wharton School of the University of Pennsylvania)
  - #5 in Speech-Language Pathology
  - #6 in Social Psychology
  - #6 in Analytical Chemistry
  - #6 in Rehabilitation Counseling
  - #7 in Atomic, Molecular, and Optical Physics
  - #8 in Entrepreneurship (up from #10 in 2011)
  - #9 in Ecology and Evolutionary Biology
  - #10 in Pharmacy
  - #10 in Geochemistry

# Economic Development

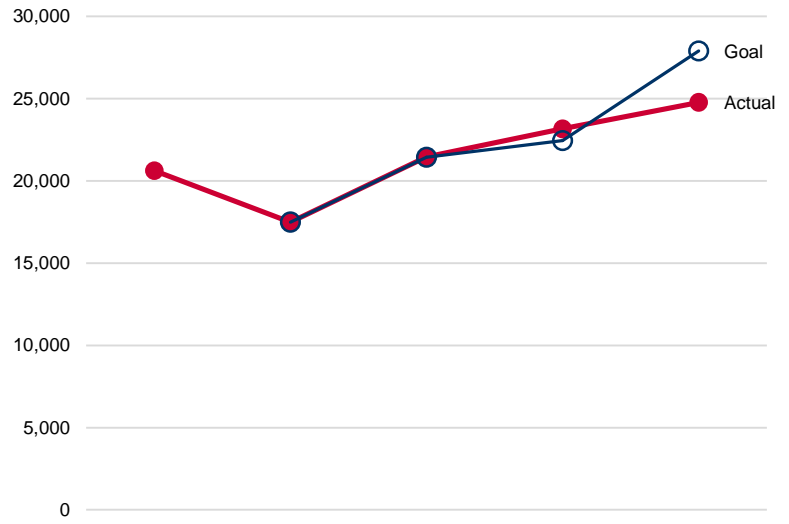
Intellectual Property Income (in Thousands)



ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	1,126	989	1,258	1,414	1,550
Goal		989	1,258	1,414	1,850
Difference		0	0	0	-300

# Economic Development

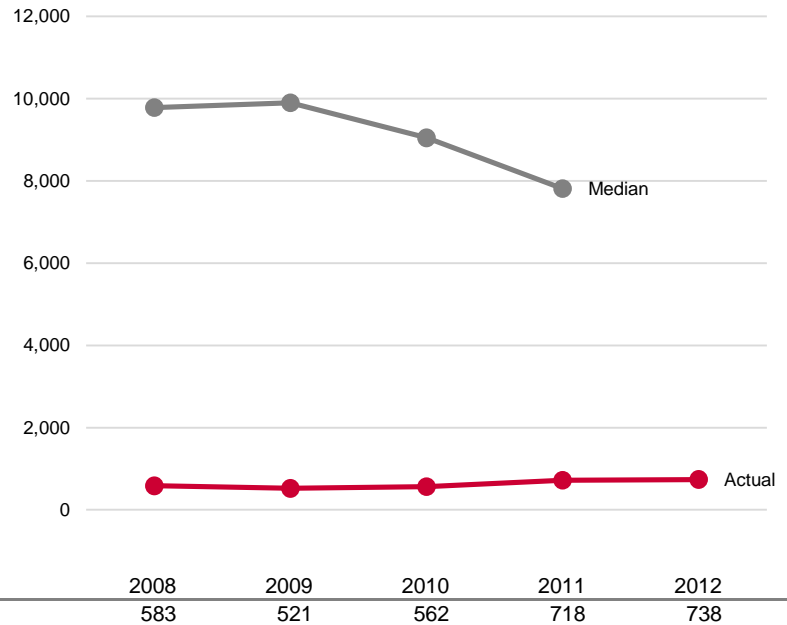
Intellectual Property Income per \$10 Million in Total Research Expenditures



ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	20,626	17,497	21,450	23,164	24,778
Goal		17,497	21,439	22,449	27,903
Difference		0	10	715	-3,125

# Economic Development

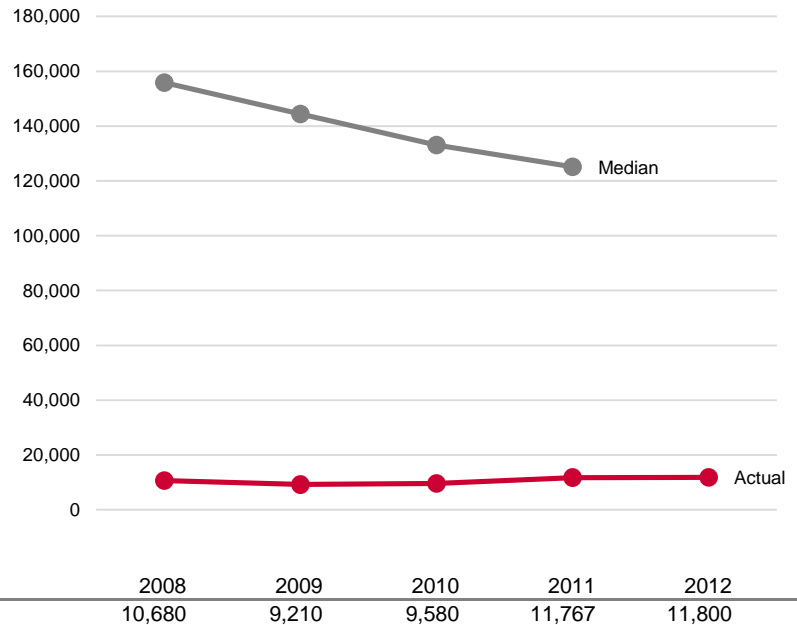
Licenses and Options Income (in Thousands)



		2008	2009	2010	2011	2012	
Actual		583	521	562	718	738	
<b>ABOR Peer Group</b>	<b>Med. Sch. AUTM Adj.</b>	<b>2,008</b>	<b>2,009</b>	<b>2,010</b>	<b>2,011</b>	<b>2,012</b>	<b>Rank</b>
University of Washington	X	80,331	87,340	69,032	67,362		1
University of Wisconsin - Madison	X	54,130	56,714	54,300	57,730		2
University of Florida	X	52,252	53,880	29,235	29,494		3
University of California - Los Angeles	X	32,837	22,557	27,485	16,153		4
University of California - Davis	X	8,011	9,845	9,048	10,233		5
University of Minnesota	X	84,669	95,169	83,906	10,079		6
Texas A&M University		11,787	9,898	8,621	9,264		7
University of Illinois - Urbana - Champaign		4,241			6,363		8
University of Iowa	X	23,560	42,922	26,991	6,285		9
Michigan State University	X	4,769	4,449	4,017	3,616		10
Pennsylvania State University, All Campuses	X	1,504	1,227	2,271	2,947		11
University of North Carolina - Chapel Hill	X	2,779	3,064	2,598	1,483		12
The Ohio State University	X	2,095	1,712	1,907	1,420		13
<b>The University of Arizona</b>	<b>X</b>	<b>583</b>	<b>521</b>	<b>562</b>	<b>718</b>	<b>738</b>	<b>14</b>
University of Maryland - College Park		1,555					
University of Texas - Austin		11,554					
<b>Median</b>		<b>9,783</b>	<b>9,898</b>	<b>9,048</b>	<b>7,813</b>		

# Economic Development

Licenses and Options Income per \$10 Million in Total Research Expenditures



	Med. Sch. NSF Adj. AUTM Adj.	2008	2009	2010	2011	2012	Rank
<b>ABOR Peer Group</b>							
University of Washington	X	1,049,893	1,122,555	674,971	586,506		1
University of Wisconsin - Madison	X	613,874	595,661	527,546	519,322		2
University of Florida	X	894,466	910,017	428,950	398,598		3
University of California - Los Angeles	X	376,797	253,451	293,331	164,431		4
University of California - Davis	X	124,681	144,436	133,075	144,555		5
University of Iowa	X	802,551	1,301,059	607,859	141,587		6
Texas A&M University		178,037	138,566	125,010	131,271		7
University of Minnesota	X	1,240,277	1,284,360	1,067,406	118,932		8
University of Illinois - Urbana - Champaign		84,604			116,601		9
Michigan State University	X	133,673	119,229	93,121	79,596		10
Pennsylvania State University, All Campuses	X	21,451	16,289	29,476	37,080		11
University of North Carolina - Chapel Hill	X	52,848	47,429	34,398	19,317		12
The Ohio State University	X	29,818	23,891	25,252	17,065		13
<b>The University of Arizona</b>	X	<b>10,680</b>	<b>9,210</b>	<b>9,580</b>	<b>11,767</b>	<b>11,800</b>	<b>14</b>
University of Maryland - College Park		39,363					
University of Texas - Austin		234,221					
<b>Median</b>		<b>155,855</b>	<b>144,436</b>	<b>133,075</b>	<b>125,101</b>		

# Economic Development

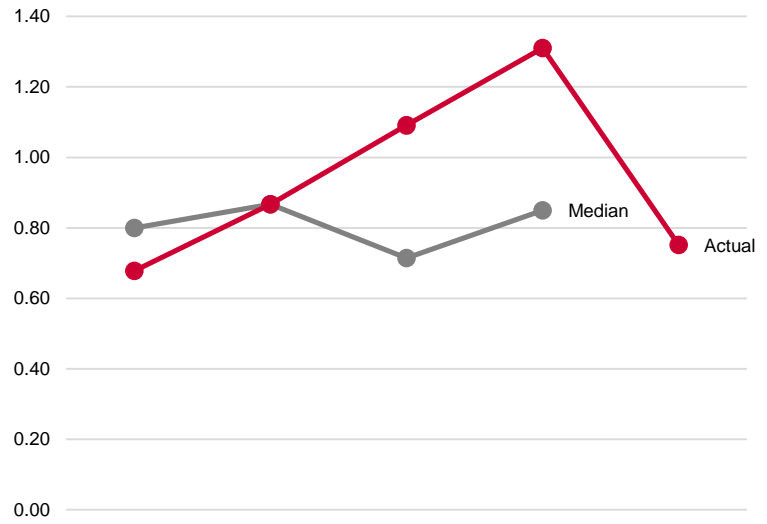
Licenses and Options Executed



		2008	2009	2010	2011	2012	
Actual		37	49	64	80	47	
<b>ABOR Peer Group</b>	<b>Med. Sch. AUTM Adj.</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>Rank</b>
University of Washington	X	212	231	196	194		1
University of Florida	X	75	115	92	131		2
University of Minnesota	X	63	53	73	113		3
<b>The University of Arizona</b>	<b>X</b>	<b>37</b>	<b>49</b>	<b>64</b>	<b>80</b>	<b>47</b>	<b>4</b>
Texas A&M University		41	63	49	67		5
University of Wisconsin - Madison	X	75	57	62	62		6
University of California - Davis	X	123	74	67	58		7
University of Illinois - Urbana - Champaign		43		40	55		8
University of California - Los Angeles	X	38	37	52	46		9
University of North Carolina - Chapel Hill	X	58	72	39	45		10
Michigan State University	X	25	44	31	40		11
The Ohio State University	X	23	27	35	25		12
University of Iowa	X	22	21	21	24		13
Pennsylvania State University, All Campuses	X	26	21	24	23		14
University of Maryland - College Park		12					
University of Texas - Austin		56					
<b>Median</b>		<b>42</b>	<b>53</b>	<b>51</b>	<b>57</b>		

# Economic Development

Licenses and Options Executed per \$10 Million in Total Research Expenditures

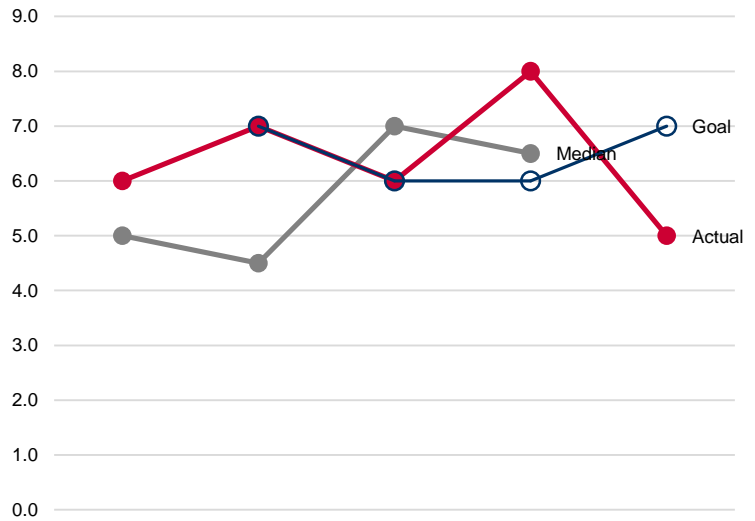


	2008	2009	2010	2011	2012
Actual	0.7	0.9	1.1	1.3	0.8

	Med. Sch. NSF Adj. AUTM Adj.	2008	2009	2010	2011	2012	Rank
<b>ABOR Peer Group</b>							
University of Florida	X	1.3	1.9	1.3	1.8		1
University of Washington	X	2.8	3.0	1.9	1.7		2
University of Minnesota	X	0.9	0.7	0.9	1.3		3
<b>The University of Arizona</b>	<b>X</b>	<b>0.7</b>	<b>0.9</b>	<b>1.1</b>	<b>1.3</b>	<b>0.8</b>	<b>4</b>
University of Illinois - Urbana - Champaign		0.9		0.8	1.0		5
Texas A&M University		0.6	0.9	0.7	0.9		6
Michigan State University	X	0.7	1.2	0.7	0.9		7
University of California - Davis	X	1.9	1.1	1.0	0.8		8
University of North Carolina - Chapel Hill	X	1.1	1.1	0.5	0.6		9
University of Wisconsin - Madison	X	0.9	0.6	0.6	0.6		10
University of Iowa	X	0.7	0.6	0.5	0.5		11
University of California - Los Angeles	X	0.4	0.4	0.6	0.5		12
The Ohio State University	X	0.3	0.4	0.5	0.3		13
Pennsylvania State University, All Campuses	X	0.4	0.3	0.3	0.3		14
University of Maryland - College Park		0.3					
University of Texas - Austin		1.1					
<b>Median</b>		<b>0.8</b>	<b>0.9</b>	<b>0.7</b>	<b>0.8</b>		

# Economic Development

## Startup Companies



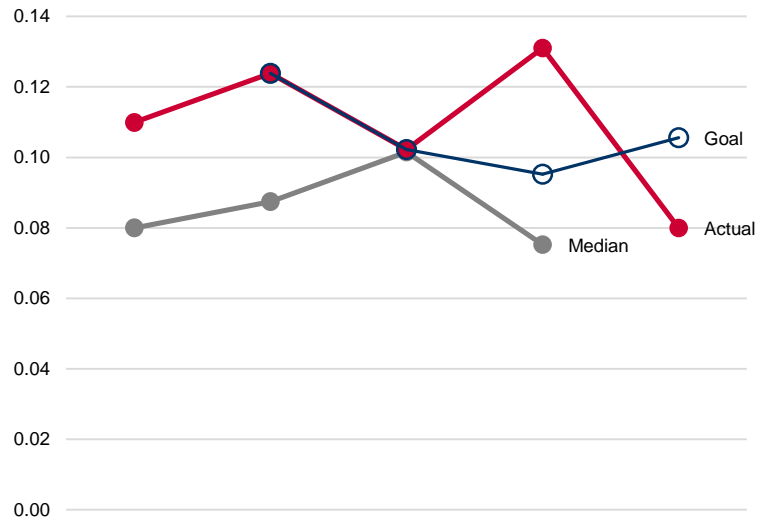
ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	6	7	6	8	5
Goal		7	6	6	7
Difference		0	0	2	-2

ABOR Peer Group	Med. Sch. AUTM Adj.	2008	2009	2010	2011	2012	Rank
University of California - Los Angeles	X		22	27	19		1
University of Florida	X	14	10	9	12		2
University of Illinois - Urbana - Champaign		6		5	12		2
University of Minnesota	X	1	3	8	9		4
University of Washington	X	9	10	7	9		4
<b>The University of Arizona</b>	<b>X</b>	<b>6</b>	<b>7</b>	<b>6</b>	<b>8</b>	<b>5</b>	<b>6</b>
University of North Carolina - Chapel Hill	X	5	1	5	7		7
The Ohio State University	X	5	7	8	6		8
Pennsylvania State University, All Campuses	X	1	3	5	5		9
University of California - Davis	X		2	9	5		9
Texas A&M University		1	6	7	4		11
University of Wisconsin - Madison	X	6	1	5	4		11
University of Iowa	X	0	3	3	2		13
Michigan State University	X	3			1		14
University of Maryland - College Park		3					
University of Texas - Austin		10					
<b>Median</b>		<b>5</b>	<b>5</b>	<b>7</b>	<b>7</b>		



# Economic Development

Startup Companies per \$10 Million in Total Research Expenditures

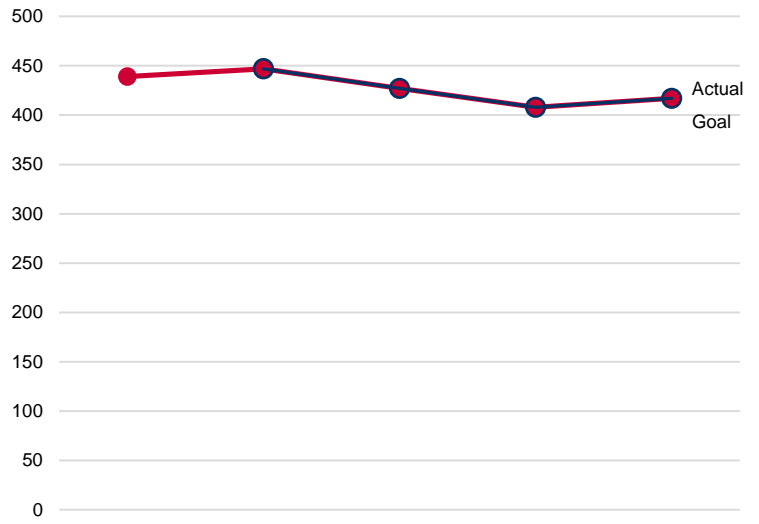


ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	0.1	0.1	0.1	0.1	0.1
Goal		0.1	0.1	0.1	0.1
Difference		0.0	0.0	0.0	0.0

ABOR Peer Group	Med. Sch. NSF Adj. AUTM Adj.	2008	2009	2010	2011	2012	Rank
University of Illinois - Urbana - Champaign		0.1		0.1	0.2		1
University of California - Los Angeles			0.2	0.3	0.2		2
University of Florida	X	0.2	0.2	0.1	0.2		3
<b>The University of Arizona</b>	<b>X</b>	<b>0.1</b>	<b>0.1</b>	<b>0.1</b>	<b>0.1</b>	<b>0.1</b>	<b>4</b>
University of Minnesota	X	0.0	0.0	0.1	0.1		5
University of North Carolina - Chapel Hill	X	0.1	0.0	0.1	0.1		6
University of Washington	X	0.1	0.1	0.1	0.1		7
The Ohio State University	X	0.1	0.1	0.1	0.1		8
University of California - Davis	X		0.0	0.1	0.1		9
Pennsylvania State University, All Campuses	X	0.0	0.0	0.1	0.1		10
Texas A&M University		0.0	0.1	0.1	0.1		11
University of Iowa	X	0.0	0.1	0.1	0.0		12
University of Wisconsin - Madison	X	0.1	0.0	0.0	0.0		13
Michigan State University	X	0.1			0.0		14
University of Maryland - College Park		0.1					
University of Texas - Austin		0.2					
<b>Median</b>		<b>0.1</b>	<b>0.1</b>	<b>0.1</b>	<b>0.1</b>		

# Economic Development

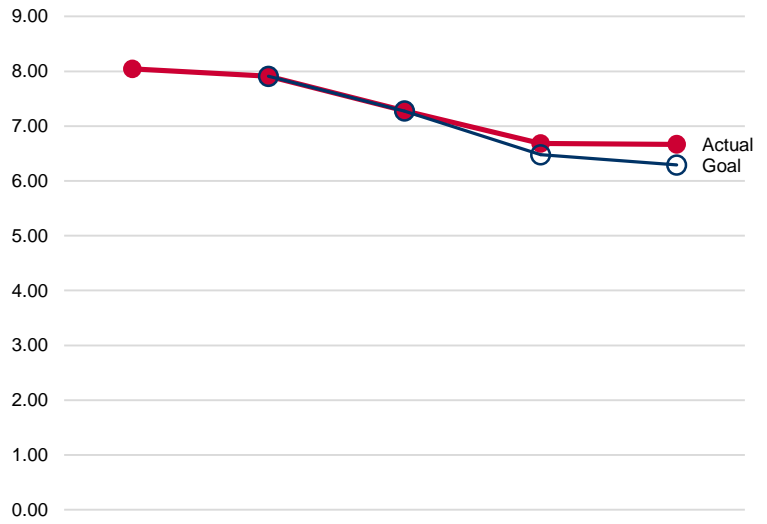
Ph.D. Degrees Conferred



ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	439	447	427	408	417
Goal		447	427	408	417
Difference		0	0	0	0

# Economic Development

Ph.D. Degrees Conferred per \$10 Million in Total Research Expenditures



ABOR Enterprise Plan	2008	2009	2010	2011	2012
Actual	8.0	7.9	7.3	6.7	6.7
Goal		7.9	7.3	6.5	6.3
Difference		0.0	0.0	0.2	0.4

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**Leadership and Recognition**

Recognition for leadership and innovation in knowledge discovery are among the highest accolades that a university can receive. International and national academic awards honor achievements that change how we view and make sense of the world. The UA Research Office actively promotes faculty members and students for recognition at the national and international levels.

**Olivier Guyon**, assistant professor of astronomy and optical sciences, is the recipient of a \$500K “genius grant.” Guyon was named a **2012 MacArthur Foundation Fellow** for his breakthroughs in telescope optics that have allowed him to discover and image planets outside the solar system (“exoplanets”) and his vision of bringing cutting-edge science to the public. Guyon joins the company of seven other MacArthur Fellows with ties to the UA: Regents’ Professor of Astronomy and Optical Sciences Roger Angel; evolutionary biologist and Regents’ Professor Nancy Moran; ethnobiologist Gary Nabhan; poet and author Leslie Marmon Silko; neurobiologist and Regents’ Professor Nicholas Strausfeld; anthropologist Brackette Williams; and linguist and Regents’ Professor Ofelia Zepeda.



Olivier Guyon (photo: MacArthur Foundation).

Decades of research by UA researchers in particle physics were rewarded by the July 2012 announcement that the **elusive Higgs Boson**, a subatomic particle long predicted by theory but heretofore undetected, had likely been **observed**. UA physicists built part of an instrument called ATLAS, which is inside the Large Hadron Collider in Switzerland, where the particle was being sought. The UA-ATLAS team includes faculty members Elliott Cheu, Kenneth Johns, John Rutherford, Michael Shupe, and Erich Varnes, along with numerous research engineers, technicians, postdoctoral and graduate students, and undergraduates.



ATLAS Detector at the Large Hadron Collider.

The university as a whole benefits from being part of a valuable network with a strong research tradition.

As an **invited member of the 62-institution Association of American Universities (AAU)**, UA participates in discussion and dialog with other research-intensive universities on topics and concerns of mutual interest, such as funding for research, research policy issues, and graduate and undergraduate education.

# Leadership and Recognition

## *Introduction*



The latest (2011) national ranking by the Center for Measuring University Performance at ASU places the UA at **16th among public universities, with 5 of the 9 measures in the top 25 and 3 in the top 50**. Metrics include: total research, federal research, endowment assets, annual giving, National Academy members, faculty awards, doctorates granted, postdoctoral appointees, and SAT scores.

## Leadership and Recognition

*Selected Accomplishments*

- **Roy Parker**, a Regents' Professor in the Department of Molecular and Cellular Biology, and **Marcia J. Rieke**, a Regents' Professor in the Department of Astronomy, were **elected to the National Academy of Sciences**, bringing to 14 the number of UA faculty members elected to the Academy. Parker's work examines the ways that cells regulate the expression of their genes, focusing on messenger RNA. Rieke has been heralded for the international effort that she has led on the Spitzer space telescope to conduct very deep surveys at far-infrared wavelengths, which will allow astronomers to trace the history of star formation back in time 10 billion years. Rieke is also the PI for the near-infrared camera on the planned James Webb Space Telescope.



NAS inductees Roy Parker and Marcia Rieke.

- The American Association for the Advancement of Sciences, the world's largest general scientific society and publisher of *Science*, named four UA professors **AAAS Fellows** in 2012. They are: **Alexander Badyayev**, a professor in the Department of Ecology and Evolutionary Biology, for distinguished contributions to evolutionary ecology by integrating tools and theory from quantitative genetics and the evolution of development; **Michael Brown**, a professor in the Department of Chemistry and Biochemistry, for advancing the theoretical and experimental understanding of the structure, dynamics and function of cellular membranes and membrane proteins; **Yves Carrière**, a professor in the Department of Entomology, for advances in understanding and managing evolution of insect resistance to insecticides and transgenic plants; and **Brian Enquist**, a professor in the Department of Ecology and Evolutionary Biology, for his contributions in the fields of ecology, plant biology, theoretical biology, global ecology and for pioneering contributions in the origin of biological scaling laws.



Clockwise: New AAAS Fellows Alexander Badyayev, Michael Brown, Yves Carrière, and Brian Enquist.

- UA faculty regularly obtain **top awards in their disciplinary fields**. As one example, **Achintya Haldar**, professor of **Civil Engineering and Engineering Mechanics**, was named a distinguished member of the American Society of Civil Engineering. According to ASCE, Haldar's work "has fundamentally changed structural engineering research, education and practice." Haldar's current research focuses on structural reliability, especially in the presence of earthquakes. His research could help determine the fate of buildings: whether they are doomed to demolition or repairable.



## Leadership and Recognition

### *Selected Accomplishments*

Distinguished membership is the highest honor bestowed by this discipline's technical society (current membership is 140,000) and has only been given to about 650 members in its 160-year history.

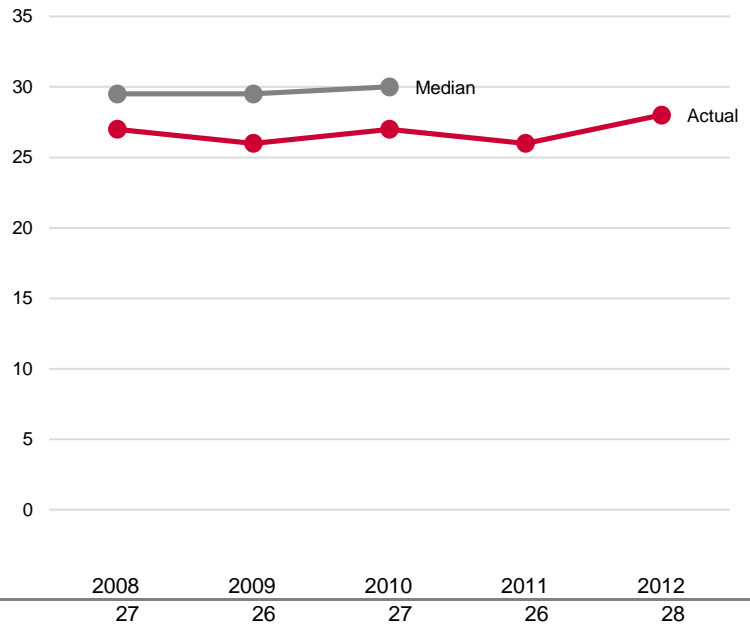


Achintya Haldar

- **UA graduate students continued to garner awards** in 2012. Twenty-one UA students received NSF predoctoral fellowships, one of the most competitive and prestigious fellowships in the country, with a total value of over \$126,000 per student. This places UA 29<sup>th</sup> among all universities in the number of awarded fellowships (16<sup>th</sup> among public universities). UA recipients were from thirteen academic disciplines across campus, including anthropology, astronomy, chemistry, entomology and insect science, geography, geosciences, neuroscience, optical science, planetary sciences and plant sciences. Current NSF Graduate Research Fellow Benjamin Blonder was granted additional international funding under the NSF's Nordic Research Opportunity to study plant adaptation in Denmark. The national Philanthropic Educational Organization awarded fellowships to seven UA graduate students out of only 85 nationwide, the most of any public institution. The PEO supports the research of women who are predicted to make significant contributions in their fields of endeavor. Finally, in 2011-12, 16 former Science Foundation Arizona Graduate Research Fellows were given an opportunity to be involved in translating their research for K-12 audiences.

# Leadership and Recognition

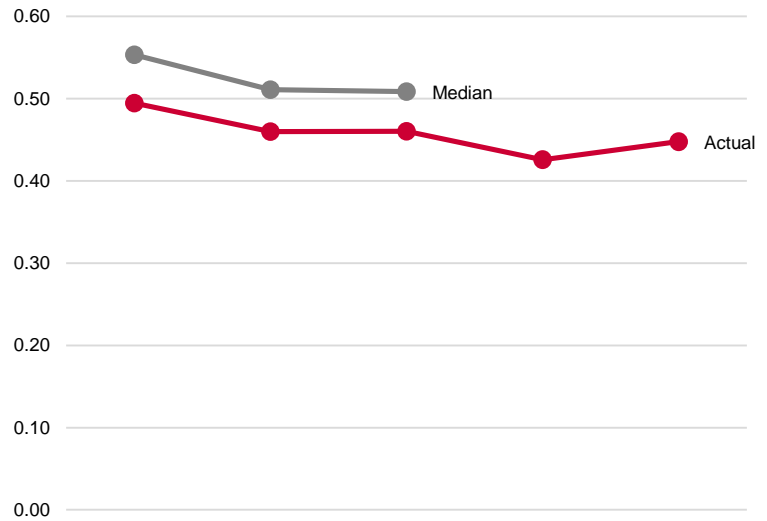
National Academy Members



		2008	2009	2010	2011	2012	
Actual		27	26	27	26	28	
	Med. Sch.						Rank
<b>ABOR Peer Group</b>							
University of Washington	X	102	101	102			1
University of California - Los Angeles	X	81	85	91			2
University of Wisconsin - Madison	X	73	71	71			3
University of Texas - Austin		63	65	67			4
University of Illinois - Urbana - Champaign		57	55	59			5
University of Minnesota	X	34	39	41			6
University of California - Davis	X	32	32	36			7
University of Maryland - College Park		27	27	30			8
University of North Carolina - Chapel Hill	X	32	32	30			8
The Ohio State University	X	24	26	27			10
<b>The University of Arizona</b>	<b>X</b>	<b>27</b>	<b>26</b>	<b>27</b>	<b>26</b>	<b>28</b>	<b>10</b>
Pennsylvania State University, All Campuses	X	25	24	24			12
University of Florida	X	21	23	23			13
Texas A&M University		22	22	22			14
University of Iowa	X	21	21	22			14
Michigan State University	X	8	7	7			16
<b>Median</b>		<b>30</b>	<b>30</b>	<b>30</b>			

# Leadership and Recognition

National Academy Members per \$10 Million in Total Research Expenditures



	2008	2009	2010	2011	2012
Actual	0.5	0.5	0.5	0.4	0.4

ABOR Peer Group	Med. Sch. NSF Adj.	2008	2009	2010	2011	2012	Rank
University of Illinois - Urbana - Champaign		1.1	1.0	1.1			1
University of Texas - Austin		1.3	1.3	1.1			2
University of Washington	X	1.3	1.3	1.0			3
University of California - Los Angeles	X	0.9	1.0	1.0			4
University of Wisconsin - Madison	X	0.8	0.7	0.7			5
University of Maryland - College Park		0.7	0.7	0.7			6
University of California - Davis	X	0.5	0.5	0.5			7
University of Minnesota	X	0.5	0.5	0.5			8
University of Iowa	X	0.7	0.6	0.5			9
<b>The University of Arizona</b>	<b>X</b>	<b>0.5</b>	<b>0.5</b>	<b>0.5</b>	<b>0.4</b>	<b>0.4</b>	<b>10</b>
University of North Carolina - Chapel Hill	X	0.6	0.5	0.4			11
The Ohio State University	X	0.3	0.4	0.4			12
University of Florida	X	0.4	0.4	0.3			13
Texas A&M University		0.3	0.3	0.3			14
Pennsylvania State University, All Campuses	X	0.4	0.3	0.3			15
Michigan State University	X	0.2	0.2	0.2			16
<b>Median</b>		<b>0.6</b>	<b>0.5</b>	<b>0.5</b>			

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**Technology Transfer**

FY 2012 began a critical transition year for technology transfer at the UA. During this year, the Office of Technology Transfer (OTT) built on the achievements of prior years (see examples below), while laying the foundation for a new technology transfer framework at the UA.

In Fall 2011, UA Interim President Eugene Sander announced **Tech Launch Arizona** (TLA), an exciting new initiative designed to make dramatic progress in the effort to leverage UA intellectual property in order to contribute to the economic development of southern Arizona. Eller College Dean Len Jessup was named to head a national search for an executive director of the newly established organization, as well as to work with campus colleagues to explore and identify characteristics of effective models in technology transfer and consider implications for application at the UA.

Less than one year after Eugene Sander announced TLA, David Allen assumed the position of Executive Director. Under his leadership, TLA is integrating the University of Arizona's various private sector-facing technology units—the Office of Technology Transfer (OTT), Office of Business and Corporate Relations, and the Office of University Research Parks. In doing so, TLA will create value via expanded and coordinated strategies and services. TLA will better capitalize on existing efforts by more efficiently moving research to the marketplace through both licensing and the incubation of startup companies. This approach coordinates the entire commercialization continuum, from identification of high value research projects, through intellectual property protection and prototype development, to company launch, incubation, and acceleration.

In addition to the offices of corporate relations and research parks, OTT was joined in TLA by new units, including Commercialization Networks and Operations and Marketing and Communications, with the aim of strengthening, expanding, and creating resiliency in technology transfer outcomes at the UA. Beneficiaries will include:

- UA faculty who produce important discoveries and inventions but lack support for getting them to market and ultimate impact;
- Students engaged in research and experiential education and are preparing for a technology-rich economy, regardless of their field of study;
- Departments and colleges that will be better able to attract top faculty and students to an innovation-rich environment;
- Tucson and the state of Arizona, through increased economic opportunity, closer university connection to regional challenges and goals;
- Society in general, who will benefit by the important discoveries and inventions that will be better poised to move to market.

Although this level of transition created challenges in core deliverables, UA accomplished the following in FY 2012:

- Closed on 47 licensing and option deals that bring UA technology into use with Arizona and global companies;
- Continued outreach and service to the faculty to maintain increases in key metrics (including 142 invention disclosures and 21 patents issued) that fuel the technology transfer process;
- Created five new companies based on UA technology, three of which are Arizona companies, in one of the toughest economic climates in decades (31 total startups over the past five fiscal years).

Technology transfer statistics for the last five years are reflected in the table (following page) and in the charts earlier in this report (Discovery and Scholarly Impact; Economic Development).

## Transactions

Licenses, options, and other major agreements represent a key step in the technology-transfer pipeline of idea creation, technology translation, product realization, and royalty generation. In FY 2012, OTT professionals executed 47 licenses and options with a total output of 60 major agreements. These agreements involve considerable effort by OTT's six licensing professionals in intellectual property management, team marketing, and deal execution.

## Revenues & Distributions

Total revenues from licensing activity and related legal reimbursements in FY 2012 rose by 10% to just over \$1.54 million, reflecting an annual increase of 45% in legal reimbursements, which were offset by a decrease in licensing revenue. The improving financial performance reflects a strong showing by the OTT in rebuilding the active licensing portfolio. We maintain our diligent management of the patent portfolio: a continued strong deal flow has resulted in an increase on patent expenditures in advance of licensing opportunity. The historical five-year ratio of the OTT's current legal expenditures to legal reimbursements remains above 55%, reflecting a disciplined approach to patent asset management; the median ratio for UA's peer institutions is 33%.

# Technology Transfer

## Statistical Exhibits



Technology Transfer Activities	2008	2009	2010	2011	2012
Invention Disclosures Transacted	101	125	131	149	142
Invention Disclosures Transacted Year/Year Percentage Change		24%	5%	14%	-5%
New Patent Applications	68	99	67	104	98
New Patent Applications Year/Year Percentage Change		46%	-32%	55%	-6%
U.S. Patents Issued	19	11	13	19	21
U.S. Patents Issued Year/Year Percentage Change		-42%	18%	46%	11%
Licenses and Options Executed	37	49	64	80	47
Licenses and Options Executed Year/Year Percentage Change		32%	31%	25%	-41%
Other Major Agreements	10	20	13	8	13
Other Major Agreements Year/Year Percentage Change		100%	-35%	-38%	63%
<b>Licensing and Other Revenue</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>
Licensing Revenue (Including Options)	\$583,007	\$520,634	\$562,014	\$718,449	\$737,956
Licensee Legal Reimbursements	\$435,700	\$301,988	\$540,324	\$432,790	\$627,572
Other Revenue	\$107,183	\$166,476	\$156,013	\$263,046	\$184,009
<b>Total</b>	<b>\$1,125,890</b>	<b>\$989,098</b>	<b>\$1,258,351</b>	<b>\$1,414,285</b>	<b>\$1,549,537</b>
<b>Sponsored Research Facilitated</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>
<b>Total</b>	<b>\$1,001,716</b>	<b>\$1,857,451</b>	<b>\$4,701,776</b>	<b>\$5,918,193</b>	<b>\$5,100,000</b>
<b>Royalty Distribution</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>
Inventors	-\$242,770	-\$225,842	-\$248,107	-\$346,698	-\$322,687
Laboratories and Units	-\$188,146	-\$171,589	-\$188,505	-\$231,132	-\$276,590
University	-\$176,008	-\$157,873	-\$173,437	-\$192,609	-\$184,779
Undistributed	\$83,266	\$131,807	\$107,977	\$211,056	\$137,909



Two examples from the 21 U.S. patents that were granted or filed to UA in FY 2012:

- **U.S. Patent No. 7,994,963 “High-Sensitivity Subsurface Sensing System”**

Differential Target Antenna Coupling (DTAC) is a new UA-developed subsurface imaging technology that overcomes fundamental limitations in subsurface imaging and will have vast implications in the areas of natural-resource exploration (petroleum and mining), environmental cleanup, water resource development, solar and wind energy (compressed air underground storage), civil engineering, and national defense.

Compared to existing electromagnetic sub-surface sensing systems, DTAC increases the potential depth of detection by an order of magnitude, has higher resolution, and drastically reduces false positives from surface features. The inventors for this technology were recently awarded a Proof of Concept grant to further translate their research into commercial applications. Security and resource exploration partnerships are currently being explored by TLA and the inventors.



- **UA 10-117 PCT Patent Application Filed**

This patent is for an intraocular lens (IOL) that uses both rigid and deformable materials to provide a large accommodation range. The novel lens components and method of attachment to the eye are designed to allow the IOL to match the natural focusing ability of the normal eye, thereby enhancing practicality and comfort.

In addition to the start-ups outlined in the following pages, OTT licenses and options included licensing to a wide variety of partners, from large corporations such as Lexis-Nexis, Canon and Nitto Denko Corporation to small companies and organizations such as Zonare Medical Systems. Content distribution licenses for the Udall Center's Native Nations Institute and Arizona Public Media provide high visibility to the University and its creative faculty, and demonstrate the range of licenses handled by the OTT. Example innovations transferred under licenses or options include:

- **Zonare Medical Systems**

Dr. Russell Witte developed an in-line photoacoustic imaging system that extends the existing capabilities of an ultrasound transducer with the ability to acquire photoacoustic data. Zonare and the UA entered into an exclusive license agreement to extend the capabilities of Zonare Ultrasound systems.

- **Immucell Corporation**

An anti-*Cryptosporidium hybridoma* cell line is being used to develop a vaccine for veterinary applications. PI: Michael Riggs, Veterinary Sciences/Microbiology, College of Agriculture & Life Sciences. The UA has entered into a non-exclusive agreement with Immucell.

- **Magnum Seeds, Inc.**

Infectious viral clones in the form of plasmid vectors are being used in experimental inoculation of plants to identify disease resistant plant varieties. PI Judy Brown, Plant Sciences, College of Agriculture & Life Sciences. The UA has entered into a non-exclusive license agreement with Magnum Seeds.

- **Optical Perspectives Group, LLC (Tucson, AZ)**

*Optical Sciences Research Assistant Professor Robert E. Parks*

Optical Perspectives Group is a Tucson-based, investor-backed technology company focused on providing unique consulting services and metrology products for optical component fabrications.

- **Diomics Corporation (La Jolla, CA)**

*College of Medicine-Phoenix Professor Frederic Zenhausern*

Diomics Corporation is a UA technology company focused on commercializing various material technologies that will enhance sample collection for rapid DNA analysis.

- **Arizona Optical Systems, LLC (Tucson, AZ)**

*Astronomy and Optical Sciences Professor James Burge, and Director of Optical Fabrication and Engineering Facility at Optical Sciences Martin Valente*

Arizona Optical Systems is a Tucson-based investor-backed technology company focused on the manufacture of production quantities of specialized optical components.

- **InQuest, Inc. (Menlo Park, CA)**

*Optical Sciences Professor Thomas Milster and UA Emergency Medicine Professor Kurt Denninghoff*

InQuest is an early-stage development technology company for medical diagnostic devices.

- **I-CalQ, LLC (Scottsdale, AZ)**

*UA Ag & Biosystems Engineering  
Professor Jeong-Yeol Yoon and David You*

I-CalQ is an early-stage development technology company for medical diagnostic devices.



The I-CalQ point-of-care device can leverage smartphone capabilities.

- The Center for Environmentally Sustainable Mining was created to bring together mining industries and UA researchers and support the transfer of new technologies and strategies developed at UA for this important economic driver.
- Innovation Day 2012 celebrated the creative endeavors of University faculty and students. The Technology Innovation Award recipient was Ronald S. Weinstein, who has pursued a wide variety of projects including pioneering research in cancer diagnostics and human-computer interface. Five faculty innovation awards were given:
  - Eric A. Betterton: atmospheric model to forecast wind-blown dust.
  - Leslie Gunatilaka: novel compounds synthesized by arid-lands plants with possible medicinal value.
  - Larry Head: priority-based traffic signals to help save the lives of fire and rescue first responders.
  - Sharon Megdal: state and regional water resource management and policy.
  - James Schwiegerling: novel accommodating intraocular lens.

Students also had an opportunity to present their business ideas and plans at the expo following the ceremony. The Innovation Showcase Awards recognized student teams who developed business plans from the McGuire Center for Entrepreneurship at the Eller College of Management.

- The Office of Corporate and Business Relations created a workshop designed for faculty researchers new to working with companies or those looking for tools and techniques that will make these collaborations more successful. This workshop was part of a strategy to help UA expand its industry relationships.



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## **Strategic Initiatives**

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Achieving UA targets for increased research volume (measured in R&D expenditures and number of Ph.D. degrees granted) and technology commercialization, *with the ultimate goal of increasing the health and economic well-being of the citizens of Arizona*, requires focused investment. Available resources are being directed to critical areas with high potential for growth. Meanwhile a robust research infrastructure is being created to support investigators and entrepreneurs. Specific initiatives are listed below:

## **1. Accelerate UA's interdisciplinary and collaborative environment**

The UA's pervasive atmosphere of collaboration creates an environment where water experts work with public policy makers to improve arid-land agriculture, where brain scientists collaborate with early education specialists, and where optical engineers work with physicians to advance medical imaging techniques. In an era where funds (both federal and private foundation) are increasingly being directed at "interface" areas, UA's collaborative environment is helping position its investigators for success. UA is investing in several institutes, including the **BIO5 Institute**, the **Institute for the Environment**, and the **Confluence Center**, which bring together intellectually diverse faculty and which support (through seed grants, workshops, and events) new interdisciplinary collaborations that have the potential to attract significant outside funding.

## **2. Target research areas with high growth potential**

The University of Arizona is especially strong in the sciences, ranking among the top several universities in the country in the physical sciences, year after year. Relative to our peer institutions, UA has a higher than average percentage of its funding from the National Science Foundation, and much higher (#1 ranking) funding from NASA. However, our relative funding from the National Institutes of Health is only about two-thirds the average of our peers. This discrepancy points to a growth opportunity in the area of biomedicine. Concurrent with the growth of the health sciences in Phoenix, UA is making investments in facilities and faculty to strengthen this area. Examples of this commitment include:

- Ongoing hiring of new physician-scientist faculty who have 75% assured research time in critical areas such as heart disease, cancer, and neurology, and who will engage basic science and engineering faculty in translational research.
- Coordination of research activities in Tucson and Phoenix, building on existing strengths in biosciences in Tucson and reaching into Phoenix to expand clinical research. Leveraging both campuses (including hospital partners and the new Health Sciences Education Building in Phoenix) to provide outstanding medical and interprofessional education.
- Hiring of a Senior Vice President for Health Sciences who will oversee all UA health colleges and engage other health institutions in Arizona. Significant investment in a new UA Cancer Center director will bolster this historic strength area.

## **3. Invest in research infrastructure and facilities**

Successful investigators need a supportive research infrastructure to assist with contracting, grants management, and responsible conduct of research. Investigators also need access to shared core

equipment/services and functional laboratory space to perform modern high-tech research. UA is investing to assure investigators can successfully engage in complex public-private partnerships, meet ever-increasing federal compliance regulations, and have access to state-of-the-art instrumentation. Some examples that are ongoing or in the planning stage include:

- Streamlined clinical research procedures and research agreements with Arizona clinical centers.
- New, experienced support staff in research contracting and research compliance.
- New facilities in the planned Biosciences Research Building: a large research clinic, shared clinical and pre-clinical bioimaging instrumentation, equipment and personnel for increased bioinformatics infrastructure.
- State-of-the-art facilities in the planned new Engineering Innovation Building, including interdisciplinary efforts in energy, infrastructure research, and medical device design.

#### 4. Hire research active faculty in clusters

To increase research capability in a new area, or to accelerate existing strengths, faculty cannot be hired singly or in a vacuum. The UA is committed to hiring clusters (of three to ten faculty) in the following areas of special emphasis. Clusters enable synergy in a given research area and provide a “critical mass” needed to be competitive for large program-project or center grants:

- Clinical Translation
- Informatics and Computational Biology
- Advanced Imaging for biomedical, biological, and materials sciences
- Water, Energy and the Environment

#### 5. Focus on technology transfer, industry relations, and economic development

As discussed earlier in this document, the University of Arizona has initiated Tech Launch Arizona (TLA). The TLA philosophy is **to combine the best entrepreneurial approaches from the private sector with world-class R&D, all in one unit, to elevate UA’s technology commercialization across the spectrum**. TLA will include funds and mechanisms to enable investment in promising early-stage technologies, and will combine greater access to human and financial capital with the combined technology transfer office, research parks, small-business incubator, accelerator, and our corporate relations office to create an integrated whole. TLA will work with the research office to increase industry interactions and be a powerful force for Arizona’s economic development. Plans include:

- Identifying and nurturing promising UA technologies, through TLA-faculty partnerships. TLA will provide both funding and assistance in licensing or creating robust startups which have a viable business plan and a high probability of contributing to Arizona’s economy.
- Working in close partnership with the Flinn Foundation, Southern Arizona Leadership Council, and the Tucson Regional Economic Opportunities organization, as well as cities and counties to develop in Arizona a strong high-tech economy.



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