



Annual Research Report
June 2012

Introduction



It sounds like science fiction – fueling airplanes with algae, treating illness without medicine, or using DNA sequencing to track elusive strains of tuberculosis. But in the Arizona University System, research that leads to these real innovations translates to technologies and products that improve lives and stimulate the economy.

Advances like these 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 innovative research and activity. The internationally-acclaimed research taking place at Arizona's universities have generated impressive rankings, including:

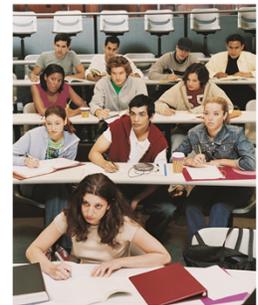
- At the University of Arizona, **its rank in the top 20 of public research universities*** means it attracts the brightest scientists, engineers and students in our state and from around the world to help create a thriving workforce and rich opportunities for commercial partners.
- Among U.S. universities with research portfolios exceeding \$100 million in research expenditures, Arizona State University **was the fastest growing research enterprise over the last five years****.
- Northern Arizona University has the highest level of research funding for biological sciences of any institution in its peer group, and has dramatically **increased its federal research funding** over the past four years.

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 to measure the growth of its research enterprise in the university system and in almost every measure, it continues to make steady progress. In fiscal year 2011, the research enterprise met or exceeded the enterprise goals in, invention disclosures, U.S. patents issued, intellectual property income, and start-up companies.

Through research activity at the universities, millions of dollars are reinvested annually into the community. In 2011, Arizona's public universities generated \$996 million in research expenditures, dollars that become purchases and employment within Arizona. The research also directly resulted in 18 different startup companies, 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. Each university benchmarks its progress and achievements against an approved set of peer institutions.



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, better living 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 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 each of these five areas will provide the reader a better understanding of the progress being made by Arizona's public universities toward understanding the world, finding solutions for Arizona's challenges, and creating economic opportunity for Arizonans.



*The Top American Research Universities, 2010 Annual Report,
The Center for Measuring University Performance
**2004 – 2009 National Science Foundation Survey

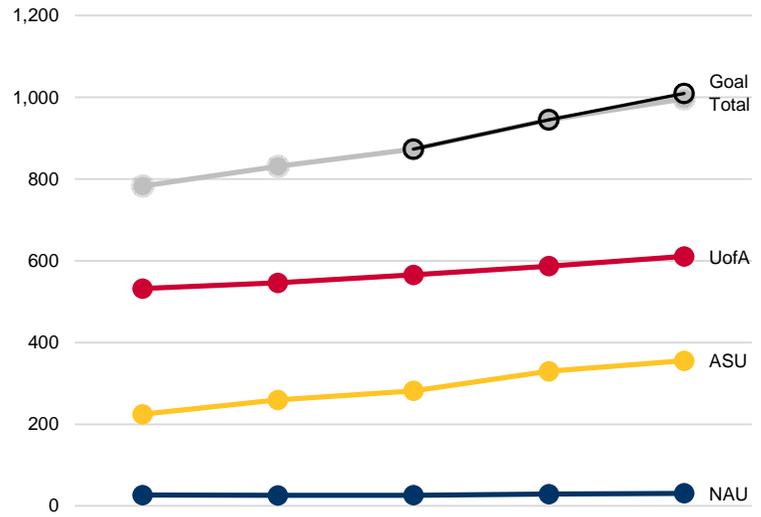
This Page Intentionally Left Blank



Enterprise Metrics

Enterprise Size

Total Research Expenditures

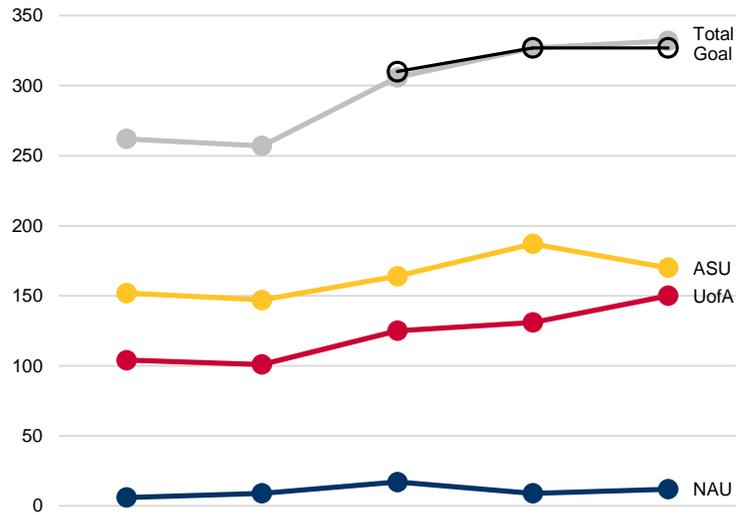


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Total	782.7	831.2	873.1	944.8	996.6
Goal			873.1	945.1	1009.3
Difference			0.0	-0.3	-12.7

ABOR Institutions	2007	2008	2009	2010	2011
Arizona State University	224.4	259.5	281.6	329.3	355.2
Northern Arizona University	26.6	25.8	26.2	28.8	30.8
The University of Arizona	531.8	545.9	565.3	586.6	610.6
Total	782.7	831.2	873.1	944.8	996.6

Discovery and Scholarly Impact

Invention Disclosures Transacted

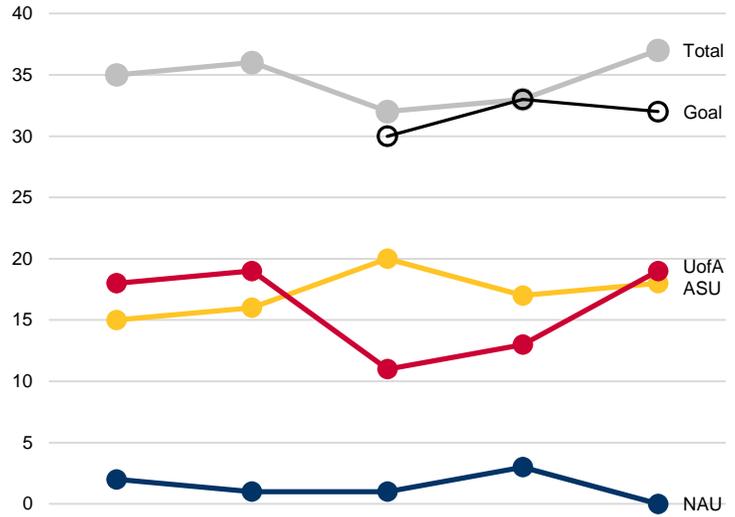


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Total	262	257	306	327	332
Goal			310	327	327
Difference			-4	0	5

ABOR Institutions	2007	2008	2009	2010	2011
Arizona State University	152	147	164	187	170
Northern Arizona University	6	9	17	9	12
The University of Arizona	104	101	125	131	150
Total	262	257	306	327	332

Discovery and Scholarly Impact

U.S. Patents Issued

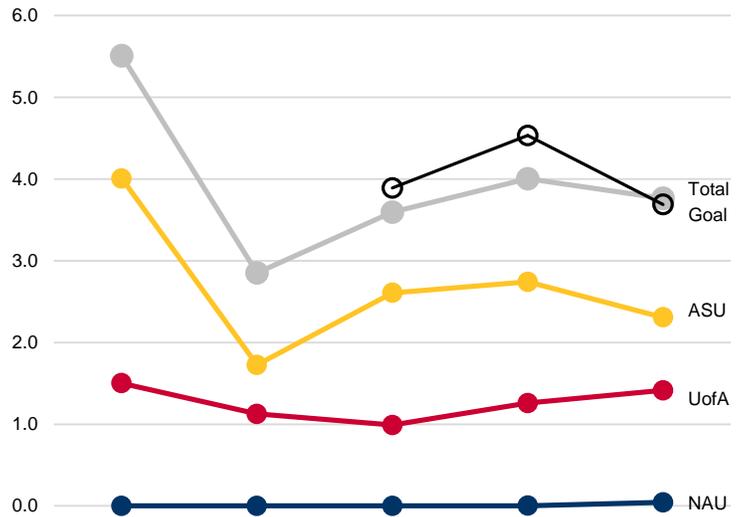


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Total	35	36	32	33	37
Goal			30	33	32
Difference			2	0	5

ABOR Institutions	2007	2008	2009	2010	2011
Arizona State University	15	16	20	17	18
Northern Arizona University	2	1	1	3	0
The University of Arizona	18	19	11	13	19
Total	35	36	32	33	37

Economic Development

Intellectual Property Income (in Millions)



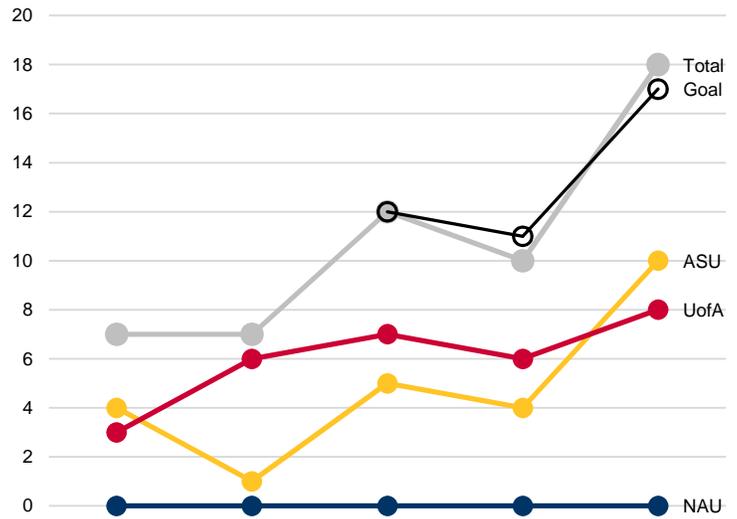
ABOR Enterprise Plan	2007	2008	2009	2010	2011
Total	5.5	2.9	3.6	4.0	3.8
Goal			3.9	4.5	3.7
Difference			-0.3	-0.5	0.1

ABOR Institutions	2007	2008	2009	2010	2011
Arizona State University	4.0	1.7	2.6	2.7	2.3
Northern Arizona University	0.0	0.0	0.0	0.0	0.0
The University of Arizona	1.5	1.1	1.0	1.3	1.4
Total	5.5	2.9	3.6	4.0	3.8

NOTE: Intellectual Property Income reported here includes: (1) Licensing revenue (including Options); (2) Licensee Legal Reimbursements; and (3) Other Revenues resulting from Technology Transfer Activities. For the purposes of each institution's peer group comparison, the Intellectual Property Income reported on page 30 of the institution's report only includes Licensing Revenue (including Options). Analyses relating these values can be found in the Technology Transfer Statistical Exhibits on page 45 of each institution's report.

Economic Development

Startup Companies

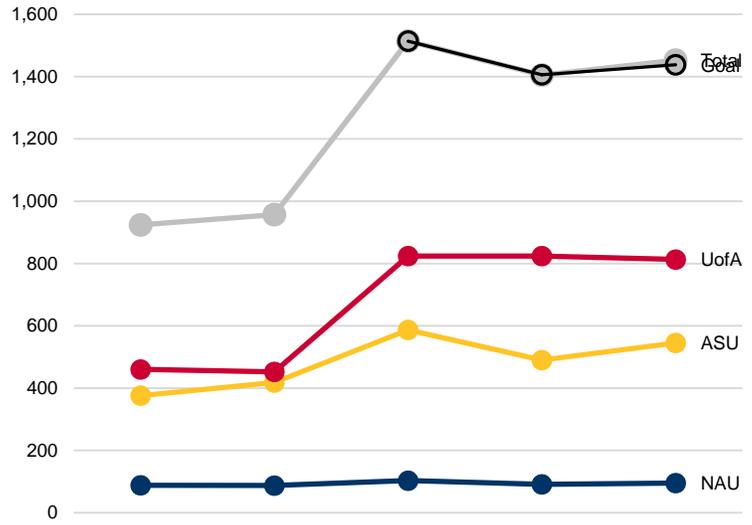


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Total	7	7	12	10	18
Goal			12	11	17
Difference			0	-1	1

ABOR Institutions	2007	2008	2009	2010	2011
Arizona State University	4	1	5	4	10
Northern Arizona University	0	0	0	0	0
The University of Arizona	3	6	7	6	8
Total	7	7	12	10	18

Economic Development

Doctoral Degrees Conferred



ABOR Enterprise Plan	2007	2008	2009	2010	2011
Total	924	957	1,514	1,405	1,453
Goal			1,514	1,406	1,438
Difference			0	-1	15

ABOR Institutions	2007	2008	2009	2010	2011
Arizona State University	376	418	587	490	545
Northern Arizona University	88	87	103	91	95
The University of Arizona	460	452	824	824	813
Total	924	957	1,514	1,405	1,453

This Page Intentionally Left Blank



Annual Research Report - FY2011

Table of Contents

Enterprise Size	
Introduction	6
Selected Accomplishments	7
Total Research Expenditures	8
Average Growth Rate in Total Research Expenditures Over 3 years	9
Federally Financed Research Expenditures	10
Average Growth Rate in Federally Financed Research Expenditures Over 3 years	11
Net Research Square Feet	12
Total Research Expenditures per Square Foot	13
Total Faculty Population	14
Total Research Expenditures per Faculty	15
Discovery and Scholarly Impact	
Introduction	18
Selected Accomplishments	19
Invention Disclosures Transacted	20
Invention Disclosures Transacted per \$10 Million in Total Research Expenditures	21
U.S. Patents Issued	22
U.S. Patents Issued per \$10 Million in Total Research Expenditures	23
Economic Development	
Introduction	26
Selected Accomplishments	27
Licenses and Options Executed	28
Licenses and Options Executed per \$10 Million in Total Research Expenditures	29
Intellectual Property Income	30
Intellectual Property Income per \$10 Million in Total Research Expenditures	31
Startup Companies	32
Startup Companies per \$10 Million in Total Research Expenditures	33
Doctoral Degrees Conferred	34
Doctoral Degrees Conferred per \$10 Million in Total in Research Expenditures	35
Leadership and Recognition	
Introduction	38
Selected Accomplishments	39
National Academy Members	40
National Academy Members per \$10 Million in Total Research Expenditures	41
Technology Transfer Activity	
Introduction	44
Technology Transfer Statistical Exhibits	45
Selected Patents Issued	46
Selected Licenses and Options Executed	47
Selected Startup Companies	48
Other Notable Activities	49

This Page Intentionally Left Blank



Enterprise Size

Enterprise Size

Introduction

Arizona State University continues to expand the depth, breadth, and impact of research activities. In FY11, we achieved a new record in research-related expenditures and expect to maintain this bold trajectory in the future. Through strategic engagement and investment across disciplines, we have laid the foundation for future knowledge-based achievements that are the key to sustaining research growth. We concluded FY11 with \$355.2 million in total research expenditures, a 7.9% increase from the previous year. Our faculty submitted proposals worth a total of \$1.3 billion and received \$294 million in awards over FY11. These numbers place ASU well within the top 20 U.S. universities with comparable research enterprises.

While we have been very successful in seeking competitive external investment for creative and bold ideas, we view research and innovation as a continuum driven by outcomes that result in economic and societal impact. In keeping with this spirit, we renamed the Office of the Vice President of Research and Economic Affairs to the Office of Knowledge Enterprise Development (OKED). OKED helps make discovery possible at ASU by nurturing partnerships among internal and external collaborators, promoting innovation and entrepreneurship, connecting academic research and discovery with the community and the world, and providing “best in class” research administration.

The research enterprise also provides important social and economic dividends by attracting great minds, training the next generation of scientists, and embedding itself in communities that provide context and guidance for discovery and innovation.



Enterprise Size

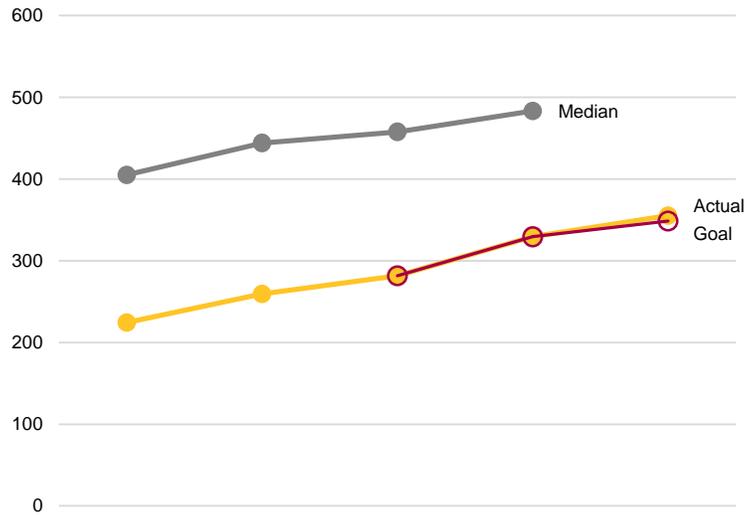
Selected Accomplishments

- Expenditures for FY 2011 reached \$355.2 million, a new record (NSF HERD expenditures).
- The university submitted more than \$1.3 billion in proposals this fiscal year and received more than \$294 million in awards
- ASU remains one of the fastest growing research enterprises over the previous five years among universities with portfolios exceeding \$100 million in research expenditures (2005 – 2010 NSF Surveys).
- ASU attained a rank well within the top 20 U.S. universities for non-science and engineering research expenditures and remained in the top 20 schools without a medical school (NSF Survey).
- ASU was noted by the *Chronicle of Higher Education* as having the second largest increase in ranking – a 30-position increase – among the top 100 U.S. universities ranked by federally funded research expenditures (NSF Survey).
- The College of Nursing and Health Innovation was again ranked in the top 15 for National Institutes of Health funding among colleges of nursing.
- The Mary Lou Fulton Teachers College was awarded a \$43.4 million Teacher Incentive Fund (TIF) grant from the U.S. Department of Education that will provide funding for comprehensive school reform in Arizona.
- The Flexible Display Center received a \$9.3 million renewal award from the Department of Defense. The center is developing a new generation of electronic displays that are flexible, lightweight, and low power. The center exemplifies a model partnership between academia, industry, and government.
- The Power Systems Engineering Research Center received a \$5.5 million renewal award from the Department of Energy. ASU is the lead university in the multi-institutional center, which seeks to engineer the future of electric energy systems.
- The Biodesign Institute's Center for Innovations in Medicine was awarded \$5.3 million from the Defense Advanced Research Projects Agency (DARPA) to develop a potential therapeutic that can protect soldiers against an unknown pathogen pre-symptomatically.
- ASU was awarded \$18 million to establish the NSF-DOE Engineering Research Center for Quantum Energy and Sustainable Solar Technologies. The Center will utilize quantum mechanics to develop photovoltaics and advanced energy converters.
- The School of Earth and Space Exploration faculty are leading a team to build an instrument for NASA'S OSIRIS-REx mission, which will travel to an asteroid to collect samples and measurements. The instrument will analyze infrared light emitted from the asteroid to map the minerals on its surface. It is the first piece of complicated space hardware to be constructed on the ASU campus. The project is in collaboration with the University of Arizona.



Enterprise Size

Total Research Expenditures (in Millions)

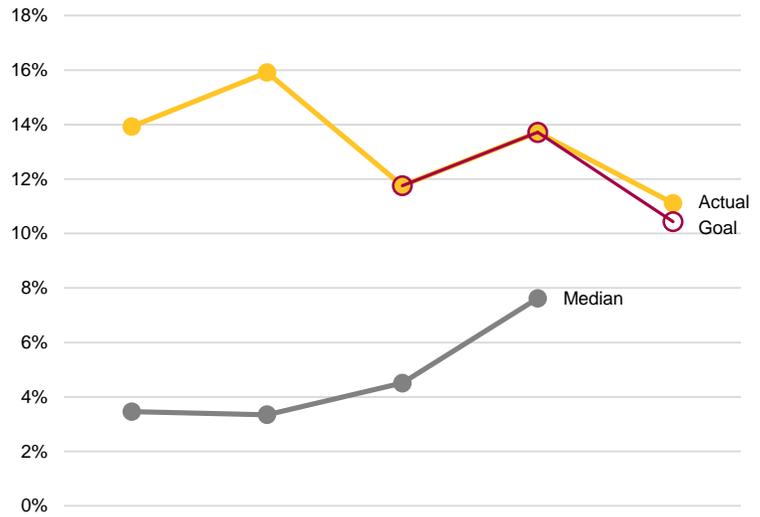


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	224.4	259.5	281.6	329.3	355.2
Goal			281.6	329.3	348.5
Difference			0.0	0.0	6.7

ABOR Peer Group	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
University of Wisconsin - Madison	X	840.7	881.8	952.1	1,029.3		1
University of Washington - Seattle	X	756.8	765.1	778.0	1,022.7		2
University of California - Los Angeles	X	823.1	871.5	890.0	937.0		3
University of Minnesota - Twin Cities	X	624.1	682.7	741.0	786.1		4
Ohio State University - Columbus	X	720.2	702.6	716.5	755.2		5
Pennsylvania State University - University Park	X	582.4	620.4	666.6	681.8		6
University of Texas - Austin		446.8	493.3	506.4	589.5		7
University of Illinois - Urbana-Champaign		473.9	501.3	563.7	515.1		8
University of Maryland - College Park		359.8	395.0	409.2	451.4		9
University of Iowa	X	363.2	293.6	329.9	444.0		10
Michigan State University	X	360.9	356.8	373.2	431.4		11
Rutgers the State University of NJ - New Brunswick	X	281.2	297.7	323.6	428.4		12
Arizona State University		224.4	259.5	281.6	329.3	355.2	13
Florida State University	X	189.6	182.3	195.2	237.9		14
Indiana University - Bloomington	X	143.6	150.8	161.3	177.5		15
University of Connecticut - Storrs	X	108.7	110.1	109.8	116.0		16
Median		405.0	444.2	457.8	483.3		

Enterprise Size

Average Growth Rate in Total Research Expenditures Over 3 Years

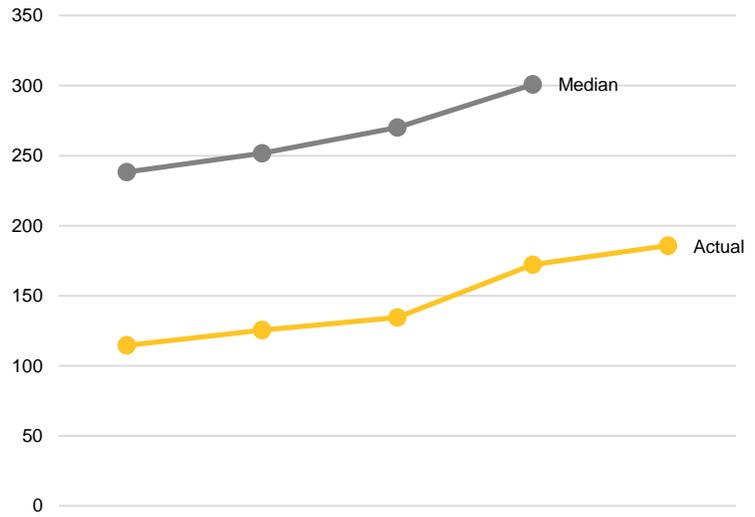


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	13.9%	15.9%	11.8%	13.7%	11.1%
Goal			11.8%	13.7%	10.4%
Difference			0.0%	0.0%	0.7%

ABOR Peer Group	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
Rutgers the State University of NJ - New Brunswick	X	2.2%	2.6%	4.9%	15.7%		1
Arizona State University		13.9%	15.9%	11.8%	13.7%	11.1%	2
University of Washington - Seattle	X	2.1%	2.8%	0.0%	11.4%		3
University of Texas - Austin		9.3%	6.3%	5.5%	9.8%		4
University of Iowa	X	5.1%	-3.6%	-0.6%	9.3%		5
Florida State University	X	4.1%	1.9%	1.8%	8.4%		6
University of Minnesota - Twin Cities	X	5.9%	7.6%	7.6%	8.0%		7
University of Maryland - College Park		3.4%	5.3%	5.0%	7.9%		8
Indiana University - Bloomington	X	-1.1%	7.2%	4.4%	7.3%		9
University of Wisconsin - Madison	X	3.3%	3.4%	4.6%	7.0%		10
Michigan State University	X	3.5%	2.3%	1.4%	6.4%		11
Pennsylvania State University - University Park	X	2.6%	3.3%	5.6%	5.4%		12
University of California - Los Angeles	X	2.1%	3.5%	3.1%	4.4%		13
University of Illinois - Urbana-Champaign		-2.1%	0.2%	5.9%	3.2%		14
University of Connecticut - Storrs	X	3.8%	2.9%	1.4%	2.2%		15
Ohio State University - Columbus	X	11.7%	5.0%	3.3%	1.6%		16
Median		3.5%	3.4%	4.5%	7.6%		

Enterprise Size

Federally Financed Research Expenditures (in Millions)

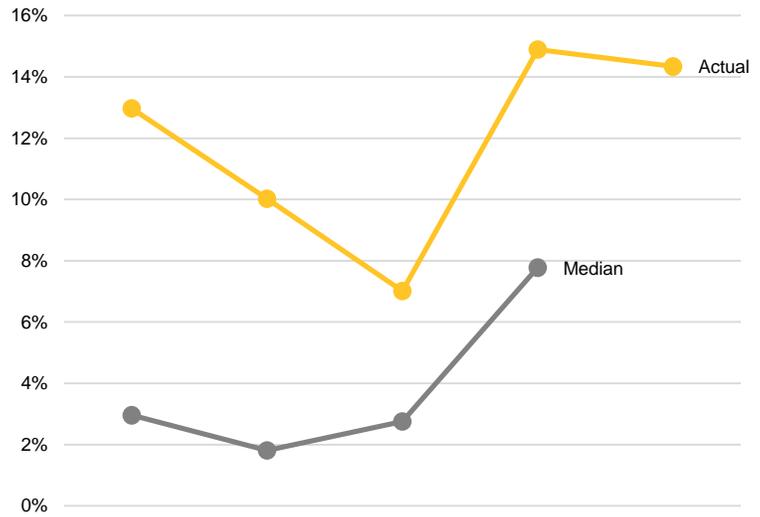


	2007	2008	2009	2010	2011
Actual	114.6	125.6	134.6	172.2	185.8

ABOR Peer Group	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
University of Washington - Seattle	X	620.4	614.1	619.4	829.9		1
University of Wisconsin - Madison	X	469.1	474.4	507.9	545.2		2
University of California - Los Angeles	X	488.8	471.9	467.5	538.5		3
University of Minnesota - Twin Cities	X	338.0	364.1	390.6	426.4		4
Pennsylvania State University - University Park	X	331.2	359.7	388.6	411.3		5
Ohio State University - Columbus	X	313.2	335.1	339.8	399.9		6
University of Texas - Austin		289.3	324.3	309.1	350.3		7
University of Illinois - Urbana-Champaign		253.6	266.9	288.0	303.9		8
University of Maryland - College Park		219.0	236.4	247.0	297.9		9
University of Iowa	X	222.9	229.9	252.3	282.5		10
Rutgers the State University of NJ - New Brunswick	X	125.4	130.9	151.0	224.9		11
Michigan State University	X	170.4	152.9	164.2	214.1		12
Arizona State University		114.6	125.6	134.6	172.2	185.8	13
Florida State University	X	113.7	110.6	117.3	134.8		14
Indiana University - Bloomington	X	64.6	68.3	72.3	71.2		15
University of Connecticut - Storrs	X	58.8	58.5	58.8	64.4		16
Median		238.3	251.7	270.2	300.9		

Enterprise Size

Average Growth Rate in Federally Financed Research Expenditures Over 3 Years

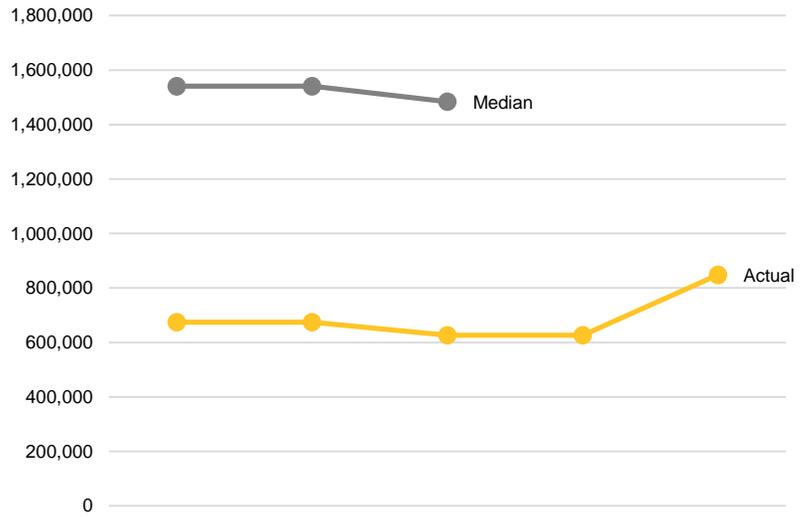


	2007	2008	2009	2010	2011
Actual	13.0%	10.0%	7.0%	14.9%	14.3%

ABOR Peer Group	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
Rutgers the State University of NJ - New Brunswick	X	3.2%	2.3%	8.3%	22.9%		1
Arizona State University		13.0%	10.0%	7.0%	14.9%	14.3%	2
University of Washington - Seattle	X	-0.1%	0.5%	-1.6%	11.3%		3
University of Maryland - College Park		6.6%	6.5%	5.6%	11.0%		4
Michigan State University	X	6.0%	-0.5%	-0.7%	9.2%		5
Ohio State University - Columbus	X	3.3%	4.5%	2.5%	8.7%		6
University of Iowa	X	2.0%	2.1%	5.3%	8.3%		7
University of Minnesota - Twin Cities	X	3.2%	4.5%	6.2%	8.1%		8
Pennsylvania State University - University Park	X	1.9%	3.8%	6.8%	7.5%		9
University of Texas - Austin		7.1%	8.4%	4.4%	6.9%		10
University of Illinois - Urbana-Champaign		-2.6%	-2.6%	3.0%	6.2%		11
Florida State University	X	3.4%	1.6%	2.1%	6.1%		12
University of Wisconsin - Madison	X	2.8%	-0.2%	1.2%	5.2%		13
University of California - Los Angeles	X	2.0%	0.2%	-1.1%	3.6%		14
Indiana University - Bloomington	X	-1.1%	0.0%	2.1%	3.4%		15
University of Connecticut - Storrs	X	-1.0%	-2.9%	-4.2%	3.2%		16
Median		3.0%	1.8%	2.8%	7.8%		

Enterprise Size

Net Assignable Square Feet

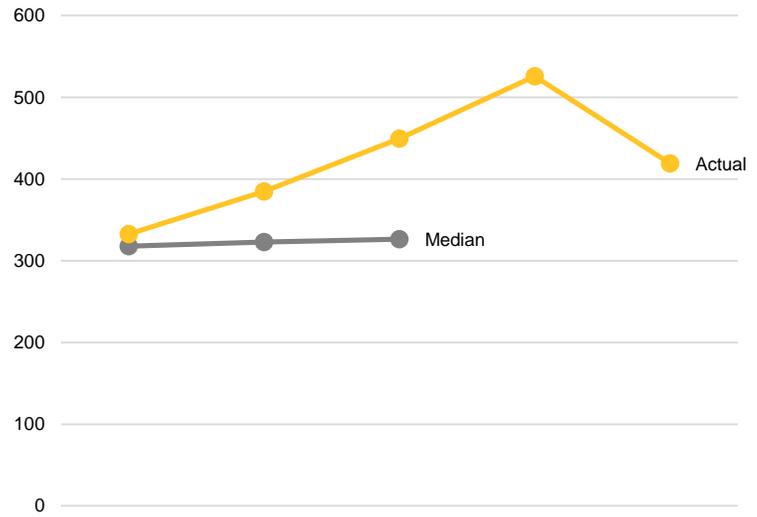


	2007	2008	2009	2010	2011
Actual	674,522	674,522	626,416	626,416	847,836

ABOR Peer Group	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
University of Illinois - Urbana-Champaign		4,319,500	4,319,500	4,561,500			1
University of Minnesota - Twin Cities	X	3,678,316	3,678,316	3,684,378			2
University of Wisconsin - Madison	X			2,844,272			3
Pennsylvania State University - University Park	X	2,601,724	2,577,836	2,652,558			4
University of California - Los Angeles	X	2,229,683	2,229,683	2,496,563			5
Michigan State University	X	2,289,100	2,289,100	2,324,423			6
University of Washington - Seattle	X	1,791,869	1,791,869	1,795,359			7
Ohio State University - Columbus	X	1,540,443	1,540,443	1,487,468			8
University of Texas - Austin		2,862,918	2,862,918	1,480,462			9
Rutgers the State University of NJ - New Brunswick	X	1,232,372	1,257,090	1,017,607			10
University of Maryland - College Park		987,352	987,352	712,085			11
Florida State University	X	397,662	397,662	675,000			12
Arizona State University		674,522	674,522	626,416	626,416	847,836	13
University of Iowa	X	760,591	760,591	616,700			14
Indiana University - Bloomington	X	473,980	467,089	507,758			15
University of Connecticut - Storrs	X	341,922	344,679	374,364			16
Median		1,540,443	1,540,443	1,483,965			

Enterprise Size

Total Research Expenditures per Net Assignable Square Foot

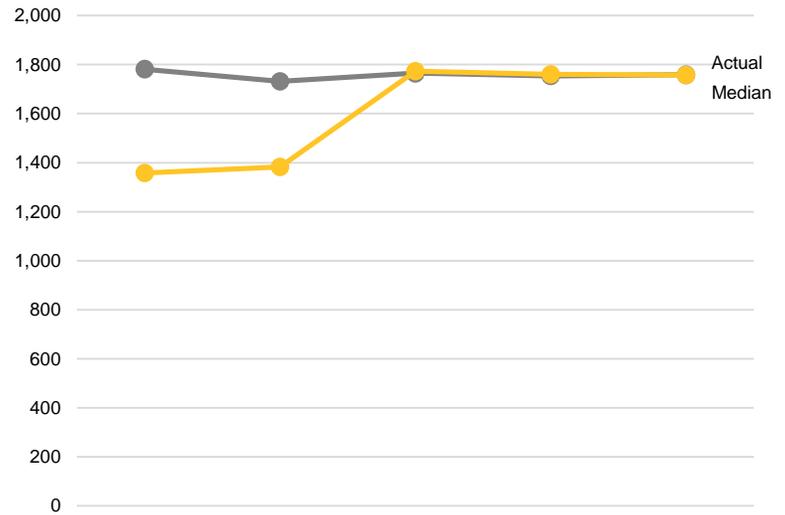


	2007	2008	2009	2010	2011
Actual	333	385	450	526	419

ABOR Peer Group	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
University of Maryland - College Park		364	400	575			1
University of Iowa	X	478	386	535			2
Ohio State University - Columbus	X	468	456	482			3
Arizona State University		333	385	450	526	419	4
University of Washington - Seattle	X	422	427	433			5
University of California - Los Angeles	X	369	391	356			6
University of Texas - Austin		156	172	342			7
University of Wisconsin - Madison	X			335			8
Rutgers the State University of NJ - New Brunswick	X	228	237	318			9
Indiana University - Bloomington	X	303	323	318			10
University of Connecticut - Storrs	X	318	320	293			11
Florida State University	X	477	458	289			12
Pennsylvania State University - University Park	X	224	241	251			13
University of Minnesota - Twin Cities	X	170	186	201			14
Michigan State University	X	158	156	161			15
University of Illinois - Urbana-Champaign		110	116	124			16
Median		318	323	326			

Enterprise Size

Total Faculty Population

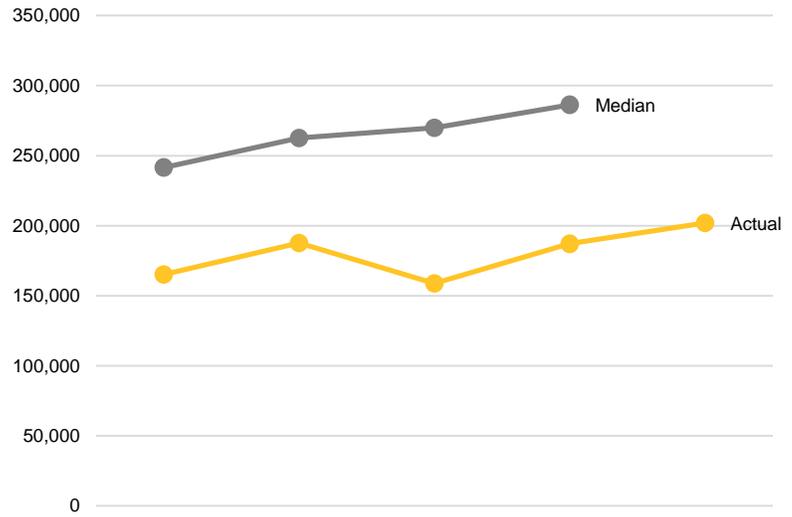


	2007	2008	2009	2010	2011
Actual	1,358	1,383	1,773	1,760	1,758

ABOR Peer Group	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
Ohio State University - Columbus	X	2,571	2,588	2,605	2,602	2,560	1
University of Minnesota - Twin Cities	X	2,458	2,489	2,377	2,319	2,277	2
University of Wisconsin - Madison	X	2,081	2,064	2,053	2,047	2,057	3
University of Texas - Austin		1,876	1,887	1,913	1,981	1,954	4
Michigan State University	X	1,882	1,885	1,921	1,948	1,906	5
University of California - Los Angeles	X	1,750	1,753	1,829	1,840	1,822	6
University of Illinois - Urbana-Champaign		1,886	1,900	1,883	1,856	1,778	7
Pennsylvania State University - University Park	X	1,716	1,711	1,757	1,748	1,759	8
Arizona State University		1,358	1,383	1,773	1,760	1,758	9
University of Washington - Seattle	X	1,890	1,607	1,568	1,548	1,536	10
University of Iowa	X	1,574	1,549	1,599	1,572	1,527	11
Rutgers the State University of NJ - New Brunswick	X	1,813	1,850	1,489	1,519	1,518	12
University of Maryland - College Park		1,468	1,472	1,485	1,472	1,463	13
Indiana University - Bloomington	X	1,319	1,329	1,334	1,368	1,351	14
University of Connecticut - Storrs	X	995	1,012	1,049	1,186	1,200	15
Florida State University	X	1,088	1,127	1,076	1,079	1,040	16
Median		1,782	1,732	1,765	1,754	1,759	

Enterprise Size

Total Research Expenditures per Faculty



	2007	2008	2009	2010	2011
Actual	165,208	187,638	158,820	187,128	202,056

ABOR Peer Group	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
University of Washington - Seattle	X	400,416	476,126	496,203	660,685		1
University of California - Los Angeles	X	470,333	497,135	486,602	509,236		2
University of Wisconsin - Madison	X	403,975	427,218	463,770	502,831		3
Pennsylvania State University - University Park	X	339,411	362,612	379,423	390,029		4
University of Minnesota - Twin Cities	X	253,926	274,272	311,729	338,971		5
University of Maryland - College Park		245,068	268,368	275,549	306,668		6
University of Texas - Austin		238,148	261,417	264,699	297,578		7
Ohio State University - Columbus	X	280,127	271,481	275,033	290,236		8
University of Iowa	X	230,777	189,518	206,317	282,464		9
Rutgers the State University of NJ - New Brunswick	X	155,101	160,915	217,337	282,049		10
University of Illinois - Urbana-Champaign		251,267	263,831	299,368	277,550		11
Michigan State University	X	191,739	189,266	194,265	221,444		12
Florida State University	X	174,233	161,769	181,454	220,449		13
Arizona State University		165,208	187,638	158,820	187,128	202,056	14
Indiana University - Bloomington	X	108,873	113,446	120,943	129,766		15
University of Connecticut - Storrs	X	109,201	108,822	104,665	97,791		16
Median		241,608	262,624	269,866	286,350		

This Page Intentionally Left Blank



Discovery and Scholarly Impact

Discovery and Scholarly Impact

Introduction

Perpetual curiosity and a quest for discovery lie at the heart of the research enterprise. In FY11, ASU researchers made discoveries and created knowledge that drive toward solutions in everything from cancer to genetic mutations to analyzing the communication patterns of terrorists.

In FY11, ASU faculty continued to demonstrate exceptional scholarly productivity in terms of the number of articles published in premier research journals, citations of ASU publications by other researchers, conferences sponsored for wide audiences and headlined by notable presenters, and high-level invited talks.

Thomson Reuters Web of Knowledge ranked ASU 6th globally for the citation impact of papers published in the area of chemistry and biochemistry. ASU is ranked 23rd in the world in social sciences, according to the Center for World-Class Universities, a ranking compiled by Shanghai Jiao Tong University that uses several objective indicators to rank world universities. These include the number of alumni and staff winning Nobel Prizes in economics; number of highly cited researchers in social sciences, economics, and business; number of articles indexed in the social science citation index; and the number of papers published in the top 20 percent of journals covering the social sciences fields.

One notable accomplishment is that ASU has become the editorial center for the internationally recognized *Journal of Policy History*, now hosted by the School of Historical, Philosophical, and Religious Studies. The quarterly publication is in its 25th year of publishing the findings of historians, social scientists, legal scholars, and economists from across the world.

ASU recognized seven Regents' Professors in 2011. Regents' Professors are faculty members who have made pioneering contributions in their areas of expertise, who have achieved a sustained level of distinction, and who enjoy national and international recognition for these accomplishments. The 2011 honorees include: Luc Anselin, Paul Davies, Colleen Keller, Jerry Y.S. Lin, Gary Marchant, Simon Ortiz, and Carlos Vález-Ibáñez.

Beyond knowledge creation, the exceptional scholarship of our faculty translates to real-world solutions and commercial products. Through the translational services of AzTE, the exclusive intellectual property management and technology transfer organization for ASU, our faculty have submitted 170 invention disclosures and 93 new patent applications, and secured 18 patents. In FY11, 10 start-up companies based on ASU intellectual property were launched.



Brianne Petritis, graduate student in the Biological Design program



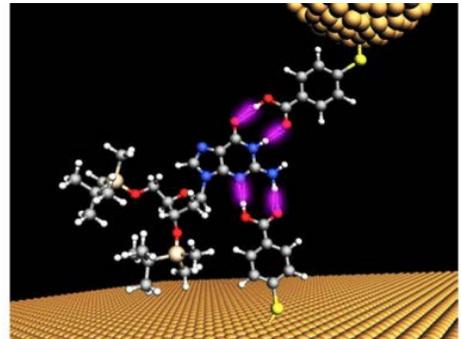
Regents' Professor Simon Ortiz speaks to a class at Westwood High School

Discovery and Scholarly Impact

Selected Accomplishments

- Three articles by ASU researchers were prominently featured in premier, high-impact research journals in FY11.

- *Science* published an article on self-assembling DNA nanostructures, co-authored by Hao Yan, a professor in the Department of Chemistry and Biochemistry. Research images were also featured on the cover.
- *Nature Nanotechnology* carried a cover highlight of an article by Regents' Professor Stuart Lindsay on the application of electron tunneling in DNA sequencing.
- ASU's Center for Nanotechnology and Society, an NSF-funded center, was featured in the October 2011 issue of *Nature Nanotechnology* as a "robust project" that seeks to democratize nanotechnology through the process of anticipatory governance.



- Two ASU research initiatives have been recognized by the Department of Defense for aiding U.S. government efforts to understand and effectively operate in the human terrain during non-conventional warfare and other missions.

- *Finding Allies for the War of Words: Mapping the Diffusion and Influence of Counter-Radical Muslim Discourse*, is a grant to the Center for the Study of Religion and Conflict, a transdisciplinary research center in the College of Liberal Arts and Sciences. It is one of seven projects at U.S. universities funded by the Minerva Research Initiative, a program of the Secretary of Defense that focuses on areas of strategic importance to U.S. national security policy.
- *Identifying Terrorist Narratives and Counter-Narratives: Embedding Story Analysis in Expeditionary Units* is part of research being conducted by the Consortium of Strategic Communication in ASU's Hugh Downs School of Human Communication.



Science and Culture Festival 2011

- A team of students from the Center for Cognitive Ubiquitous Computing in the Ira A. Fulton Schools of Engineering has created a technology device to assist low-vision students with note-taking. The *Note-Taker* team won first place in the U.S. and second place in the world for software design at Microsoft's Imagine Cup 2011. David Hayden, the inventor and a low-vision student himself, was inspired to create the device after facing challenges in accessing classroom content.

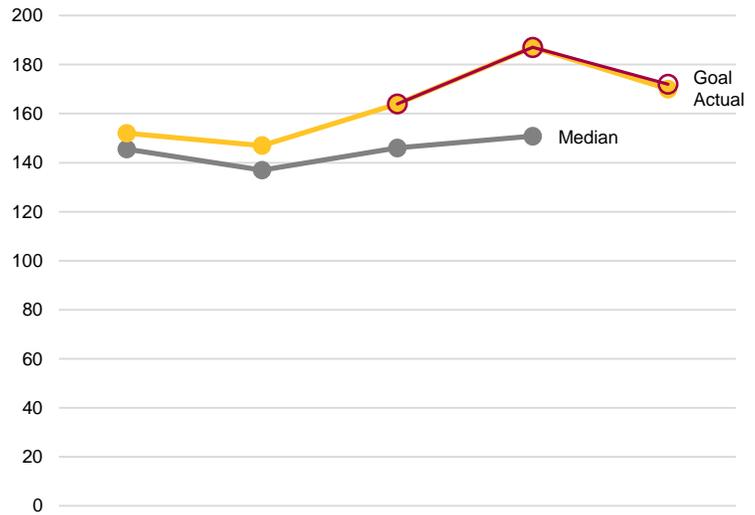


David Hayden, *Note-Taker* student team leader

- The Science and Culture Festival 2011, sponsored by ASU's Origins Project, drew thousands of attendees and honored guests such as renowned astrophysicist Stephen Hawking, author Jean Auel (who wrote the "Clan of the Cave Bear" and "Earth's Children" books), filmmaker Werner Herzog, broadcaster Hugh Downs, choreographer Liz Lerman, and philosopher A.C. Grayling.
- The Center for Sustainable Health hosted the prestigious international Forum for Sustainable Health in Phoenix in February 2011. The forum centered on the Global Biosignatures Network and creating partnerships between academia and industry. Topics included a review of the current science and economics of biosignatures, with a specific focus on health care systems.

Discovery and Scholarly Impact

Invention Disclosures Transacted

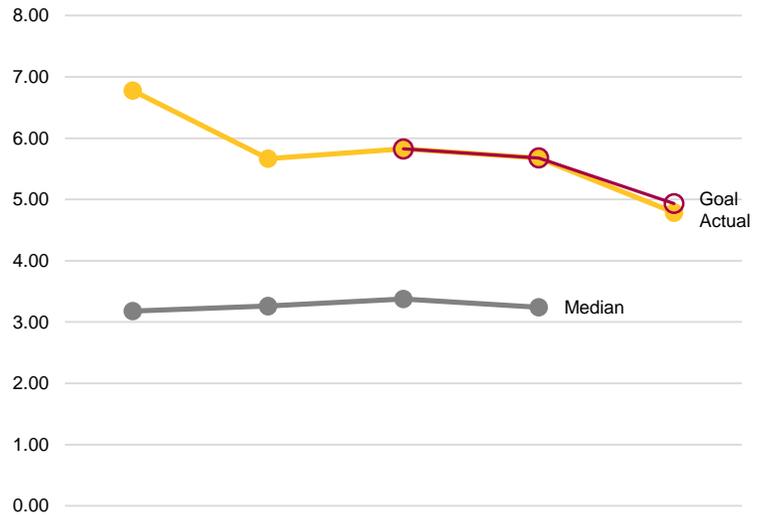


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	152	147	164	187	170
Goal			164	187	172
Difference			0	0	-2

ABOR Peer Group	Med. Sch. AUTM Adj.	2007	2008	2009	2010	2011	Rank
University of California - Los Angeles	X	267	314	333	379		1
University of Wisconsin - Madison	X	409	381	333	356		2
University of Washington - Seattle	X	335	349	349	354		3
University of Minnesota - Twin Cities	X	193	217	244	255		4
Arizona State University		152	147	164	187	170	5
University of Illinois - Urbana-Champaign		201	243	203	180		6
Ohio State University - Columbus	X	165	142	163	173		7
Rutgers the State University of NJ - New Brunswick	X	77	87	71	129		8
Pennsylvania State University - University Park	X	108	127	105	118		9
Michigan State University	X	161	91	129	116		10
University of Iowa	X	87	68	70	70		11
Indiana University - Bloomington	X	80	53	48	58		12
Florida State University	X	44	56	45	45		13
University of Connecticut - Storrs	X	36	38	42	44		14
University of Maryland - College Park		110	132				
University of Texas - Austin		139	154				
Median		146	137	146	151		

Discovery and Scholarly Impact

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

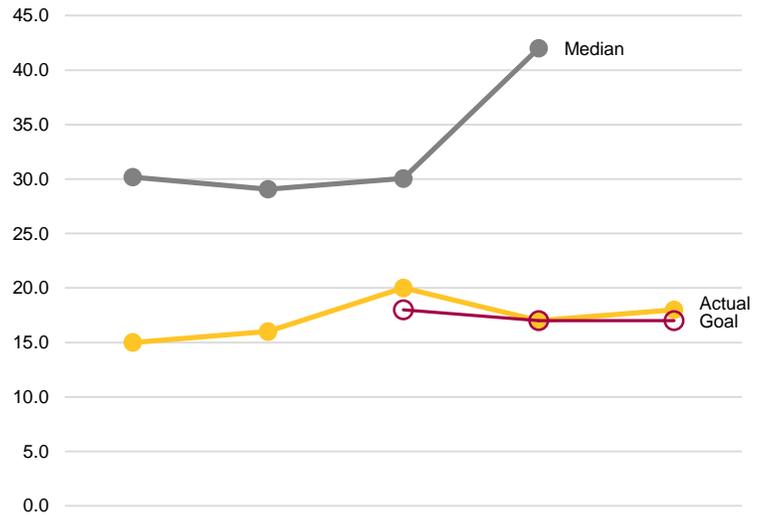


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	6.8	5.7	5.8	5.7	4.8
Goal			5.8	5.7	4.9
Difference			0.0	0.0	-0.1

ABOR Peer Group	Med. Sch.	NSF Adj.	AUTM Adj.	2007	2008	2009	2010	2011	Rank
Arizona State University				6.8	5.7	5.8	5.7	4.8	1
University of California - Los Angeles	X			3.2	3.6	3.7	4.0		2
University of Connecticut - Storrs		X	X	3.3	3.4	3.8	3.8		3
University of Illinois - Urbana-Champaign				4.2	4.8	3.6	3.5		4
University of Washington - Seattle	X			4.4	4.6	4.5	3.5		5
University of Wisconsin - Madison	X			4.9	4.3	3.5	3.5		6
University of Minnesota - Twin Cities	X			3.1	3.2	3.3	3.2		7
Indiana University - Bloomington		X	X	5.6	3.5	3.0	3.2		8
Rutgers the State University of NJ - New Brunswick		X	X	2.7	2.9	2.2	3.0		9
Michigan State University	X			4.5	2.6	3.5	2.7		10
Ohio State University - Columbus	X			2.3	2.0	2.3	2.3		11
Florida State University	X			2.3	3.1	2.3	1.9		12
Pennsylvania State University - University Park		X	X	1.9	2.0	1.6	1.7		13
University of Iowa	X			2.4	2.3	2.1	1.6		14
University of Maryland - College Park				3.1	3.3				
University of Texas - Austin				3.1	3.1				
Median				3.2	3.3	3.4	3.2		

Discovery and Scholarly Impact

U.S. Patents Issued

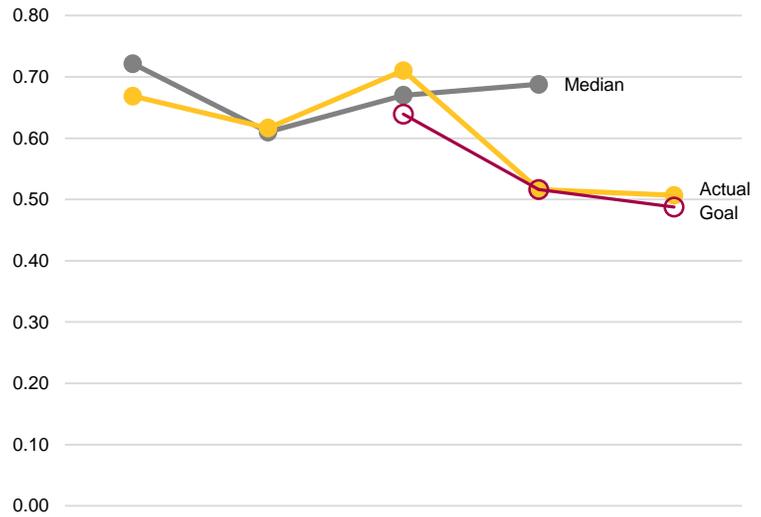


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	15	16	20	17	18
Goal			18	17	17
Difference			2	0	1

ABOR Peer Group	Med. Sch. AUTM Adj.	2007	2008	2009	2010	2011	Rank
University of Wisconsin - Madison	X	124	98	119	133		1
University of Illinois - Urbana-Champaign		40	38	42	69		2
University of Washington - Seattle	X	43	56	40	69		2
Michigan State University	X	35	48	41	52		4
Pennsylvania State University - University Park	X	30	34	30	48		5
University of California - Los Angeles	X	42	42	60	47		6
University of Minnesota - Twin Cities	X	44	37	37	46		7
Ohio State University - Columbus	X	25	15	20	38		8
University of Iowa	X	30	24	30	32		9
Rutgers the State University of NJ - New Brunswick	X	21	33	26	29		10
Florida State University	X	19	11	10	21		11
Arizona State University		15	16	20	17	18	12
University of Connecticut - Storrs	X	14	11	7	16		13
Indiana University - Bloomington	X	4	3	1	3		14
University of Maryland - College Park		24	23				
University of Texas - Austin		40	25				
Median		30	29	30	42		

Discovery and Scholarly Impact

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



ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	0.7	0.6	0.7	0.5	0.5
Goal			0.6	0.5	0.5
Difference			0.1	0.0	0.0

ABOR Peer Group	Med. Sch.	NSF Adj.	AUTM Adj.	2007	2008	2009	2010	2011	Rank
University of Connecticut - Storrs		X	X	1.3	1.0	0.7	1.3		1
University of Illinois - Urbana-Champaign				0.8	0.8	0.7	1.3		2
University of Wisconsin - Madison	X			1.5	1.1	1.2	1.3		3
Michigan State University	X			1.0	1.3	1.1	1.2		4
Florida State University	X			1.0	0.6	0.5	0.9		5
University of Iowa	X			0.8	0.8	0.9	0.7		6
Pennsylvania State University - University Park		X	X	0.5	0.5	0.5	0.7		7
University of Washington - Seattle	X			0.6	0.7	0.5	0.7		8
Rutgers the State University of NJ - New Brunswick		X	X	0.7	1.1	0.8	0.7		9
University of Minnesota - Twin Cities	X			0.7	0.5	0.5	0.6		10
Arizona State University				0.7	0.6	0.7	0.5	0.5	11
Ohio State University - Columbus	X			0.3	0.2	0.3	0.5		12
University of California - Los Angeles	X			0.5	0.5	0.7	0.5		13
Indiana University - Bloomington		X	X	0.3	0.2	0.0	0.2		14
University of Maryland - College Park				0.7	0.6				
University of Texas - Austin				0.9	0.5				
Median				0.7	0.6	0.7	0.7		

This Page Intentionally Left Blank



Economic Development

Economic Development

Introduction

As the nation's largest university and the only research university in the Phoenix metropolitan region, ASU provides employment and training to thousands of individuals across a wide range of professional careers. Each year, thousands of students graduate from ASU with the skills and knowledge needed to succeed in today's most challenging careers. These graduates create a lifetime of value for Arizona, returning the state's investment in their education.

Augmenting these substantial contributions to Arizona's economic development, the resources aggregated at SkySong 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 marketable applications. SkySong has supported 60 companies from 10 countries and houses ASU's technology transfer services.

In October, ASU launched the Venture Catalyst at SkySong with a generous \$1 million grant from the Arizona Governor's office, as part of the federal stimulus program for economic development. Venture Catalyst provides a suite of venture acceleration services for ASU faculty, student, and alumni companies, as well as U.S. and international firms, across all stages of development. Services include entrepreneurial education, connections to mentors, capital formation, intellectual property assistance, access to faculty researchers, student interns, and employee workforce development. Since its launch, Venture Catalyst has evaluated 107 company inquiries (faculty, student, alumni, U.S. and global). These evaluations identified 47 high-potential opportunities that are currently receiving services. Additionally, Venture Catalyst has recruited more than 100 accomplished entrepreneurs and business executives to mentor Venture Catalyst companies to advance local economic development.

The Edson Student Entrepreneur Initiative is funded by an endowment that generates \$200,000 per year for startup awards to students. Beyond seed grants, the initiative provides office space and training for students to explore ideas in partnership with faculty, researchers, and successful entrepreneurs from both the academic and private sectors. In FY11 the Edson grant supported 37 ventures, including 26 new grants. More than 1,000 ASU students have participated in Edson and other entrepreneurial training programs.

ASU's Engineering Research Center (ERC) for Quantum Energy and Sustainable Solar Technologies (QESST) will develop interdisciplinary research and education programs to address a significant energy challenge -- how to realize a large-scale, sustainable, domestic energy source, by developing advanced solar photovoltaic (PV) technologies and by providing the foundation for new industries through innovation. Since its inception, QESST has attracted more than 40 solar energy companies that span the industrial spectrum from basic materials, semiconductor manufacturing, and PV production to energy system installation firms and utilities.

Finally, ASU's technology transfer team, AzTE, employs professionals with decades of experience at the intersection of academia and business, across a wide range of disciplines. The licensing and revenue from transactions they brokered translated into more than \$2.4 million for FY11.



ASU President Michael Crow accepts a check to help establish Venture Catalyst at ASU

Economic Development

Selected Accomplishments

- ASU faculty filed 170 invention disclosures in FY11. In conjunction with AzTE, faculty members applied for 93 new patents, were issued 18 patents, and executed 72 license and option agreements.
- Axon Technologies Corporation, launched by Professor Michael Kozicki, professor in the School of Electrical, Computer and Energy Engineering, will issue its first resistive memory technology product in 2012.
- Together with a broad coalition of industry and academic partners, ASU is advancing the growth of the aerospace and defense industries in Arizona through an Aerospace and Defense Collaboratory at ASU's Polytechnic Campus. This effort leverages existing ties to the Air Force Research Laboratory in partnership with the City of Mesa.
- AzTE established a partnership with eight top research universities in Japan to cross-market technologies.
- ASU's Decision Theater co-founded the Global Decision Theater Alliance with Huazhong University of Science and Technology and Harbin Institute of Technology in China. The establishment of ASU-branded Decision Theaters in China will drive new global partnerships and opportunities for commercial development.
- Arizona State University and NeXtAdvisors co-hosted the 2011 Education Innovation Summit, bringing together 600 thought leaders, education entrepreneurs, educators and investors to chart a course for an educational revolution driven by innovation. Notable attendees included James H. Shelton III, assistant deputy secretary for innovation and improvement, U.S. Department of Education; Craig Barrett, retired CEO/chairman, Intel; and Joel Klein, executive vice president, News Corp.
- Daylight Solutions is a start-up company led by ASU student entrepreneurs. The students have designed a sustainable technology to provide solar-storage lighting for communities in rural Africa.
- SMALLab (Situating Multimedia Arts Learning Lab) is an embodied learning environment. The company uses interactive whiteboard technology coupled with Microsoft Kinect technology to deliver high-impact classroom "learning by playing" programs. SMALLab developed after six years of research conducted at the School of Arts, Media and Engineering (AME) in collaboration with K-12 teachers, with funding from the National Science Foundation and Intel Corporation.
- ASU's SkySong continued to build significant collaborations with major industrial research partners. Master Research Agreements with General Electric Healthcare, Henkel Consumer Goods, Medtronic, and Quintiles, a clinical research organization, will facilitate these collaborations and help broaden future engagement.



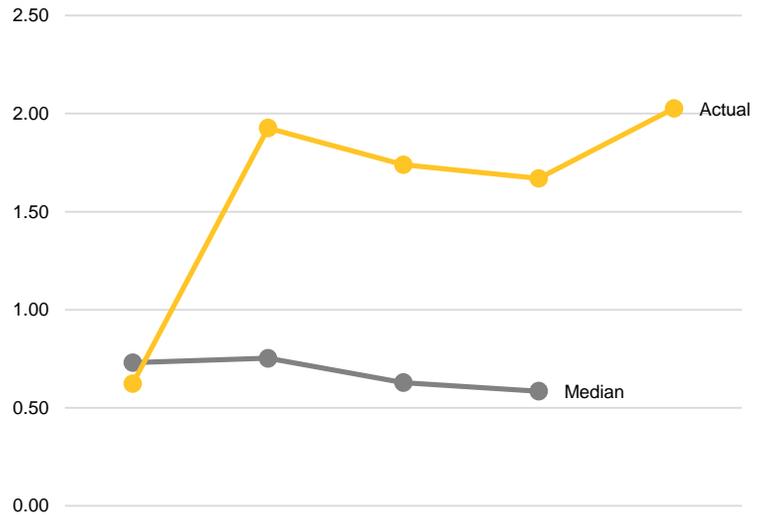
Global Decision Theater Alliance



SMALLab

Economic Development

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

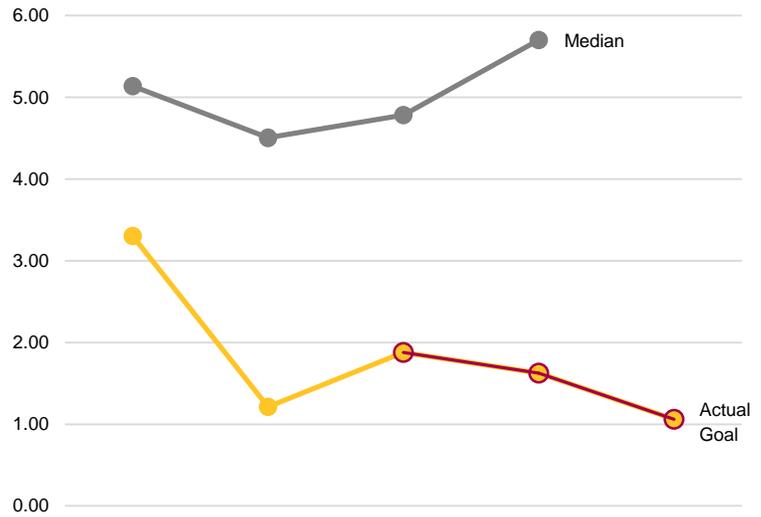


	2007	2008	2009	2010	2011
Actual	0.6	1.9	1.7	1.7	2.0

ABOR Peer Group	Med. Sch.	NSF Adj.	AUTM Adj.	2007	2008	2009	2010	2011	Rank
University of Washington - Seattle	X			2.7	2.8	3.0	1.9		1
Rutgers the State University of NJ - New Brunswick		X	X	2.1	3.0	2.5	1.7		2
Arizona State University				0.6	1.9	1.7	1.7	2.0	3
University of Minnesota - Twin Cities	X			1.2	0.9	0.7	0.9		4
University of Illinois - Urbana-Champaign				0.8	0.9	0.6	0.8		5
Michigan State University	X			0.8	0.7	1.2	0.7		6
University of Wisconsin - Madison	X			0.7	0.9	0.6	0.6		7
Indiana University - Bloomington		X	X	1.3	0.8	0.7	0.6		8
University of California - Los Angeles	X			0.5	0.4	0.4	0.6		9
University of Connecticut - Storrs		X	X	0.4	0.8	0.6	0.5		10
University of Iowa	X			1.0	0.7	0.6	0.5		11
Ohio State University - Columbus	X			0.4	0.3	0.4	0.5		12
Pennsylvania State University - University Park		X	X	0.2	0.4	0.3	0.3		13
Florida State University	X			0.7	0.6	0.5	0.3		14
University of Maryland - College Park				0.9	0.3				
University of Texas - Austin				0.4	1.1				
Median				0.7	0.8	0.6	0.6		

Economic Development

Intellectual Property Income

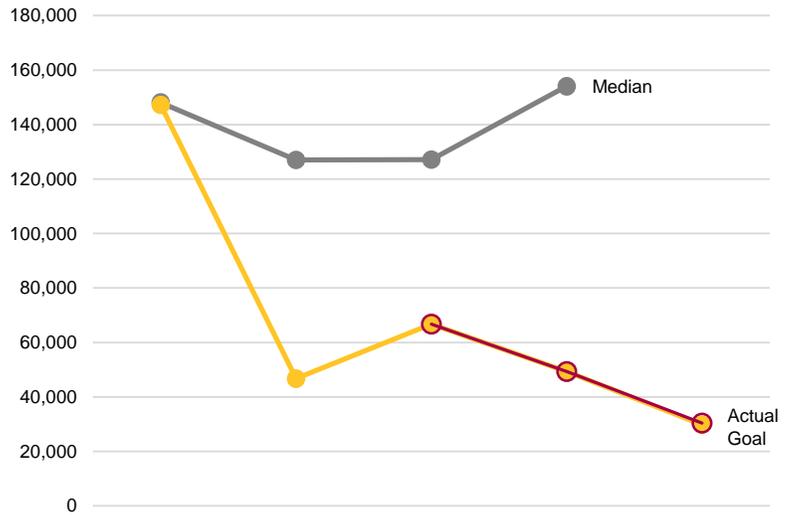


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	3.3	1.2	1.9	1.6	1.1
Goal			1.9	1.6	1.1
Difference			0.0	0.0	0.0

ABOR Peer Group	Med. Sch. AUTM Adj.	2007	2008	2009	2010	2011	Rank
University of Minnesota - Twin Cities	X	63.3	84.7	95.2	83.9		1
University of Washington - Seattle	X	63.3	80.3	87.3	69.0		2
University of Wisconsin - Madison	X	46.7	54.1	56.7	54.3		3
University of California - Los Angeles	X	20.9	32.8	22.6	27.5		4
University of Iowa	X	17.4	23.6	42.9	27.0		5
Rutgers the State University of NJ - New Brunswick	X	7.1	7.3	7.5	8.1		6
University of Illinois - Urbana-Champaign		4.7	4.2	5.1	6.1		7
Indiana University - Bloomington	X	1.7	1.8	2.2	5.3		8
Michigan State University	X	5.6	4.8	4.4	4.0		9
Pennsylvania State University - University Park	X	1.6	1.3	1.1	2.0		10
Ohio State University - Columbus	X	1.2	2.1	1.7	1.9		11
Arizona State University		3.3	1.2	1.9	1.6	1.1	12
Florida State University	X	1.8	1.3	1.2	1.3		13
University of Connecticut - Storrs	X	0.4	0.3	0.4	0.4		14
University of Maryland - College Park		1.2	1.6				
University of Texas - Austin		6.7	11.6				
Median		5.1	4.5	4.8	5.7		

Economic Development

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

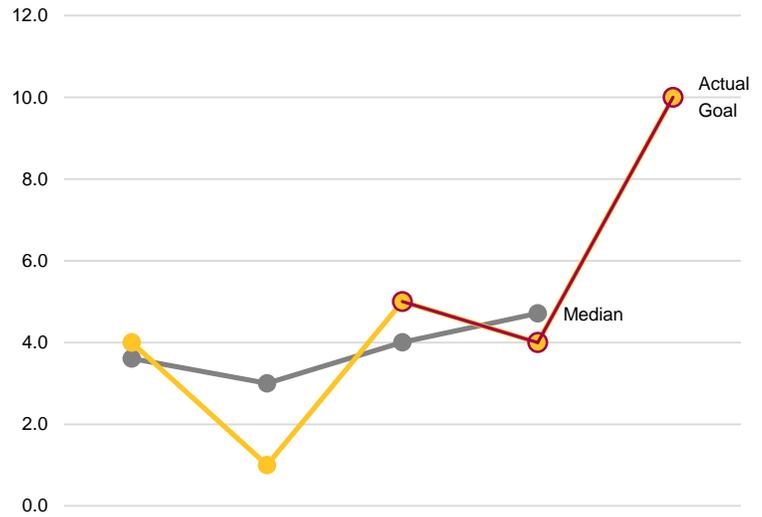


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	147,248	46,705	66,720	49,362	29,823
Goal			66,720	49,362	30,396
Difference			0	0	-572

ABOR Peer Group	Med. Sch.	NSF Adj.	AUTM Adj.	2007	2008	2009	2010	2011	Rank
University of Minnesota - Twin Cities	X			1,014,436	1,240,281	1,284,360	1,067,402		1
University of Washington - Seattle	X			836,215	1,049,890	1,122,555	674,973		2
University of Iowa	X			478,812	802,556	1,301,059	607,862		3
University of Wisconsin - Madison	X			555,508	613,874	595,661	527,546		4
Indiana University - Bloomington		X	X	119,891	120,420	135,034	297,309		5
University of California - Los Angeles	X			254,057	376,797	253,451	293,331		6
Rutgers the State University of NJ - New Brunswick		X	X	254,202	246,711	231,213	189,173		7
University of Illinois - Urbana-Champaign				98,968	84,599	90,756	118,925		8
Michigan State University	X			154,735	133,661	119,229	93,115		9
Florida State University	X			95,671	68,962	61,075	55,280		10
Arizona State University				147,248	46,705	66,720	49,362	29,823	11
University of Connecticut - Storrs		X	X	40,299	30,613	33,273	37,752		12
Pennsylvania State University - University Park		X	X	27,859	21,452	16,289	29,476		13
Ohio State University - Columbus	X			17,294	29,815	23,891	25,252		14
University of Maryland - College Park				32,576	39,352				
University of Texas - Austin				148,895	234,216				
Median				148,072	127,040	127,132	154,049		

Economic Development

Startup Companies

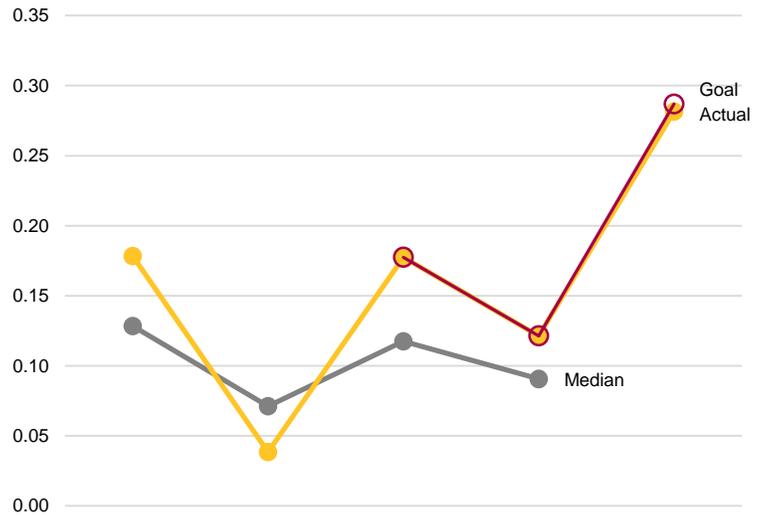


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	4	1	5	4	10
Goal			5	4	10
Difference			0	0	0

ABOR Peer Group	Med. Sch. AUTM Adj.	2007	2008	2009	2010	2011	Rank
University of California - Los Angeles	X			22	27		1
Ohio State University - Columbus	X	3	5	7	8		2
University of Minnesota - Twin Cities	X	4	1	3	8		2
Rutgers the State University of NJ - New Brunswick	X	4	2	5	7		4
University of Washington - Seattle	X	11	9	10	7		5
University of Illinois - Urbana-Champaign		7	6	6	5		6
University of Wisconsin - Madison	X	6	6	1	5		6
Pennsylvania State University - University Park	X	3	1	3	4		8
Arizona State University		4	1	5	4	10	9
University of Iowa	X	2	0	3	3		10
University of Connecticut - Storrs	X	1	1	3	3		11
Florida State University	X	1	3	2	2		12
Indiana University - Bloomington	X	2	1	2	1		13
Michigan State University	X	5	3		0		14
University of Maryland - College Park		7	3				
University of Texas - Austin		3	10	22			
Median		4	3	4	5		

Economic Development

Startup Companies per \$10 Million in Total Research Expenditures

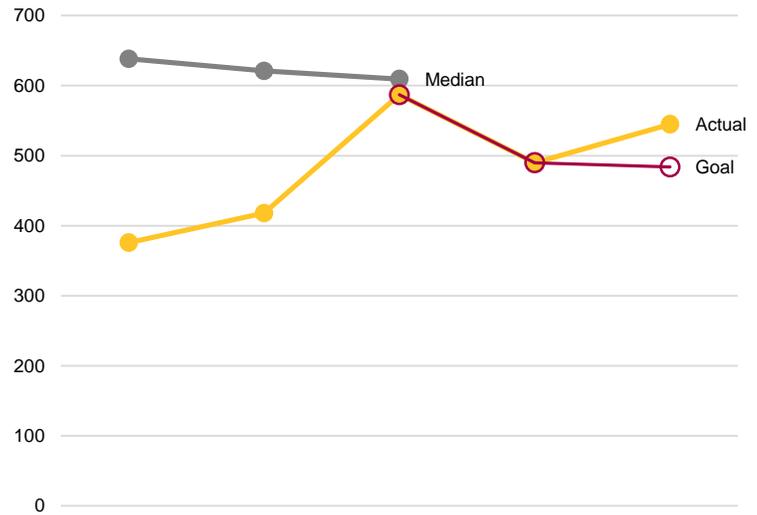


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	0.2	0.0	0.2	0.1	0.3
Goal			0.2	0.1	0.3
Difference			0.0	0.0	0.0

ABOR Peer Group	Med. Sch.	NSF Adj.	AUTM Adj.	2007	2008	2009	2010	2011	Rank
University of California - Los Angeles	X					0.2	0.3		1
University of Connecticut - Storrs		X	X	0.1	0.1	0.3	0.3		2
Rutgers the State University of NJ - New Brunswick		X	X	0.1	0.1	0.1	0.2		3
Arizona State University				0.2	0.0	0.2	0.1	0.3	4
Ohio State University - Columbus	X			0.0	0.1	0.1	0.1		5
University of Minnesota - Twin Cities	X			0.1	0.0	0.0	0.1		6
University of Illinois - Urbana-Champaign				0.1	0.1	0.1	0.1		7
Indiana University - Bloomington		X	X	0.1	0.0	0.1	0.1		8
Florida State University	X			0.1	0.2	0.1	0.1		9
University of Washington - Seattle	X			0.1	0.1	0.1	0.1		10
University of Iowa	X			0.1	0.0	0.1	0.1		11
Pennsylvania State University - University Park		X	X	0.0	0.0	0.0	0.1		12
University of Wisconsin - Madison	X			0.1	0.1	0.0	0.0		13
Michigan State University	X			0.1	0.1		0.0		14
University of Maryland - College Park				0.2	0.1				
University of Texas - Austin				0.1	0.2	0.4			
Median				0.1	0.1	0.1	0.1		

Economic Development

Doctoral Degrees Conferred

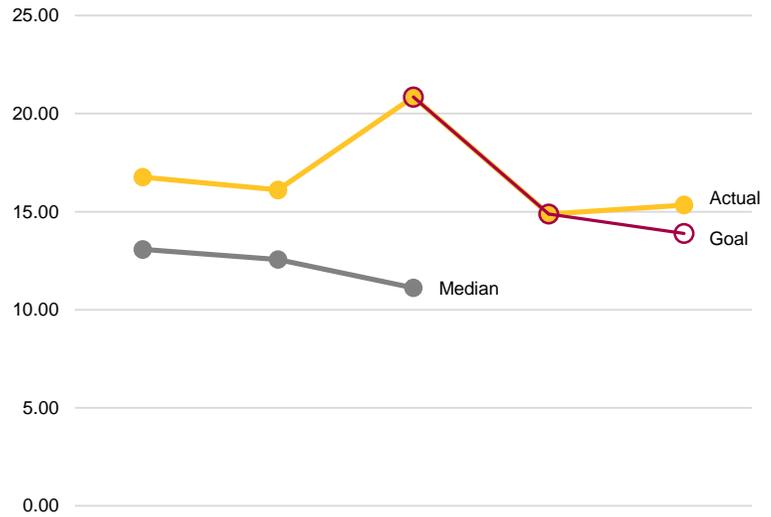


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	376	418	587	490	545
Goal			587	490	484
Difference			0	0	61

ABOR Peer Group	Med. Sch.	2007	2008	2009	2010	2011	Rank
University of Texas - Austin		779	865	818			1
University of Wisconsin - Madison	X	775	761	786			2
University of Illinois - Urbana-Champaign		698	759	780			3
University of California - Los Angeles	X	734	752	760			4
Ohio State University - Columbus	X	667	759	738			5
University of Washington - Seattle	X	631	622	683			6
University of Minnesota - Twin Cities	X	819	775	680			7
Pennsylvania State University - University Park		646	620	632			8
Arizona State University		376	418	587	490	545	9
University of Maryland - College Park		653	655	577			10
Michigan State University	X	493	446	489			11
Indiana University - Bloomington		370	414	441			12
Rutgers the State University of NJ - New Brunswick		406	431	410			13
University of Iowa	X	376	413	404			14
Florida State University	X	350	368	343			15
University of Connecticut - Storrs		339	285	238			16
Median		639	621	610			

Economic Development

Doctorate Degrees Conferred per \$10 Million in Total Research Expenditures



ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	16.8	16.1	20.8	14.9	15.3
Goal			20.8	14.9	13.9
Difference			0.0	0.0	1.5

ABOR Peer Group	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
Arizona State University		16.8	16.1	20.8	14.9	15.3	1
Florida State University	X	18.5	20.2	17.6			2
University of Texas - Austin		17.4	17.5	16.2			3
University of Maryland - College Park		18.2	16.6	14.1			4
University of Illinois - Urbana-Champaign		14.7	15.1	13.8			5
Michigan State University	X	13.7	12.5	13.1			6
University of Iowa	X	10.4	14.1	12.2			7
Rutgers the State University of NJ - New Brunswick	X	13.0	13.3	11.7			8
University of Connecticut - Storrs	X	15.1	12.6	10.6			9
Ohio State University - Columbus	X	9.3	10.8	10.3			10
Indiana University - Bloomington	X	9.6	10.1	10.0			11
University of Minnesota - Twin Cities	X	13.1	11.4	9.2			12
University of Washington - Seattle	X	8.3	8.1	8.8			13
University of California - Los Angeles	X	8.9	8.6	8.5			14
Pennsylvania State University - University Park	X	9.9	8.8	8.4			15
University of Wisconsin - Madison	X	9.2	8.6	8.3			16
Median		13.1	12.6	11.1			

This Page Intentionally Left Blank



Leadership and Recognition

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

- **Michael Hanemann**, the Julie A. Wrigley Chair in Sustainability in the School of Sustainability and a world-renowned environmental economist, has been elected a member of the National Academy of Sciences. Professor Hanemann brings an economics perspective to natural resource management. His research has been published in leading environmental and economics journals.
- **Carlos Castillo-Chavez**, ASU Regents' Professor and founding director of the Mathematical and Theoretical Biology Institute, was recently honored by President Obama in a White House ceremony as a recipient of the Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring.
- **Cheryl Nickerson**, a microbiologist at ASU's Biodesign Institute, received the Exceptional Scientific Achievement Medal – NASA's most prestigious commendation for outstanding contributions to science. Nickerson has been using spaceflight or spaceflight analogues to study microbial behavior since 1998. In an audacious series of experiments, she was able to validate her early observations about the responses of certain microorganisms to conditions of reduced gravity.
- **Stuart Lindsay**, Director of the Center for Single Molecule Biophysics in the Biodesign Institute, was honored by the White House in August 2010 for his innovative efforts to bring low-cost DNA sequencing to the masses. Lindsay was recognized during a gathering that coincided with the release of the Recovery Act Innovation Report.
- The Carnegie Foundation for the Advancement of Teaching and the Council for Advancement and Support of Education named ASU Regents' Professor **Jane Maienschein** the 2010 Arizona Professor of the Year.
- A premier global water organization, the International Water Association, has recognized the outstanding achievements of ASU Regents' Professor **Bruce Rittmann** as a 2011 Fellow, its most prestigious professional honor.
- ASU professors **Qiang Hu** and **Milton Sommerfeld** were honored with the Excellence in Research Award at the 2010 Arizona Bioindustry Association's BioFest.

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

- **Anna Barker**, former deputy director for strategic scientific initiatives at the National Cancer Institute within the National Institutes of Health, has joined ASU to lead the Transformative Healthcare Networks. This initiative will leverage science and technology across ASU, other U.S. academic institutions, research laboratories, and other sectors to provide innovative solutions to major problems in health care.
- **Werner Dahm** leads ASU's Security and Defense Systems Initiative. He was previously chief scientist of the U.S. Air Force, where he authored the "Technology Horizons" document that will guide Air Force science and technology strategy over the next two decades. ASU's Security and Defense Systems Initiative is a transdisciplinary enterprise that provides real-world solutions to growing national and global security challenges.
- **Stephen Elliot** joined ASU from Vanderbilt University's Peabody College of Education and Human Development to lead the Learning Sciences Institute. The institute will span a variety of academic disciplines to promote personalized instruction with an emphasis on learning outcomes.

We are pleased to welcome these new faculty into our cadre of exemplary faculty that include three Nobel Laureates: **Leland Hartwell**, Virginia G. Piper Chair in Personalized Medicine and chief scientist, Center for Sustainable Health (2001 Physiology or Medicine), **Elinor Ostrom**, research professor in the School of Human Evolution and Social Change and founding director of the Center for the Study of Institutional Diversity (2009 Economic Sciences), and **Edward Prescott**, Regents' Professor and W.P. Carey Chair in Economics (2004 Economic Sciences).

Leadership and Recognition

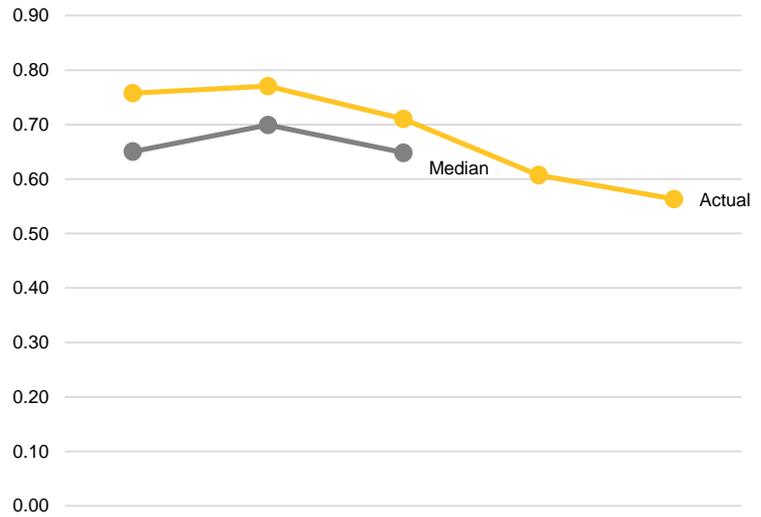
Selected Accomplishments

- ASU has achieved extraordinary growth in National Academy members as of FY11:
 - **American Academy of Arts and Sciences**
Eleven members, nine since FY02 (450% growth)
 - **National Academy of Engineering**
Nine members, seven since FY02 (350% growth)
 - **National Academy of Sciences**
Twelve members, eleven since FY02 (1,100% growth)
 - **Institute of Medicine**
Two members, both hired since FY02
 - **National Academy of Education**
Four members, two since FY02 (100% growth)
 - **National Academy of Public Administration**
Three members, two since FY02 (200% growth)
- The Academic Ranking of World Universities, compiled by Shanghai Jiao Tong University, ranked ASU 78th among 1,200 universities around the world, up from 81st place in 2010.
- Times Higher Education World University Rankings, using data supplied by Thomson Reuters, ranked ASU 21st in the world in mathematics, above Columbia, Cornell, Oxford, MIT, and Cambridge.
- *U.S. News & World Report* ranked ASU in the top tier of national universities in 2008, 2009, 2010, and 2011. It was ranked fourth among “Up and Coming Schools” in 2009 and 2010, and second in the 2011 edition of “America’s Best Colleges” – a ranking highlighting schools to watch in terms of promising and innovative changes in academics, faculty, students, campus life, diversity, and facilities.
- Graduate programs at ASU rank among the best in the nation, according to the 2012 edition of “Best Graduate Schools,” published by *U.S. News & World Report*. Among the top tier ASU graduate programs rated this year are the business, education, engineering, law, and nursing.
- In 2010-11, ASU was the second most-awarded public university for Department of State-sponsored student Fulbright awards. Nationally, ASU is sixth overall, tied with Princeton and Berkeley. With 20 awards accepted out of 50 applications, ASU’s percentage of winning applications was higher than that of any other top-15 Fulbright institution.
- ASU faculty have won 84 National Science Foundation Early CAREER development awards, an extremely competitive award that recognizes the quality work of junior faculty. These awards reflect ASU’s investment in recruiting and nurturing exceptional talent, ensuring continued success for the university as these faculty members advance in their fields.



Leadership and Recognition

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



	2007	2008	2009	2010	2011
Actual	0.8	0.8	0.7	0.6	0.6

ABOR Peer Group	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
University of Washington - Seattle	X	1.2	1.3	1.3			1
University of Texas - Austin		1.3	1.3	1.3			2
Rutgers the State University of NJ - New Brunswick	X	1.1	1.1	1.0			3
University of Illinois - Urbana-Champaign		1.2	1.1	1.0			4
University of California - Los Angeles	X	0.9	0.9	1.0			5
University of Wisconsin - Madison	X	0.9	0.8	0.7			6
Arizona State University		0.8	0.8	0.7	0.6	0.6	7
University of Maryland - College Park		0.7	0.7	0.7			8
University of Iowa	X	0.6	0.7	0.6			9
University of Minnesota - Twin Cities	X	0.6	0.5	0.5			10
Ohio State University - Columbus	X	0.3	0.3	0.4			11
Florida State University	X	0.4	0.4	0.4			12
Pennsylvania State University - University Park	X	0.4	0.4	0.3			13
Indiana University - Bloomington	X	0.3	0.2	0.2			14
Michigan State University	X	0.2	0.2	0.2			15
University of Connecticut - Storrs	X	0.1	0.1	0.0			16
Median		0.7	0.7	0.6			

This Page Intentionally Left Blank



Technology Transfer

Technology Transfer

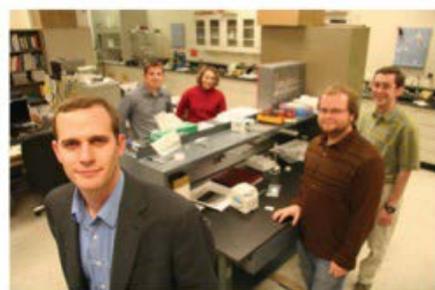
Introduction

Functioning as ASU's intellectual property management and technology transfer organization, Arizona Technology Enterprises (AzTE) advances the research enterprise by identifying and developing intellectual property, evaluating invention disclosures from legal and commercial perspectives, protecting inventions, managing marketing and licensing, and building industry-university relations. AzTE reported less total revenue in FY2011 compared to the previous year because of accounting changes in start-up equity valuation. However, sponsored research facilitated by AzTE increased markedly in FY2011 due to a concerted effort toward facilitating industry funding as a core service.

As ASU's research expenditures have continued to grow, the increased funding has driven a strong flow of invention disclosures, increasing the depth and breadth of the university's key patent portfolios (energy, medical devices, biotechnology, and education). In turn, this has created numerous opportunities for leveraging existing resources to identify and cultivate future opportunities.

The following are updates on selected ASU startup ventures founded in previous years:

- Axon, a start-up company founded in 1996 by Michael Kozicki, professor in the School of Electrical, Computer and Energy Engineering, is founded on technology covered by over 30 issued patents. The first commercial product is scheduled to be available in early 2012 through a sublicensee with over 30 employees and over \$30M in financing.
- EndoStim, Inc. is currently developing a pacemaker-like device for the treatment of severe acid reflux. AzTE has licensed to the company intellectual property covering a micro-stimulator technology invented by Bruce Towe, professor in the School of Biological and Health Systems Engineering. The company has raised \$6M in venture funding.
- Fluidic Energy, a company which was co-founded by Cody Friesen, associate professor in the School of Engineering of Matter, Transport and Energy, is developing a rechargeable metal-air battery that will offer lower cost, higher energy density, and longer run times. The company has received two significant rounds of funding from venture capital firms as well as several million dollars in funding through DOE ARPA-E.
- Founded in 1992, the Photovoltaic Testing Laboratory at ASU (ASU PTL) was the first accredited photovoltaic qualification testing laboratory in the U.S. and one of only a few in the world. Over the last decade, under the direction of Govindasamy Tamizhmani, ASU Clinical Professor in the Department of Engineering Technology, ASU PTL developed a top-tier network of experienced professionals with expertise in energy-related technologies. In 2008, AzTE, for and on behalf of ASU PTL, joined forces with TÜV Rheinland to create TUV-PTL. This company has a state-of-the-art 40,000 square foot facility in Tempe, AZ, where clients can take advantage of full testing for all photovoltaic system components. TUV-PTL received OSHA certification as a recognized photovoltaic test laboratory in 2011. The company is profitable and has 57 employees, the majority of which are former ASU students.



Cody Friesen (foreground),
ARPA-E recipient



ASU provides the largest solar energy
capacity (10MW) of any higher education
institution in the U.S.

ASU has created a dynamic mechanism for translating research into products, services and processes that benefit the public and generate economic returns for Arizona through its facilities at SkySong in Scottsdale, just north of the Tempe campus. At SkySong, innovative companies large and small are co-located under one roof to enable collaboration, and place them proximal to technology translation and business acumen available through ASU. The facilities not only house AzTE, but also the recently established Venture Catalyst group. This location-based synergy results in priceless networking opportunities, leveraging of resources, and ultimately, the acceleration of the commercialization of research.

Technology Transfer

Statistical Exhibits



Technology Transfer Activities	2007	2008	2009	2010	2011
Invention Disclosures Transacted	152	147	164	187	170
Invention Disclosures Transacted Year/Year Percentage Change		-3%	12%	14%	-9%
New Patent Applications	84	87	126	99	93
New Patent Applications Year/Year Percentage Change		4%	45%	-21%	-6%
U.S. Patents Issued	15	16	20	17	18
U.S. Patents Issued Year/Year Percentage Change		7%	25%	-15%	6%
Licenses and Options Executed	14	50	49	55	72
Licenses and Options Executed Year/Year Percentage Change		257%	-2%	12%	31%
Other Major Agreements	68	78	53	108	126
Other Major Agreements Year/Year Percentage Change		15%	-32%	104%	17%

Licensing and Other Revenue	2007	2008	2009	2010	2011
Licensing Revenue (Including Options)	3,303,549	1,212,021	1,878,749	1,625,716	1,059,372
Licensee Legal Reimbursements	687,866	508,710	661,986	1,111,111	1,205,679
Other Revenue	16,000	4,978	65,367	5,021	41,945
Total	4,007,415	1,725,709	2,606,102	2,741,848	2,306,996

Sponsored Research Facilitated	2007	2008	2009	2010	2011
Total	293,000	15,626,906	7,215,259	5,623,534	8,945,930

Royalty Distribution	2007	2008	2009	2010	2011
Inventors	-959,782	-275,885	-359,299	-281,466	-242,493
Laboratories and Units	-954,777	-332,210	-347,918	-313,358	-208,090
University	-826,762	-245,188	-297,424	-235,699	-138,557
Undistributed	64,227	221,980	12,979	548,128	169,983

- M01-043L, US Patent No. 7,875,440, is entitled, "Method of Determining the Nucleotide Sequence of Oligonucleotides and DNA Molecules." This technology is exclusively licensed to Helicos Biosciences Corporation (Helicos) and forms the basis for their DNA sequencing technology. That DNA sequencing technology is the subject of a patent infringement lawsuit commenced by Helicos against three companies. AzTE recently joined the lawsuit as a plaintiff. The ASU patented methods include the use of fluorescently labeled nucleotides that are added to a primed DNA strand by an enzyme, the fluorescent label being detected to determine the identity of the nucleotide added (A, T, G, or C). The methods also include the identification of DNA sequence by the detection of a reaction product (the proton, for example), liberated in the formation of the phosphodiester bond between consecutive bases in the sequence. The technology was developed by Dr. Peter Williams, ASU Professor in the Department of Chemistry and Biochemistry.
- M03-037P, US Patent No. 7,781,356, is entitled "Epitaxial Growth of Group III Nitrides on Silicon Substrates Via a Reflective Lattice-Matched Zirconium Diboride Buffer Layer." This technology is exclusively optioned to Translucent, Inc. The patent describes a method that allows the integration of semiconductor materials that are used for fabricating light emitting diodes and high power transistors (e.g. Gallium Nitride) onto Silicon wafers, overcoming the present need to use expensive (and small) Sapphire substrates. This technology has the potential to significantly reduce the cost of solid state lighting. The technology was developed by Dr. John Kouvetakis, ASU Professor in the Department of Chemistry and Biochemistry.
- M05-060P, US Patent No. 7,833,666, is entitled "Electric Current Producing Device Having Sulfone-Based Electrolyte." This technology was exclusively optioned to Dow Chemicals and has had interest from a host of other lithium ion battery materials companies. The patent describes a new chemical compound that can be used as an electrolyte for rechargeable lithium ion batteries. This newly developed compound has a lower melting point and also provides a higher window of electrochemical stability that leads to longer lasting batteries with higher power density. Additionally, this electrolyte is naturally fire retardant. This technology was developed by Dr. Austen Angell, ASU Professor in the Department of Chemistry and Biochemistry.
- M07-121L, US Patent No. 7,785,001, is entitled, "Apparatus and Method for Sensing Change in Environmental Conditions." This technology provides a novel means of sensing infrared energy by detecting changes in a quartz resonator in contact with an infrared sensitive material. The invention would be useful in non-contact temperature measurements and possibly night vision and remote sensing applications. The technology was developed by Dr. Nongjian (NJ) Tao, ASU Professor in the School of Electrical, Computer and Energy Engineering.

Technology Transfer

Selected Licenses and Options Executed

- Translucent, Inc.
Translucent is owned by Silex, a public Australian company. AzTE and Translucent have entered into an exclusive option agreement to license a portfolio of solar-related technologies. This revolutionary technology eliminates the use of costly germanium as a substrate for concentrating solar devices, and instead uses a buffer layer deposited directly onto silicon substrates, thereby reducing cost while increasing device reliability and efficiency. Recently Translucent has expressed interest in exercising this option agreement and is currently in negotiations for an exclusive license.
- Zcube, Srl.
Zcube is the US division of the Italian pharmaceutical company, Zambon Group. They are developing technology recently licensed from AzTE to create a medical device to measure nitric oxide (NO) in exhaled human breath. NO is a marker for the presence and severity of asthma and other lung conditions. The anticipated device is being created and refined through a sponsored research agreement in the inventor's laboratory at the Biodesign Institute.
- NanoVoltaix, Inc.
In FY2010, AzTE and NanoVoltaix, a local company with headquarters in Phoenix, AZ, entered into an exclusive option agreement for a portfolio of technologies related to the production of nanoporous materials. In FY2011, this option was exercised and AzTE has recently completed a license agreement with Matteren Inc., a separate, local start-up company formed by NanoVoltaix to commercialize the technology. Nanoporous materials have applications in thermal insulation, catalysis, and energy storage, and ASU's materials manufacturing technology produces a more efficient, cost-effective design.

Technology Transfer

Selected Startup Companies

- 3D Cell Technologies - 3D Cell Technologies is an ASU Biodesign Impact Accelerator company that is housed in the ASU Biodesign Institute. The company has an innovative platform for creating in vitro tissue models that better replicate in vivo conditions. This technology is being developed to serve a variety of markets, including basic research, drug and biomarker discovery, and preclinical drug testing.
- Daylight Solutions - Daylight Solutions is commercializing novel technology in the field of energy generation using waste heat developed for the purpose of off-grid energy applications in third world countries.
- Renco - Renco is a Lebanon-based company which has licensed algae technology for the purposes of commercializing nutraceuticals and bio-fuels. The company will grow, harvest, and produce the end products through a combination of proprietary algae strains and photo-bioreactors transferred from ASU.
- GFS Tech - GFS Tech's primary business is that of research, development and production of security technologies for applications in the information and communications industries including mobile and cloud computing.
- HealthTell - HealthTell is a personalized medicine company developing tools for the diagnosis of human health and disease conditions based on patterns of immunological reactivity. The company is pioneering peptide array technology at densities never before achieved.
- IasoTek - IasoTek is a diagnostics company based on a revolutionary new method of analyte detection and reagent production for the diagnosis of Dengue fever. The company's development model is one of "frugal innovation," a paradigm becoming increasingly popular for developing inexpensive, robust, and easy-to-use products in emerging markets.
- ISW Technologies - ISW Technologies is an ASU Biodesign Impact Accelerator company that is housed in the ASU Biodesign Institute. The company is developing environmental testing technology that is based on the use of cartridges that allow pollutants to be concentrated at the monitoring site for later analysis in a remote laboratory.
- Material-Wave Interactions (MWI) Laboratory - MWI is applying its materials research expertise to producing radio frequency test devices in large scale and commercializing new application technologies of the materials for applications in aerospace and computer circuit board industries.
- SMALLab (Situating Multimedia Arts Learning Lab) - SMALLab Learning was founded with the mission of advancing embodied learning in schools and museums. The company offers embodied learning solutions that utilize motion capture technology to track students' 3D movements as they learn in immersive interactive space. The company has received a prestigious development grant of \$500,000 from Educause and the Gates Foundation.
- VProctor - Developing unique software algorithms coupled with computer hardware devices to minimize cheating in online education systems. The company uses a combination of software, webcams, and microphones to address the rising incidence of fraud in online education.

Technology Transfer

Other Notable Activities

- Head Start(up) 2011

On May 10th, 2011, AzTE joined with the tech transfer offices of Caltech, UCLA and USC to host Head Start(up) 2011, a half-day conference giving Silicon Valley investors visibility into each of the universities' most promising startups and venture-ready technologies. About 90 people attended the conference, with investors from top Silicon Valley venture funds, including Draper Fisher Jurvetson, Intel Capital, Khosla Ventures, Kleiner Perkins Caufield & Byers, Redpoint Ventures, and Sofinnova Ventures. The event underscored the value of providing a venue where venture capitalists could come and hear first-hand the best investment opportunities from multiple research institutions at one location convenient to their offices.

- Venture Catalyst

In October 2010, Arizona State University, together with AzTE, launched the ASU Venture Catalyst coincident with a \$1,000,000 grant from the Arizona Governor's office as part of the federal stimulus program for economic development. The Venture Catalyst at ASU provides a suite of venture acceleration services for ASU faculty, student and alumni companies as well as US and international firms in all stages of their development, growth and success. These services include entrepreneurial education, connections to mentors, capital formation, intellectual property assistance, access to faculty researchers, student interns and employee workforce development. Since the launch of the Venture Catalyst, 107 company inquiries (faculty, student, alumni, U.S. and global companies) have been evaluated. This has resulted in the identification of 47 high potential opportunities which are currently receiving services. Additionally, the ASU Venture Catalyst has assembled over 100 mentors who are accomplished entrepreneurs and business executives willing to provide voluntary assistance to Venture Catalyst companies in furtherance of local economic development.

This Page Intentionally Left Blank



Annual Research Report - FY2011

Northern Arizona University is proud to present the following summary of research performance and progress towards Enterprise goals for FY2011. As the institution with the smallest research portfolio among the state's three public universities, we recognize that our numerical contributions to the enterprise goals are modest; qualitatively, however, we make invaluable and unique contributions to outcomes for the state's citizens. Research at an institution such as ours is interwoven with the educational and public service activities that constitute our core university mission.

Historically, the university has drawn a greater share of its external research and development (R&D) funding from state and local sources than has its sister and peer institutions. This reflects our dedication to addressing the real-world, regional challenges most often funded by state agencies, regional municipalities and tribal governments. That dedication has been a strength for us, but of course it has also posed some challenges, as state agencies suffered from the faltering economy beginning in 2008. A key part of our research strategy over the past three years, then, has been a focus on increasing our competitiveness for federal funding, as well as more attention to overall diversity of funding sources for R&D.



Dr. Laura Huenneke, Vice
President for Research at
Northern Arizona University



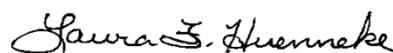
A notable example of research that has a direct impact on Northern Arizona is the exciting work being done on the use of acoustics to control and deter bark beetles, a species that is devastating state and national forests throughout the region. In this photo (left to right), David Dunn, undergraduate student Reagan McGuire and Dr. Richard Hofstetter listen to the sounds made by bark beetles. Their work has led to the development of a device (patent pending) that may eventually help forest managers as well as private landowners protect and preserve trees that are damaged and even killed by these beetles.

Research carried out by our faculty, staff, and students focuses heavily on those fields and issues that matter most to our neighbors, our region, and our students. These scholarly, creative, and technological efforts reflect the university's strategic priorities – environmental and regional stewardship and sustainability; service to tribal students and communities; health and bioscience; and diversity of culture. Furthermore, we are at the forefront of integrating research experiences and original contributions into the academic experience and overall success of undergraduate students.

This summary of research performance is perhaps most noteworthy and valuable because of the presentation of data from our 15 peer institutions. The benchmarking and comparisons are not indicative of direct competition—public Doctoral High-Research institutions are rarely focused on moving past one another for national rankings—but they are invaluable for assessing our relative effectiveness and for learning about best practices among universities of our type and mission. Northern Arizona University can demonstrate through these data that we perform extremely well—e.g., first in the peer group in biological science R&D funding – despite smaller investments in faculty and research facilities.

Over the past five years, we have made considerable progress as a research institution. In addition to increased R&D funding, especially from federal sources, we are demonstrating growing accountability to the state and to our partners. From astronomical research in the dark skies of Flagstaff to our annual Undergraduate Research Symposium; from the Partnership for Native American

Cancer Prevention to forest health and management options; from the genetics of emerging diseases to the future of water resources in the Colorado River basin—our increased effectiveness translates into impacts on the health of the state's citizens, the state's environment, and the state's economy.



Laura Foster Huenneke
Vice President for Research

Table of Contents

Enterprise Size	
Introduction	6
Selected Accomplishments	7
Total Research Expenditures	8
Average Growth Rate in Total Research Expenditures Over 3 years	9
Federally Financed Research Expenditures	10
Average Growth Rate in Federally Financed Research Expenditures Over 3 years	11
Net Research Square Feet	12
Total Research Expenditures per Square Foot	13
Total Faculty Population	14
Total Research Expenditures per Faculty	15
Discovery and Scholarly Impact	
Introduction	18
Selected Accomplishments	19
Invention Disclosures Transacted	20
Invention Disclosures Transacted per \$10 Million in Total Research Expenditures	21
U.S. Patents Issued	22
U.S. Patents Issued per \$10 Million in Total Research Expenditures	23
Economic Development	
Introduction	26
Selected Accomplishments	27
Licenses and Options Executed	28
Licenses and Options Executed per \$10 Million in Total Research Expenditures	29
Intellectual Property Income	30
Intellectual Property Income per \$10 Million in Total Research Expenditures	31
Startup Companies	32
Startup Companies per \$10 Million in Total Research Expenditures	33
Doctoral Degrees Conferred	34
Doctoral Degrees Conferred per \$10 Million in Total in Research Expenditures	35
Leadership and Recognition	
Introduction	38
Selected Accomplishments	39
National Academy Members	40
National Academy Members per \$10 Million in Total Research Expenditures	41
Technology Transfer Activity	
Introduction	44
Technology Transfer Statistical Exhibits	45
Selected Patents Issued	46
Selected Licenses and Options Executed	47
Selected Startup Companies	48
Other Notable Activities	49

This Page Intentionally Left Blank



Enterprise Size

For many public Doctoral High-Research institutions like Northern Arizona University, research is not pursued for the sake of growth in dollars or improvement in rankings, but for the purpose of enhancing educational quality and contributing to regional vitality. While we aim to contribute proportionally to the enterprise goal of doubling total research expenditures, we are more focused on maintaining and increasing our funding in a few specific and strategic research areas. Northern Arizona University is also striving to find external (especially federal and private) sources of dollars to replace and enhance state support for instruction, public service, and capital projects, increasing our accountability to the citizens of Arizona.

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 (near \$10M). With research expenditures ranging between \$25M and \$30M each year, we are neither near the top nor near the bottom of our peers. Some of those peers are clearly aimed at increasing research expenditures greatly; our growth has been modest. A key area of growth is in federal research expenditures, because we were initially more dependent on state sources of research funding than most of our peers. The shift has clearly been successful, as federal funding continues to reach new highs and in the past year we achieved an 18 percent increase (year over year) in federal R&D. Because such a large fraction of our sponsored projects are not in R&D (in the formal sense) but in public service and instructional projects, much of the growth in sponsored projects activity continues to be there rather than reflected in NSF-reported numbers.

Research Space

The university has been making significant investments as appropriate to improve our competitive performance in selected areas of importance to the state and region. Overall the size of our research space is modest relative to our peers (ranked 12 in the group of 16), but the trend is upward. In terms of productivity, we are squarely in the middle range of the peer group in terms of R&D expenditures per square foot of research space. New space added over the past couple of years has been designed to serve both instructional and research purposes (the new Science Laboratory Facility for biological sciences and chemistry); we continue to invest in renovating and using more efficiently some of the facilities not originally designed for modern research activities (e.g., Engineering).



The Science Laboratory Facility located on NAU's Flagstaff Mountain Campus.

Faculty Numbers and Research Personnel

Northern Arizona University has long been toward the bottom of its peer group with respect to numbers of tenured/tenure track faculty members, and trends in faculty numbers are of concern to us. Tenured/tenure-track numbers are decreasing, even as enrollment has increased dramatically. Retirement incentives and budget reductions have replaced tenured faculty in some areas with instructors and lecturers who do not have research expectations. However, the effectiveness of our tenured/tenure-track faculty (research expenditures per faculty member) has increased nearly 30 percent over the past four years. The institution is also increasing its emphasis on Research (non-tenure-track, soft-money) Faculty and postdoctoral associates to maintain strength in research and mentoring of graduate students in select areas. Having very few doctoral degree programs on campus also limits the ability of faculty to pursue funded research in some disciplines; during 2011 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.

Enterprise Size

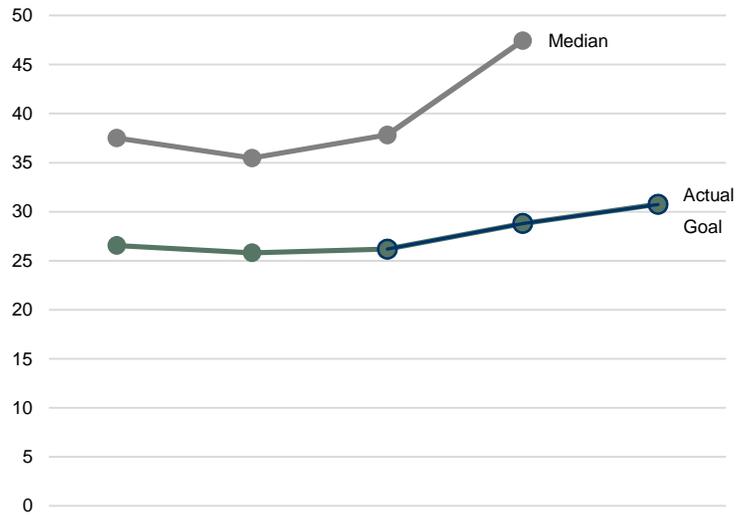
Selected Accomplishments



- Federal research expenditures increased from \$15M to \$18M in the past year, continuing a steady increase since 2007.
- A very high priority for Northern Arizona University has been a focused effort on increasing indirect cost recovery. From 2007 to 2011, the amount of indirect cost requested in external proposals increased from \$17.6M to \$26.1M; in 2011, the amount of indirect cost recovery in new awards was at an all-time high, \$7.9 million. The effective rate of recovery has nearly doubled over the past five years, reflecting both the shift from state to federal sources (state agencies are typically reluctant to pass indirect cost recovery to the university) and a change in campus culture and sponsored project management.
- Talented individuals were hired into Research Faculty positions and provided with incentives for expanded proposal-writing activity in several key areas (primarily the Center for Microbial Genetics and Genomics, and the environmental sciences).
- Northern Arizona University partnered with Science Foundation Arizona in hiring the state's first Bisgrove Postdoctoral Scholar, recruiting **Dr. Ophelia Wang** to join the Laboratory of Landscape Ecology and Conservation Biology. Dr. Wang graduated from universities in Costa Rica, Panama, and Taiwan before receiving her Ph.D. in Geography and the Environment at the University of Texas. Dr. Wang was awarded the NSF Doctoral Dissertation Research Improvement Grant for her dissertation.

Enterprise Size

Total Research Expenditures (in Millions)

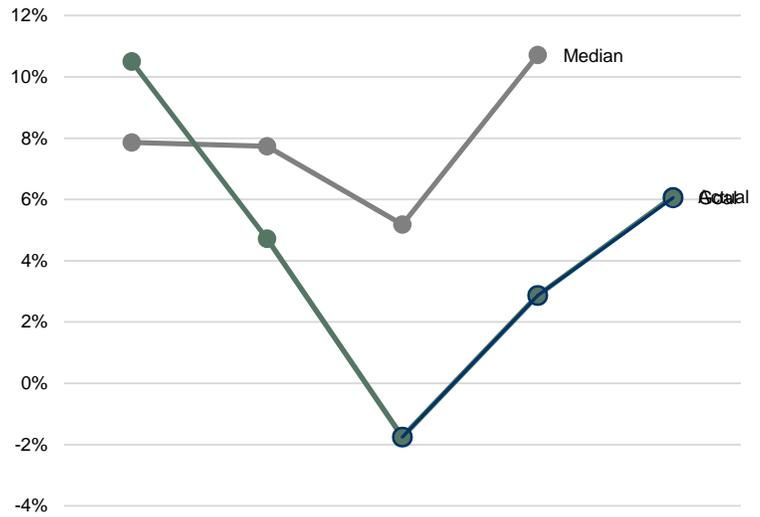


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	26.6	25.8	26.2	28.8	30.8
Goal			26.2	28.8	30.8
Difference			0.0	0.0	0.0

ABOR Peer Group	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
University of Maine		96.1	95.0	100.6	111.3		1
Old Dominion University		52.1	66.5	71.9	97.2		2
George Mason University		58.3	72.5	78.5	84.1		3
Georgia State University		51.4	77.7	60.6	81.0		4
Southern Illinois University - Carbondale	X	64.7	67.1	66.3	69.9		5
University of Akron		27.1	27.2	34.5	52.9		6
Wichita State University		47.4	47.9	66.0	51.5		7
Ohio University	X	38.7	38.1	41.3	50.4		8
University of Nevada - Las Vegas		56.0	50.8	39.1	44.5		9
University of Alabama		36.4	32.8	36.5	40.8		10
Northern Arizona University		26.6	25.8	26.2	28.8	30.8	11
Northern Illinois University		16.7	14.9	20.6	27.0		12
Western Michigan University		17.2	14.6	13.3	26.4		13
Kent State University - Kent		19.0	23.3	25.1	26.3		14
University of North Carolina - Greensboro		6.1	7.9	10.4	22.4		15
Bowling Green State University		9.1	10.7	8.4	8.1		16
Median		37.5	35.5	37.8	47.4		

Enterprise Size

Average Growth Rate in Total Research Expenditures Over 3 Years

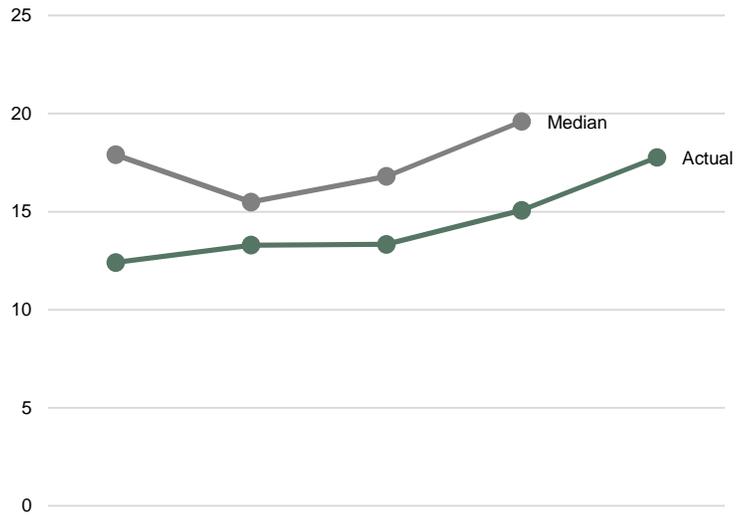


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	10.5%	4.7%	-1.8%	2.9%	6.1%
Goal			-1.8%	2.9%	6.1%
Difference			0.0%	0.0%	0.0%

ABOR Peer Group	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
University of North Carolina - Greensboro		18.3%	18.3%	20.5%	58.8%		1
University of Akron		-0.3%	0.5%	7.5%	26.8%		2
Western Michigan University		8.0%	-5.6%	-9.5%	24.8%		3
Old Dominion University		15.2%	12.8%	13.3%	23.6%		4
Georgia State University		4.3%	17.9%	8.9%	21.0%		5
Northern Illinois University		14.9%	12.6%	9.4%	19.5%		6
George Mason University		8.7%	19.4%	16.1%	13.3%		7
Kent State University - Kent		19.6%	31.5%	33.9%	11.7%		8
Ohio University	X	0.5%	-3.9%	2.9%	9.7%		9
Wichita State University		18.5%	15.7%	29.2%	5.6%		10
University of Maine		6.6%	8.7%	2.6%	5.1%		11
University of Alabama		1.2%	-1.5%	1.7%	4.4%		12
Northern Arizona University		10.5%	4.7%	-1.8%	2.9%	6.1%	13
Southern Illinois University - Carbondale	X	7.7%	6.8%	-3.5%	2.7%		14
Bowling Green State University		3.8%	3.7%	-4.1%	-2.5%		15
University of Nevada - Las Vegas		7.5%	2.3%	-11.3%	-6.2%		16
Median		7.9%	7.7%	5.2%	10.7%		

Enterprise Size

Federally Financed Research Expenditures (in Millions)

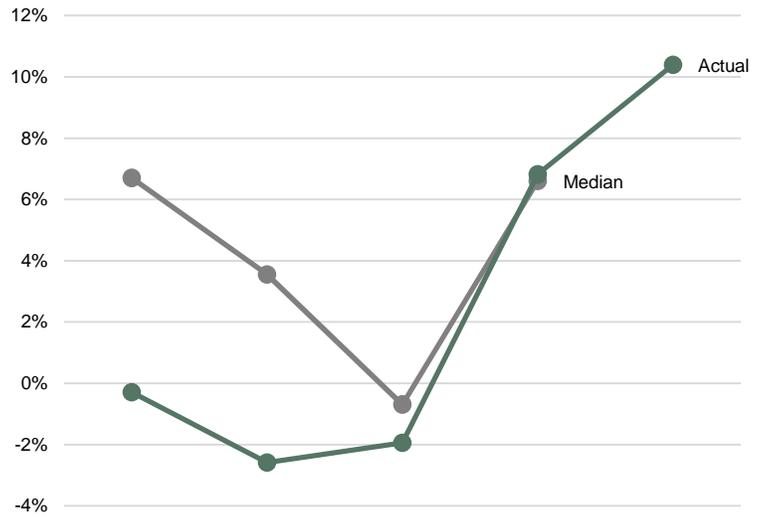


	2007	2008	2009	2010	2011
Actual	12.4	13.3	13.3	15.1	17.8

	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
ABOR Peer Group							
George Mason University		46.6	50.4	55.7	63.0		1
University of Maine		42.0	40.9	47.3	50.2		2
Old Dominion University		25.7	28.3	27.6	34.7		3
University of Nevada - Las Vegas		48.6	41.5	31.3	32.4		4
Georgia State University		24.6	26.3	24.0	27.1		5
University of Alabama		27.7	23.4	23.9	26.4		6
Southern Illinois University - Carbondale	X	17.7	17.5	19.2	22.2		7
Western Michigan University		10.3	8.6	8.1	19.7		8
University of North Carolina - Greensboro		5.3	6.3	8.5	19.5		9
Ohio University	X	18.6	18.2	16.5	18.5		10
Northern Illinois University		13.0	11.6	17.1	17.3		11
Northern Arizona University		12.4	13.3	13.3	15.1	17.8	12
Kent State University - Kent		9.8	12.5	13.3	14.6		13
Wichita State University		18.1	13.5	12.2	13.8		14
University of Akron		11.2	9.3	11.0	12.1		15
Bowling Green State University		6.3	5.9	4.3	5.0		16
Median		17.9	15.5	16.8	19.6		

Enterprise Size

Average Growth Rate in Federally Financed Research Expenditures Over 3 Years

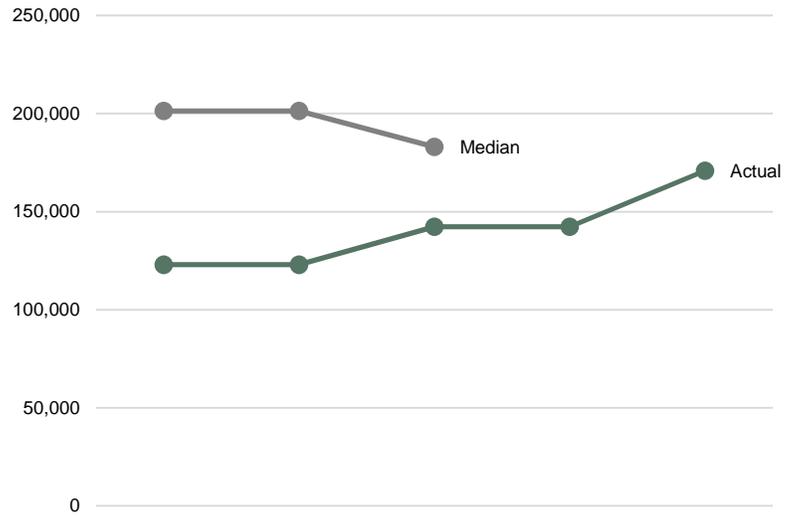


	2007	2008	2009	2010	2011
Actual	-0.3%	-2.6%	-1.9%	6.8%	10.4%

ABOR Peer Group	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
University of North Carolina - Greensboro		18.0%	18.6%	18.7%	61.1%		1
Western Michigan University		9.7%	-10.4%	-10.2%	40.7%		2
Kent State University - Kent		3.6%	18.1%	17.8%	14.5%		3
Northern Illinois University		25.1%	16.1%	16.0%	12.6%		4
Old Dominion University		6.8%	5.3%	0.4%	11.1%		5
George Mason University		6.6%	12.1%	16.1%	10.6%		6
Southern Illinois University - Carbondale	X	5.2%	1.8%	-1.1%	8.0%		7
Northern Arizona University		-0.3%	-2.6%	-1.9%	6.8%	10.4%	8
University of Maine		7.9%	14.0%	4.8%	6.4%		9
University of Akron		3.1%	-2.6%	-0.3%	3.8%		10
Georgia State University		-1.7%	1.4%	-1.1%	3.7%		11
Ohio University	X	-3.7%	-4.2%	-5.5%	0.1%		12
University of Alabama		3.8%	-0.2%	2.7%	-1.1%		13
Bowling Green State University		7.1%	-1.8%	-5.7%	-5.9%		14
Wichita State University		20.7%	18.5%	-7.9%	-7.4%		15
University of Nevada - Las Vegas		20.3%	6.0%	-8.5%	-11.8%		16
Median		6.7%	3.6%	-0.7%	6.6%		

Enterprise Size

Net Assignable Square Feet

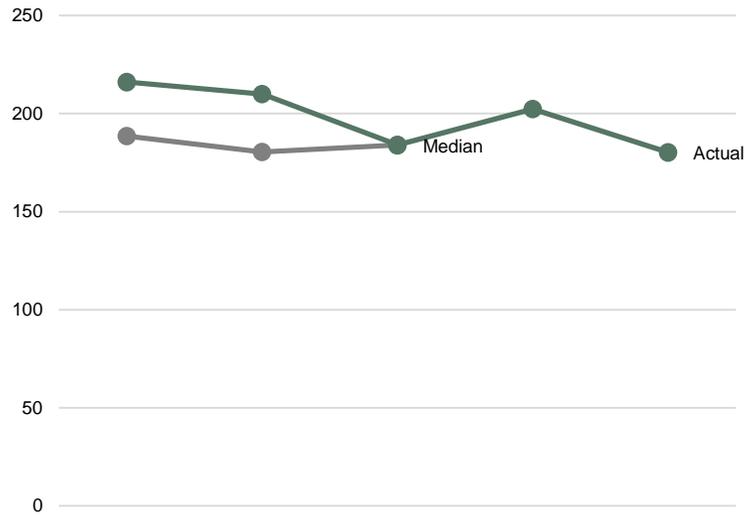


	2007	2008	2009	2010	2011
Actual	122,955	122,955	142,340	142,340	170,831

ABOR Peer Group	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
University of Maine		614,399	614,399	643,390			1
Ohio University	X	321,719	321,719	331,694			2
Southern Illinois University - Carbondale	X	335,086	335,086	328,265			3
Old Dominion University		223,237	223,237	263,988			4
Wichita State University		216,294	216,294	220,272			5
Georgia State University		198,532	198,532	198,532			6
University of Alabama		204,331	204,331	183,990			7
Kent State University - Kent				183,065			8
University of Nevada - Las Vegas		126,918	126,918	181,955			9
Bowling Green State University		173,816	173,816	170,600			10
George Mason University		125,414	125,414	161,103			11
Northern Arizona University		122,955	122,955	142,340	142,340	170,831	12
Northern Illinois University		279,758	279,758	122,986			13
University of North Carolina - Greensboro		111,868	111,868	97,658			14
Western Michigan University		93,353	93,353	83,055			15
University of Akron							
Median		201,432	201,432	183,065			

Enterprise Size

Total Research Expenditures per Net Assignable Square Foot

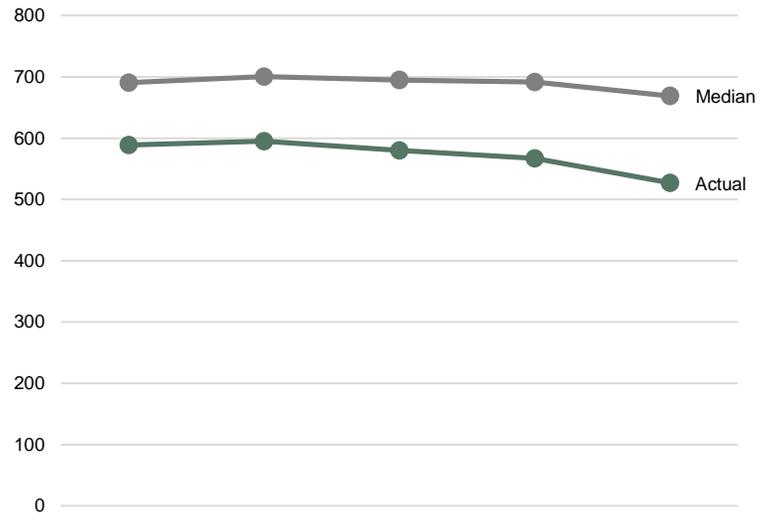


	2007	2008	2009	2010	2011
Actual	216	210	184	202	180

	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
ABOR Peer Group							
George Mason University		464	578	487			1
Georgia State University		259	391	305			2
Wichita State University		219	221	300			3
Old Dominion University		234	298	272			4
University of Nevada - Las Vegas		441	400	215			5
Southern Illinois University - Carbondale	X	193	200	202			6
University of Alabama		178	161	198			7
Northern Arizona University		216	210	184	202	180	8
Northern Illinois University		60	53	168			9
Western Michigan University		184	157	160			10
University of Maine		156	155	156			11
Kent State University - Kent				137			12
Ohio University	X	120	118	124			13
University of North Carolina - Greensboro		55	70	106			14
Bowling Green State University		52	62	49			15
University of Akron							
Median		189	180	184			

Enterprise Size

Total Faculty Population

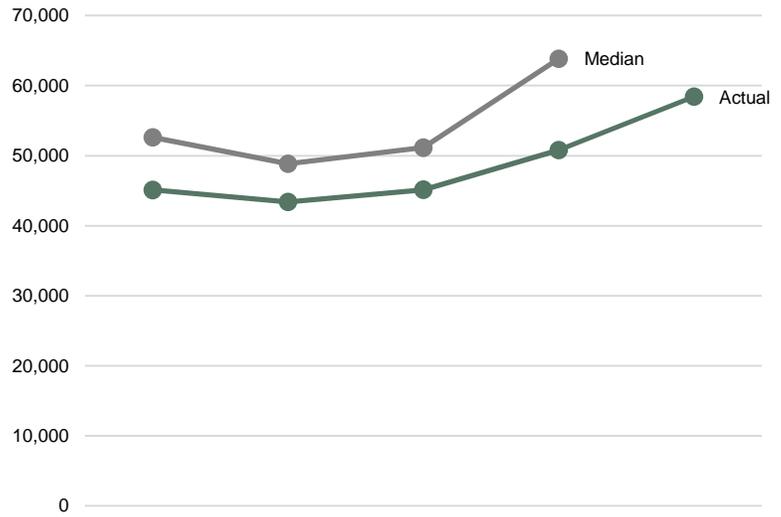


	2007	2008	2009	2010	2011
Actual	589	595	580	567	527

	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
ABOR Peer Group							
Ohio University	X	938	919	881	898	886	1
George Mason University		809	856	877	885	882	2
University of Akron		797	830	803	823	848	3
Southern Illinois University - Carbondale	X	847	836	853	860	841	4
Western Michigan University		804	805	819	828	829	5
Georgia State University		712	735	746	739	736	6
Northern Illinois University		745	745	758	758	732	7
University of Nevada - Las Vegas		711	724	706	699	672	8
Kent State University - Kent		670	677	684	684	666	9
University of Alabama		605	605	619	636	636	10
University of North Carolina - Greensboro		537	546	553	573	593	11
Old Dominion University		524	516	528	525	553	12
Northern Arizona University		589	595	580	567	527	13
Bowling Green State University		591	596	557	533	508	14
University of Maine		491	486	480	466	449	15
Wichita State University		407	402	401	378	360	16
Median		691	701	695	692	669	

Enterprise Size

Total Research Expenditures per Faculty



	2007	2008	2009	2010	2011
Actual	45,104	43,395	45,143	50,799	58,416

ABOR Peer Group	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
University of Maine		195,794	195,560	209,542	238,803		1
Old Dominion University		99,492	128,950	136,191	185,097		2
Wichita State University		116,457	119,037	164,559	136,307		3
Georgia State University		72,173	105,727	81,176	109,628		4
George Mason University		72,005	84,745	89,495	95,051		5
Southern Illinois University - Carbondale	X	76,391	80,256	77,744	81,307		6
University of Akron		34,050	32,749	42,973	64,258		7
University of Alabama		60,136	54,291	58,979	64,091		8
University of Nevada - Las Vegas		78,810	70,131	55,450	63,601		9
Ohio University	X	41,227	41,467	46,829	56,169		10
Northern Arizona University		45,104	43,395	45,143	50,799	58,416	11
University of North Carolina - Greensboro		11,415	14,425	18,796	39,155		12
Kent State University - Kent		28,360	34,406	36,623	38,496		13
Northern Illinois University		22,430	20,064	27,235	35,668		14
Western Michigan University		21,371	18,158	16,241	31,873		15
Bowling Green State University		15,431	17,973	15,074	15,242		16
Median		52,620	48,843	51,140	63,846		

This Page Intentionally Left Blank

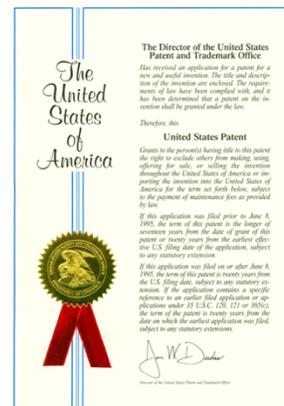


Discovery and Scholarly Impact

Research—the discovery, dissemination, and application of new understanding and innovations—is best measured not in dollars spent or in numbers of grant awards but in the impact achieved on individuals, society, and the environment. 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

In 2008, Northern Arizona University restructured its technology transfer operations to respond to a statewide performance audit and to ensure a closer connection between campus research and regional economic development. In 2010, the university entered into a partnership with NAU Ventures, a limited liability corporation established by the NAU Foundation for the purpose of facilitating the commercialization of university-owned inventions through startup companies that will create jobs for Arizonans. In FY11, Northern Arizona University, NAU Ventures and NACET (Northern Arizona Center for Entrepreneurship and Technology) began a cooperative effort to catalyze the discovery and innovation process on campus, to translate university intellectual property into commercial goods and services for the public benefit and to enhance the university's ability to attract industry funding to continue these efforts.



The starting point for the commercialization and translation of university research is the disclosure of innovations as “inventions.” As more and more faculty members learn the value and potential of their research, the numbers of invention disclosures have climbed. In 2011, we began implementing a technology transfer “in-reach” program—a plan to meet with every faculty member/principal investigator currently performing funded research at the Mountain Campus. In doing so, we not only keep current on the research programs of our faculty, but we are able to educate our researchers about the potential commercial applications of their work. This in-reach program has already generated a number of invention disclosures.

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 now seeing the results of discoveries and decisions (about those discoveries) made five or more years ago. However, we are enthusiastic about the future of our technology transfer program; we have a number of patents pending and expect that, in a few short years, we will be reaping the benefits of discoveries and decisions (about those discoveries) being made now. 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.

Publication and Citation

As noted above, we believe that published, peer-reviewed work is an important measure of the quality and impact of our researchers' activities. The Web of Science InCites database confirms that our strongest publication areas are in the subject areas of Ecology, Environmental Sciences, Geosciences, Forestry, and Astronomy & Astrophysics. In 2011, researchers at Northern Arizona University were authors or co-authors on 197 published articles.

- A comparison with our peers shows that we have consistently led our peer group (being first or second between 2005 and 2010) in publications reported in Web of Science in the fields of Biodiversity Conservation, Forestry and Ecology. In 2010, the university led its peers in citations per document (impact) in Forestry (first), Biodiversity Conservation (third) and Plant Sciences (third).
- Ecosystems are not as efficient in counteracting the effects of global warming as once believed, according to a study led by NAU visiting research fellow **Kees Jan van Groenigen**, co-author Professor **Bruce Hungate** and colleagues at the University of Florida. The study, "Increased Soil Emissions Of Potent Greenhouse Gases Under Increased Atmospheric Carbon Dioxide," published in *Nature* in 2011, details how the research team found the opposite is occurring in several regions in the world—higher levels of carbon dioxide in the atmosphere triggers soil to release methane and nitrous oxide, two potent greenhouse gases. The study concluded that the feedback to our changing atmosphere means that nature is not as efficient in slowing global warming as had been previously thought.
- We exceeded our goals for number of inventions disclosed in FY2011.
- **César Fuentes**, postdoctoral researcher of physics and astronomy, and **David Trilling**, assistant professor of physics and astronomy, published "Trans-Neptunian Objects with Hubble Space Telescope ACS/WFC" in the *Astrophysical Journal*. The paper outlines research conducted by NAU, Harvard and NASA scientists that used Hubble photographs to calculate the space objects' size and distance from the sun based on their location, brightness and reflectivity. Fuentes told *Space* magazine, "Trans-Neptunian objects interest us because they are building blocks left over from the formation of the solar system."
- Analysis of a primitive meteorite from Northern Arizona University's Meteorite Repository Collection resulted in it being declared 4.568 billion years old—the oldest known material in the solar system. The finding by ASU researchers was published in *Nature Geoscience* and *Scientific American*.
- **Scott Anderson**, paleoecology and environmental sciences professor in the School of Earth Sciences and Environmental Sustainability, and **Susan J. Smith**, senior research specialist at Bilby Research Center, published the study, "Extended Megadroughts in the Southwestern United States During Pleistocene Interglacials," in *Nature*, the prestigious international journal of science. While the historical record they examined—preserved in sediment cores removed from Valle Caldera in New Mexico—provided insight into the climate and environment 250,000 to 500,000 years ago, the findings may have implications for future resource management in the region, and concluded that the southwest is trending towards drier, warmer conditions. "We are trending toward drier, warmer conditions," Anderson said. "In the record, under natural conditions, the monsoons failed, and that period lasted hundreds of years. Natural conditions could be compounded by the effects of human-caused climate change, perhaps flipping us into a different climate state, with a greater likelihood of seeing a 'megadrought' in the region that will could last for centuries."



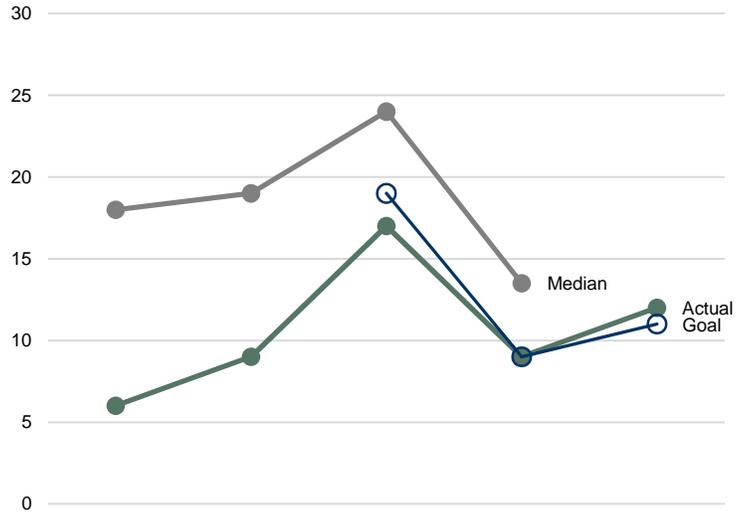
Increasing amounts of carbon dioxide absorbed by plants triggers a release of nitrous oxide and methane. Artist's rendering by Victor Leshyk.



Our NWA 2364 meteorite, which ASU scientists recently declared as the oldest known material in the solar system.

Discovery and Scholarly Impact

Invention Disclosures Transacted

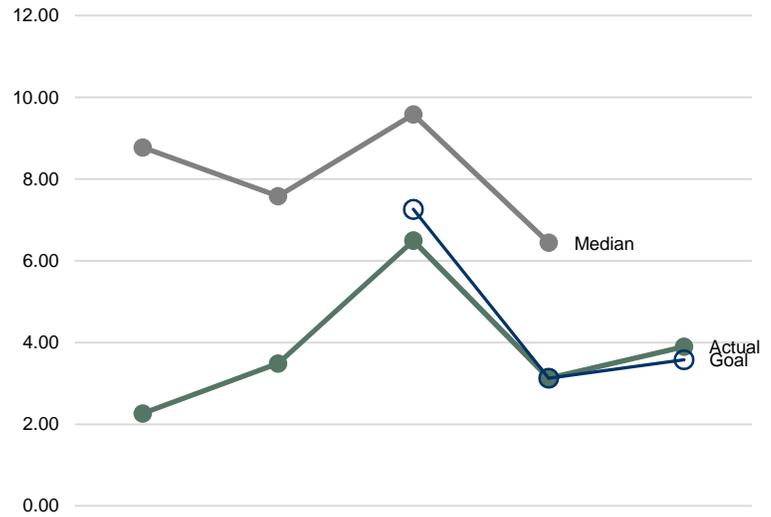


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	6	9	17	9	12
Goal			19	9	11
Difference			-2	0	1

ABOR Peer Group	Med. Sch. AUTM Adj.	2007	2008	2009	2010	2011	Rank
George Mason University		64	55	55	61		1
University of Akron		71	46	58	38		2
University of Alabama		46	38	41	31		3
Kent State University - Kent		14	20	24	15		4
University of North Carolina - Greensboro		18	19	16	12		5
Northern Illinois University			13	6	11		6
Bowling Green State University		8	8	12	9		7
Northern Arizona University		6	9	17	9	12	7
Georgia State University			8				
Ohio University	X	43	24	39			
Old Dominion University							
Southern Illinois University - Carbondale	X	21	35				
University of Maine							
University of Nevada - Las Vegas		15					
Western Michigan University		15	15				
Wichita State University			16				
Median		18	19	24	14		

Discovery and Scholarly Impact

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

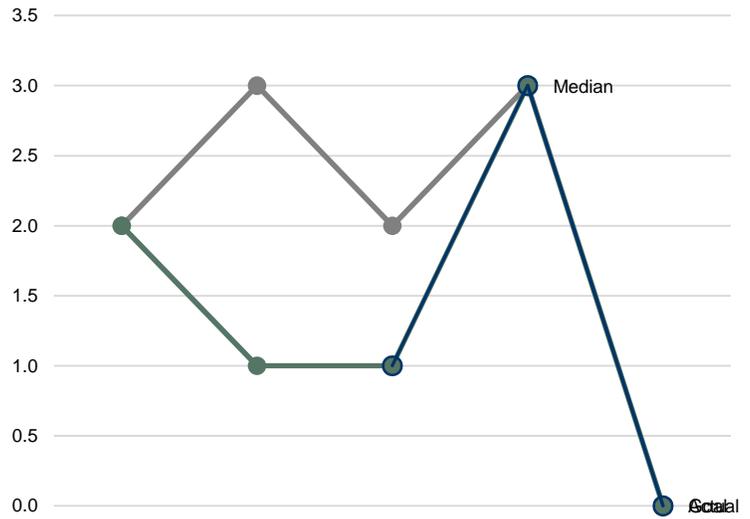


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	2.3	3.5	6.5	3.1	3.9
Goal			7.3	3.1	3.6
Difference			-0.8	0.0	0.3

ABOR Peer Group	Med. Sch. NSF Adj. AUTM Adj.	2007	2008	2009	2010	2011	Rank
Bowling Green State University		8.8	7.5	14.3	11.1		1
University of Alabama		12.6	11.6	11.2	7.6		2
George Mason University		11.0	7.6	7.0	7.3		3
University of Akron		26.2	16.9	16.8	7.2		4
Kent State University - Kent		7.4	8.6	9.6	5.7		5
University of North Carolina - Greensboro		29.4	24.1	15.4	5.3		6
Northern Illinois University			8.7	2.9	4.1		7
Northern Arizona University		2.3	3.5	6.5	3.1	3.9	8
Georgia State University			1.0				
Ohio University	X	11.1	6.3	9.5			
Old Dominion University							
Southern Illinois University - Carbondale	X	3.2	5.2				
University of Maine							
University of Nevada - Las Vegas		2.7					
Western Michigan University		8.7	10.3				
Wichita State University			3.3				
Median		8.8	7.6	9.6	6.4		

Discovery and Scholarly Impact

U.S. Patents Issued

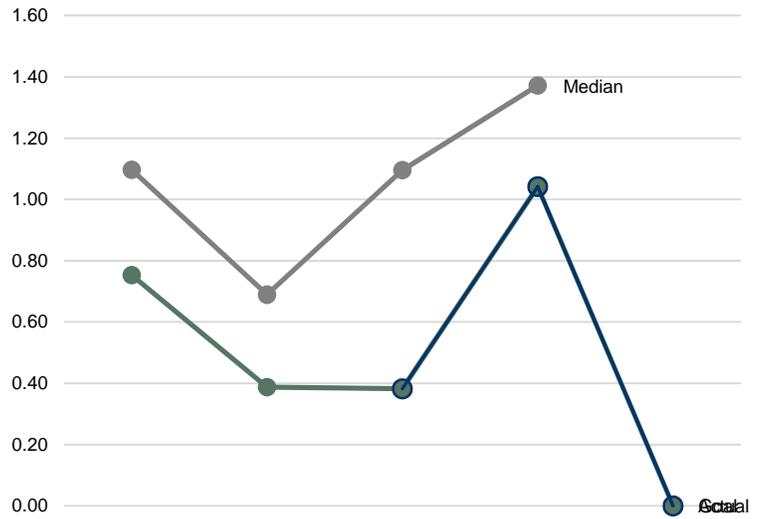


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	2	1	1	3	0
Goal			1	3	0
Difference			0	0	0

ABOR Peer Group	Med. Sch. AUTM Adj.	2007	2008	2009	2010	2011	Rank
George Mason University		9	5	7	24		1
University of Akron		12	4	8	9		2
Kent State University - Kent		7	8	3	8		3
Bowling Green State University		1	0	1	3		4
Northern Arizona University		2	1	1	3	0	4
Northern Illinois University			0	2	1		6
University of Alabama		0	4	4	1		6
University of North Carolina - Greensboro		2	2	2	0		8
Georgia State University			8				
Ohio University	X	5	5	2			
Old Dominion University							
Southern Illinois University - Carbondale	X	4	3				
University of Maine							
University of Nevada - Las Vegas		0					
Western Michigan University		0	0				
Wichita State University			0				
Median		2	3	2	3		

Discovery and Scholarly Impact

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



ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	0.8	0.4	0.4	1.0	0.0
Goal			0.4	1.0	0.0
Difference			0.0	0.0	0.0

ABOR Peer Group	Med. Sch. NSF Adj. AUTM Adj.	2007	2008	2009	2010	2011	Rank
Bowling Green State University		1.1	0.0	1.2	3.7		1
Kent State University - Kent		3.7	3.4	1.2	3.0		2
George Mason University		1.5	0.7	0.9	2.9		3
University of Akron		4.4	1.5	2.3	1.7		4
Northern Arizona University		0.8	0.4	0.4	1.0	0.0	5
Northern Illinois University			0.0	1.0	0.4		6
University of Alabama		0.0	1.2	1.1	0.2		7
University of North Carolina - Greensboro		3.3	2.5	1.9	0.0		8
Georgia State University			1.0				
Ohio University	X	1.3	1.3	0.5			
Old Dominion University							
Southern Illinois University - Carbondale	X	0.6	0.4				
University of Maine							
University of Nevada - Las Vegas		0.0					
Western Michigan University		0.0	0.0				
Wichita State University			0.0				
Median		1.1	0.7	1.1	1.4		

This Page Intentionally Left Blank



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. Technology transfer activity, translating university innovations into commercial impacts and business activity, is an important element of the university's economic impact. The university has radically improved and rebuilt its TT operations since 2008; we now have more appropriate support, policies, and infrastructure to enhance the movement of university innovation into the private sector. The initial focus in our creation of "NAU Ventures" was to stimulate an increase in invention disclosures and then growth in licensing agreements, revenues, and startups; only now are we seeing the fruits of those efforts. Meanwhile NAU Ventures, LLC, has been formed to provide an explicit mechanism for working more smoothly with startup enterprises; the collaboration of the NAU Foundation with the existing partnership between the university's Research Division and our local incubator, NACET (Northern Arizona Center for Entrepreneurship and Technology), adds an exciting option to our repertoire.

Licensing and Intellectual Property Income

Numbers of (and revenues from) licensing agreements do not yet reflect the increased emphasis on technology transfer activities at Northern Arizona University. While the university's performance lags that of the best of our peers, performance is modest in the peer group overall; several of our peer institutions do not report at all to the Association of University Technology Managers (AUTM), reflecting a lack of overall focus in this area. At least two of our patented technologies made significant progress toward market during FY11, indicating the possibility of some royalty income over the next year.

Startup Companies

Only about half of our peer institutions report any startup company activity over the past few years. Our close relationship with NACET, as well as the maturing of some research-based technologies, is anticipated to increase our modest number of university-affiliated startups over the next few years. During FY11 Northern Arizona University used a grant from the Arizona Governor's Office of Economic Recovery to establish a student incubator program (in partnership with NACET), and student teams will be launching their businesses with support from the incubator during FY12.

Doctoral Degrees Granted

Northern Arizona University offers relatively few doctoral degree programs, and numbers of doctoral graduates are 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 FY11 opens the door to new students and productivity in one of the university's core strengths.

Public Service Expenditures

An additional important aspect of economic development is the direct impact of funding flowing through the institution as sponsored projects, especially funds from outside the state (e.g., federal). A third of the university's sponsored projects portfolio is awards for sponsored 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.



Economic Development

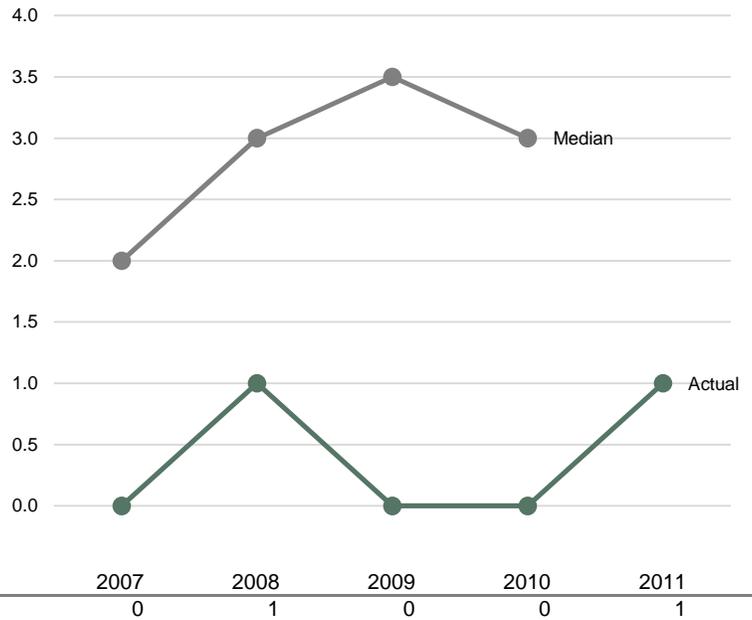
Selected Accomplishments



- The university signed a license agreement with BTE Technologies for rights to commercialize the Eccentron™, a recumbent exercise machine that allows a user to perform eccentric (or 'negative') exercise which involves muscles resisting force rather than producing force. The Eccentron™ capitalizes on the unique combination of benefits from eccentric muscular activity plus low cardiac demand to provide a key advantage over other products on the market. The Eccentron™ will be NAU's first commercial product in the global marketplace.
- The university and NACET each received a \$500,000 grant from the Governor's Office of Economic Recovery (GOER) to strengthen the relationship between NAU and NACET. As part of that collaboration, NACET and the university established a bricks-and-mortar business incubator exclusively for students, "LaunchBox," in facilities being leased at Flagstaff Pulliam Airport. Support under this grant was also used to help establish AZ Core Labs, a consortium of laboratories across the State that provides testing and analytical services to business incubator clients, university researchers and industry.
- We reallocated staff effort to increase economic development activities.
- The new Professional Science Master's degree program in Climate Science and Solutions—launched with NSF grant funding, attracted a full cohort of students in FY11. These students are now approaching graduation and finding employment.
- The President's *University Economic Impact Study* showed enormous statewide impact of our direct spending including funds that are generated through sponsored projects.
- Public service awards were 23% of total new awards in FY10, 33% of new award dollars in FY11.
- TGen and Northern Arizona University licensed jointly-owned technologies to Pathogene, a medical diagnostics start-up company based in Flagstaff (a NACET client).

Economic Development

Licenses and Options Executed

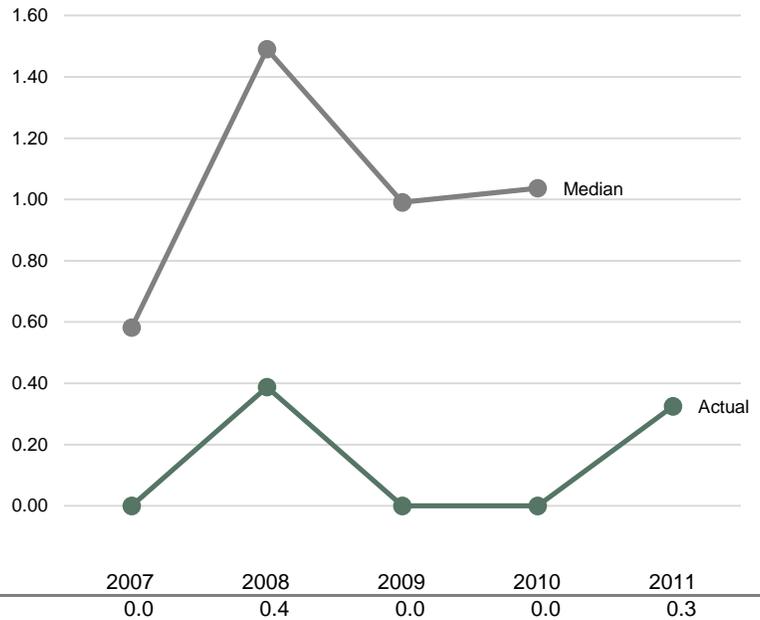


Actual

ABOR Peer Group	Med. Sch. AUTM Adj.	2007	2008	2009	2010	2011	Rank
University of Akron		5	10	4	10		1
Kent State University - Kent		6	6	6	8		2
George Mason University		2	13	4	6		3
University of Alabama		5	5	3	3		4
University of North Carolina - Greensboro		1	5	8	3		4
Bowling Green State University		0	2	3	2		6
Northern Arizona University		0	1	0	0	1	7
Northern Illinois University			0		0		7
Georgia State University			0				
Ohio University	X	1	3	1			
Old Dominion University							
Southern Illinois University - Carbondale	X	6	10				
University of Maine							
University of Nevada - Las Vegas		3					
Western Michigan University		1	1				
Wichita State University			0				
Median		2	3	4	3		

Economic Development

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

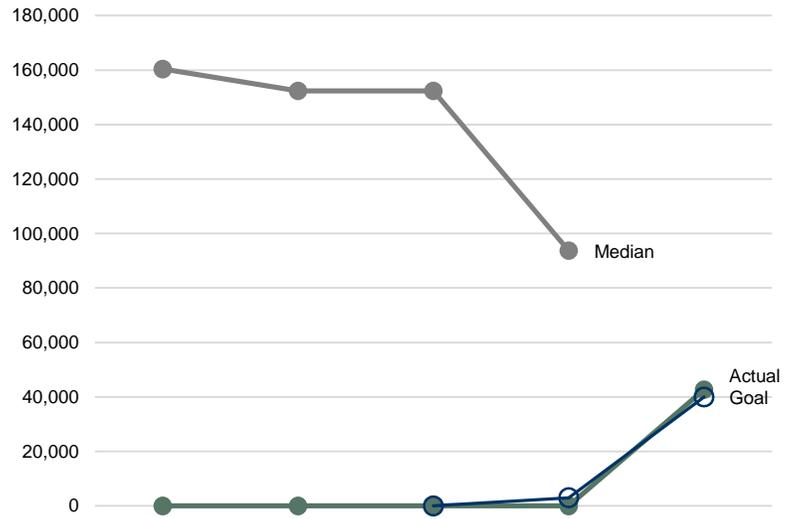


Actual

	Med. Sch. NSF Adj. AUTM Adj.	2007	2008	2009	2010	2011	Rank
ABOR Peer Group							
Kent State University - Kent		3.2	2.6	2.4	3.0		1
Bowling Green State University		0.0	1.9	3.6	2.5		2
University of Akron		1.8	3.7	1.2	1.9		3
University of North Carolina - Greensboro		1.6	6.3	7.7	1.3		4
University of Alabama		1.4	1.5	0.8	0.7		5
George Mason University		0.3	1.8	0.5	0.7		6
Northern Arizona University		0.0	0.4	0.0	0.0	0.3	7
Northern Illinois University			0.0		0.0		7
Georgia State University			0.0				
Ohio University	X	0.3	0.8	0.2			
Old Dominion University							
Southern Illinois University - Carbondale	X	0.9	1.5				
University of Maine							
University of Nevada - Las Vegas		0.5					
Western Michigan University		0.6	0.7				
Wichita State University			0.0				
Median		0.6	1.5	1.0	1.0		

Economic Development

Intellectual Property Income

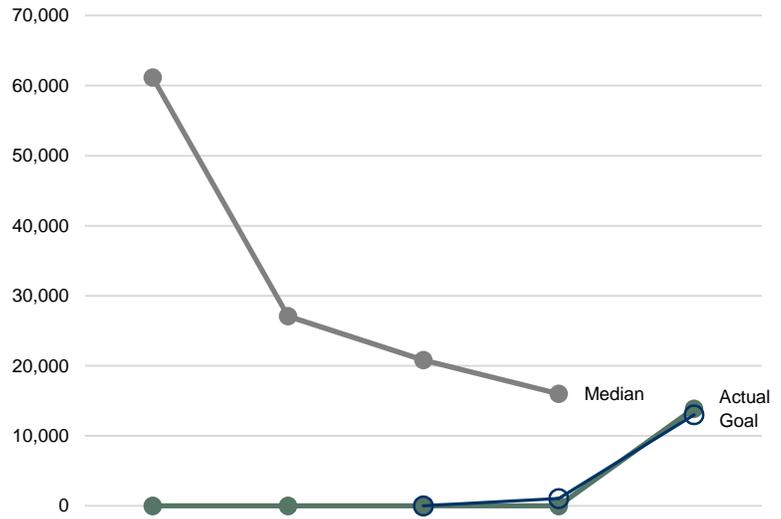


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	0	0	0	0	42,684
Goal			0	3,000	40,000
Difference			0	-3,000	2,684

ABOR Peer Group	Med. Sch. AUTM Adj.	2007	2008	2009	2010	2011	Rank
Kent State University - Kent		433,010	351,680	339,444	401,233		1
University of Akron		6,328,239	1,122,879	454,625	202,226		2
University of North Carolina - Greensboro		170,732	200,744	152,354	120,523		3
George Mason University		69,542	104,007	163,444	110,375		4
University of Alabama		150,000	38,163	5,005	77,051		5
Northern Illinois University			36,195	19,500	10,378		6
Bowling Green State University		0	8,000	10,500	6,335		7
Northern Arizona University		0	0	0	0	42,684	8
Georgia State University			233,000				
Ohio University	X	4,412,900	5,872,011	6,875,069			
Old Dominion University							
Southern Illinois University - Carbondale	X	524,584	776,102				
University of Maine							
University of Nevada - Las Vegas		26,500					
Western Michigan University							
Wichita State University			0				
Median		160,366	152,376	152,354	93,713		

Economic Development

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

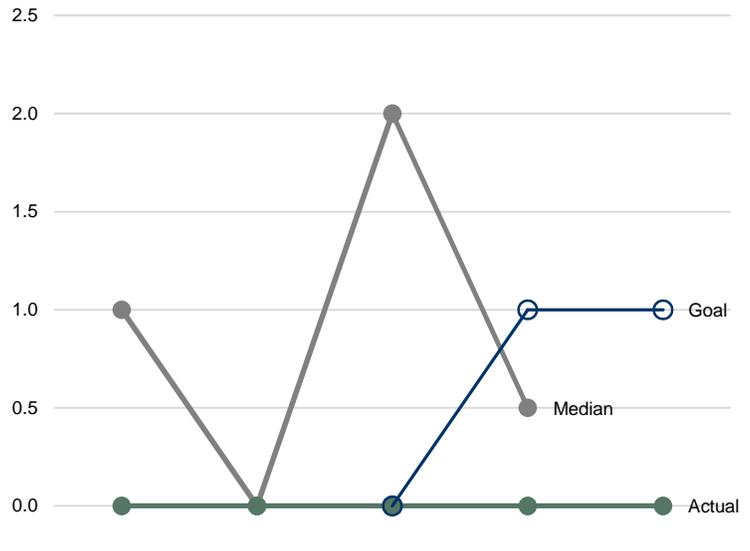


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	0	0	0	0	13,865
Goal			0	1,042	13,008
Difference			0	-1,042	857

ABOR Peer Group	Med. Sch. NSF Adj. AUTM Adj.	2007	2008	2009	2010	2011	Rank
Kent State University - Kent		227,888	150,981	135,507	152,380		1
University of North Carolina - Greensboro		278,519	254,881	146,579	53,719		2
University of Akron		2,331,874	413,097	131,749	38,240		3
University of Alabama		41,229	11,619	1,371	18,903		4
George Mason University		11,938	14,337	20,824	13,121		5
Bowling Green State University		0	7,468	12,506	7,798		6
Northern Illinois University			24,214	9,446	3,839		7
Northern Arizona University		0	0	0	0	13,865	8
Georgia State University			29,984				
Ohio University	X	1,141,139	1,540,887	1,666,441			
Old Dominion University							
Southern Illinois University - Carbondale	X	81,076	115,674				
University of Maine							
University of Nevada - Las Vegas		4,729					
Western Michigan University							
Wichita State University			0				
Median		61,152	27,099	20,824	16,012		

Economic Development

Startup Companies

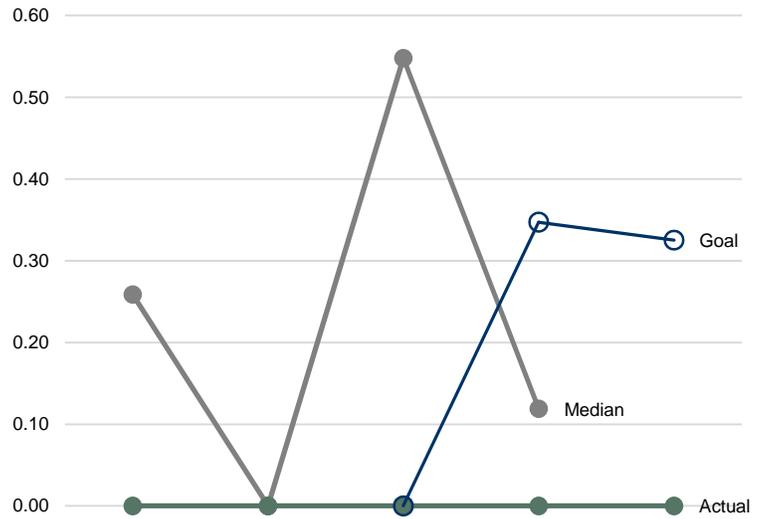


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	0	0	0	0	0
Goal			0	1	1
Difference			0	-1	-1

ABOR Peer Group	Med. Sch. AUTM Adj.	2007	2008	2009	2010	2011	Rank
George Mason University		2	5	2	2		1
University of Akron		2	5	4	2		1
Bowling Green State University		0	0	1	1		3
University of North Carolina - Greensboro		1	2	2	1		3
Kent State University - Kent		1	0	1	0		5
Northern Arizona University		0	0	0	0	0	5
Northern Illinois University			0		0		5
University of Alabama		4	3	2	0		5
Georgia State University		0	1				
Ohio University	X	1	3				
Old Dominion University							
Southern Illinois University - Carbondale	X	1					
University of Maine			0				
University of Nevada - Las Vegas		0					
Western Michigan University		1	0				
Wichita State University		0	0				
Median		1	0	2	1		

Economic Development

Startup Companies per \$10 Million in Total Research Expenditures

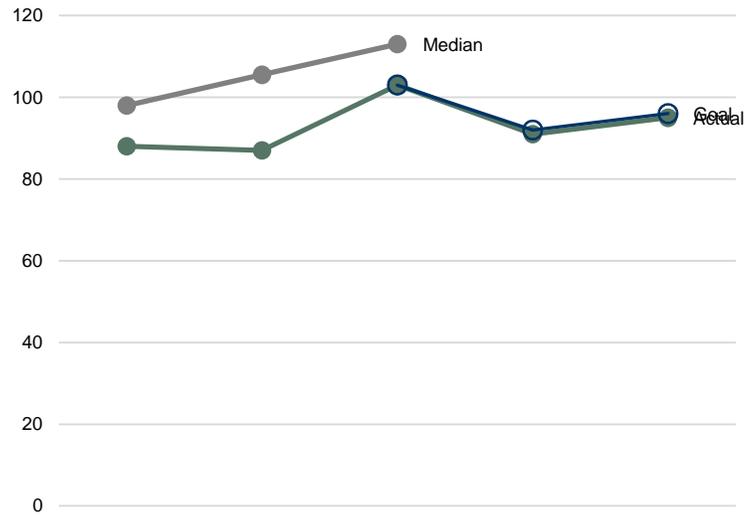


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	0.0	0.0	0.0	0.0	0.0
Goal			0.0	0.3	0.3
Difference			0.0	-0.3	-0.3

ABOR Peer Group	Med. Sch. NSF Adj. AUTM Adj.	2007	2008	2009	2010	2011	Rank
Bowling Green State University		0.0	0.0	1.2	1.2		1
University of North Carolina - Greensboro		1.6	2.5	1.9	0.4		2
University of Akron		0.7	1.8	1.2	0.4		3
George Mason University		0.3	0.7	0.3	0.2		4
Kent State University - Kent		0.5	0.0	0.4	0.0		5
Northern Arizona University		0.0	0.0	0.0	0.0	0.0	5
Northern Illinois University			0.0		0.0		5
University of Alabama		1.1	0.9	0.5	0.0		5
Georgia State University		0.0	0.1				
Ohio University	X	0.3	0.8				
Old Dominion University							
Southern Illinois University - Carbondale	X	0.2					
University of Maine			0.0				
University of Nevada - Las Vegas		0.0					
Western Michigan University		0.6	0.0				
Wichita State University		0.0	0.0				
Median		0.3	0.0	0.5	0.1		

Economic Development

Doctoral Degrees Conferred

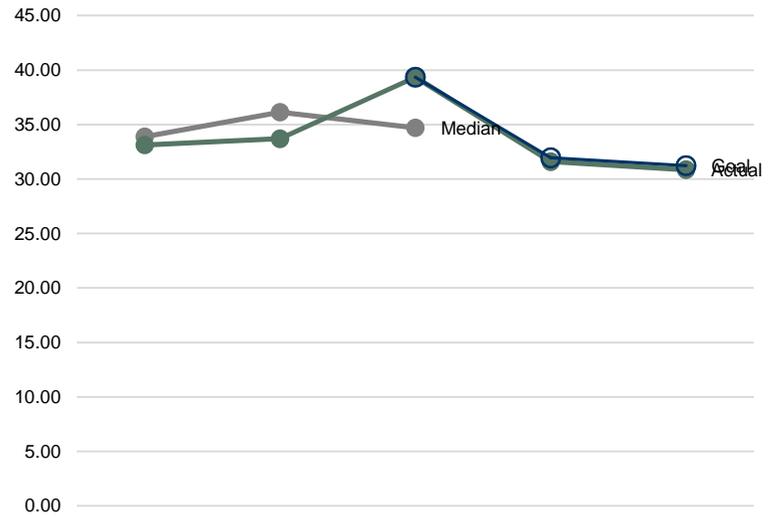


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	88	87	103	91	95
Goal			103	92	96
Difference			0	-1	-1

ABOR Peer Group	Med. Sch.	2007	2008	2009	2010	2011	Rank
Georgia State University		170	200	213			1
George Mason University		181	189	202			2
University of Alabama		160	191	192			3
Kent State University - Kent		136	177	141			4
Southern Illinois University - Carbondale	X	145	141	137			5
Ohio University	X	162	147	135			6
University of Nevada - Las Vegas		82	91	134			7
Northern Illinois University		107	106	119			8
University of North Carolina - Greensboro		74	93	107			9
Northern Arizona University		88	87	103	91	95	10
University of Akron		94	110	100			11
Western Michigan University		95	105	100			11
Bowling Green State University		91	86	99			13
Old Dominion University		101	77	84			14
Wichita State University		23	60	61			15
University of Maine		50	50	58			16
Median		98	106	113			

Economic Development

Doctorate Degrees Conferred per \$10 Million in Total Research Expenditures



ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	33.1	33.7	39.3	31.6	30.9
Goal			39.3	31.9	31.2
Difference			0.0	-0.3	-0.4

ABOR Peer Group	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
Bowling Green State University		99.8	80.3	117.9			1
University of North Carolina - Greensboro		120.7	118.1	102.9			2
Western Michigan University		55.3	71.8	75.2			3
Northern Illinois University		64.0	70.9	57.6			4
Kent State University - Kent		71.6	76.0	56.3			5
University of Alabama		44.0	58.2	52.6			6
Northern Arizona University		33.1	33.7	39.3	31.6	30.9	7
Georgia State University		33.1	25.7	35.2			8
University of Nevada - Las Vegas		14.6	17.9	34.2			9
Ohio University	X	41.9	38.6	32.7			10
University of Akron		34.6	40.5	29.0			11
George Mason University		31.1	26.1	25.7			12
Southern Illinois University - Carbondale	X	22.4	21.0	20.7			13
Old Dominion University		19.4	11.6	11.7			14
Wichita State University		4.9	12.5	9.2			15
University of Maine		5.2	5.3	5.8			16
Median		33.9	36.1	34.7			

This Page Intentionally Left Blank



Leadership and Recognition

Leadership and Recognition

Introduction

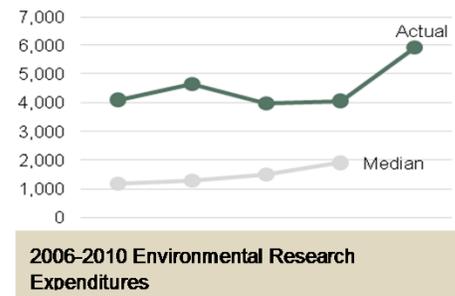
Northern Arizona University seeks to provide regional and (in selected disciplines) national and international leadership through the activities and outcomes of its researchers. The metrics typically used by the nation's largest research institutions rarely provide useful insights for our peer group, 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

Like most of our peers, we do not currently have members of the National Academies of Science or of Engineering on our faculty. However, as noted in the list of accomplishments, 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

Over the past year, the enterprise metric discussions made it clear that there is no intent to use the National Research University rankings of CMUP to assess our performance. We track our rankings in NSF expenditures, not so much in total R&D expenditures, but in the select areas in which we aim to compete and contribute. Thus – our overall ranking in 2009 was 224 (11th of our peer group). But in funding for environmental science, where we aim to be competitive, our overall ranking was 114 (7th of our peers). One of the university's strategic goals is to move into the top 100 and to compete with the best performers in our peer group in environmental research expenditures.



A key indication of the quality and competitiveness of our research is the pattern of funding for biological science. In this field Northern Arizona University has been first in its group of 16 peer institutions in both 2008 and 2009 (ranked second in 2006 and 2007), though having much smaller research faculty and smaller facilities than some of our peers. Although we are not a land-grant institution and we do not have formal programs in agriculture, we also rank highly in funding for agriculture (third among our peers in 2009), indicating in part the strong performance of our forestry program.

Leadership and Recognition

Selected Accomplishments

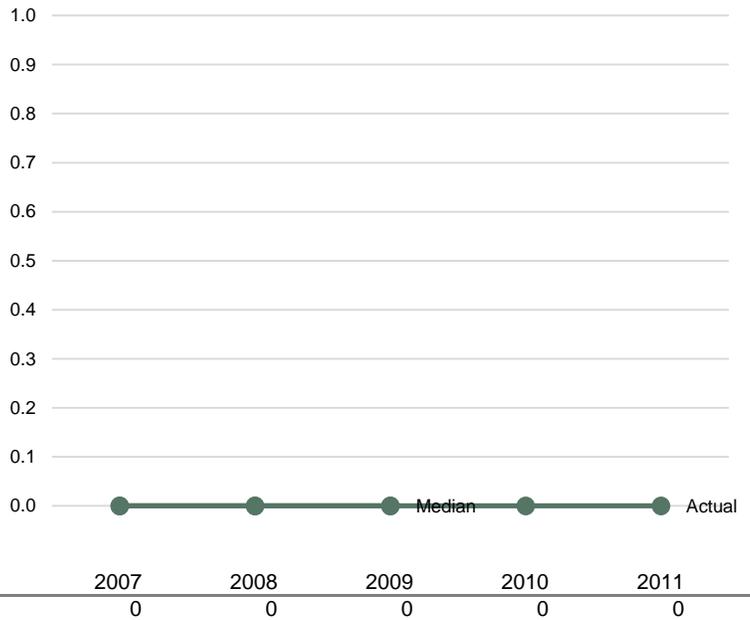
- **Regents' Professor Thomas Whitham** (Biological Sciences, Merriam Powell Center for Environmental Research) received the Eminent Ecologist award from the Ecological Society of America, in recognition of "an outstanding body of ecological work or of sustained ecological contributions of extraordinary merit."
- **Professor Alan Lew** (Geography, Planning and Recreation) was elected Fellow of the International Academy for the Study of Tourism, a small and distinguished honorary group. There are only 75 Fellows worldwide, and only 3 new Fellows were elected in 2011.
- **Associate Professor Janine Schipper** (Sociology and Social Work) was named Executive Editor of the journal *Humanity and Society*.
- **Pam Stephens, associate professor** in the School of Art, was named Arizona Art Educator of the Year, the association's top honor. The award recognizes Stephens' contributions to art education, including workshops in schools and at conferences, keynote addresses, books for teachers and children, award-winning animated art history videos for young viewers and a national column for art teachers.
- **Thomas Sisk, professor** in the School of Earth Sciences and Environmental Sustainability, and Leslie Ries, ecologist from the University of Maryland, were awarded the Strategic Environmental Research and Development Program's Project of the Year for Resource Conservation and Climate Change. Sisk and Ries created a modeling tool for the U.S. Department of Defense for managing land use and natural habitats while promoting the missions of sustainability and conservation planning.
- Doctoral student **Cindy Liu** was selected to attend the 61st Lindau Nobel Laureate Meetings in Lindau, Germany, this summer. The gathering is a globally recognized forum for the transfer of knowledge between generations of scientists from 78 countries. At NAU, Liu is performing health-related "translational research," which seeks to translate advancements in basic science research into impactful applications for public health and clinical settings. Her work studies the paranasal sinus, the adenoid and the middle ear, with a focus on comparing the microbial communities from individuals without disease and individuals with chronic, recalcitrant infections.
- **Regents' Professor Paul Keim** (Biological Sciences, Center for Microbial Genetics and Genomics) serves as chair of the US National Science Advisory Board for Biosecurity (NSABB), guiding a national discussion of the values and potential perils of so-called "dual use" research that has both high scientific importance and considerable risks. Professor Keim also received a grant award of \$3.3 million from the U.S. Department of Homeland Security for the study, "Microbial Forensics: Statistical Confidence in Evidentiary Materials Based Upon Bacterial Population Genetics."



Paul Keim works in the Keim Genetics Laboratory on Flagstaff campus.

Leadership and Recognition

National Academy Members



Actual

	Med. Sch.	2007	2008	2009	2010	2011	Rank
ABOR Peer Group							
George Mason University		2	3	3			1
University of Akron		2	2	2			2
University of Maine		1	2	2			2
Kent State University - Kent		1	1	1			4
Bowling Green State University		0	0	0			5
Georgia State University		0	0	0			5
Northern Arizona University		0	0	0	0	0	5
Northern Illinois University		0	0	0			5
Ohio University	X	0	0	0			5
Old Dominion University		0	0	0			5
Southern Illinois University - Carbondale	X	0	0	0			5
University of Alabama		0	0	0			5
University of Nevada - Las Vegas		0	0	0			5
University of North Carolina - Greensboro		0	0	0			5
Western Michigan University		0	0	0			5
Wichita State University		0	0	0			5
Median		0	0	0			

This Page Intentionally Left Blank



Technology Transfer

In 2008, Northern Arizona University restructured its technology transfer operations to respond to a statewide performance audit and to ensure a closer connection between campus research and regional economic development. In 2010, the university entered into a partnership with NAU Ventures, a limited liability corporation established by the NAU Foundation for the purpose of facilitating the commercialization of university-owned inventions through startup companies that will create jobs for Arizonans. In FY11, Northern Arizona University, NAU Ventures and NACET (Northern Arizona Center for Entrepreneurship and Technology) began a cooperative effort to catalyze the discovery and innovation process on campus, to translate university intellectual property into commercial goods and services for the public benefit and to enhance the university's ability to attract industry funding to continue these efforts.

In FY11, we devoted much effort to capacity building. To this end, increased staff effort was allocated to technology transfer. Funds from a grant from the Governor's Office on Economic Recovery (GOER) were used to purchase a comprehensive technology transfer data management system, Sophia™, which will allow all of the university's tech transfer partners—Office of the Vice President for Research, NACET and NAU Ventures—to have real-time access to the most up-to-date data of the university's entire portfolio.

In conjunction with NACET and with funding from the GOER, the university established a bricks-and-mortar student incubator, which will be available to students not only to develop their own business ideas but, in some cases, to test the feasibility of starting businesses based on NAU technologies (if the university has not been successful attracting licensees).

The university began implementing a technology transfer "in-reach" program—a plan to meet with every faculty member/principal investigator currently performing funded research at the Mountain Campus. In doing so, we not only keep current on the research programs of our faculty, but we are able to educate our researchers about the potential commercial applications of their work. This in-reach program has already generated a number of invention disclosures.

In addition to capacity building activities, the university brought in more licensing revenue than in any previous year going back to 2006.

Technology Transfer

Statistical Exhibits



Technology Transfer Activities	2007	2008	2009	2010	2011
Invention Disclosures Transacted	6	9	17	9	12
Invention Disclosures Transacted Year/Year Percentage Change		50%	89%	-47%	33%
New Patent Applications	3	10	12	5	2
New Patent Applications Year/Year Percentage Change		233%	20%	-58%	-60%
U.S. Patents Issued	2	1	1	3	0
U.S. Patents Issued Year/Year Percentage Change		-50%	0%	200%	-100%
Licenses and Options Executed	0	1	0	0	1
Licenses and Options Executed Year/Year Percentage Change			-100%		
Other Major Agreements			2	1	1
Other Major Agreements Year/Year Percentage Change				-50%	0%
Licensing and Other Revenue	2007	2008	2009	2010	2011
Licensing Revenue (Including Options)	0	0	0	0	42,684
Licensee Legal Reimbursements	0	0	0	2,931	0
Other Revenue	0	0	0	0	0
Total	0	0	0	2,931	42,684
Sponsored Research Facilitated	2007	2008	2009	2010	2011
Total	0	0	0	0	0
Royalty Distribution	2007	2008	2009	2010	2011
Inventors	0	885	0	0	0
Laboratories and Units	0	0	0	0	0
University	0	885	0	0	0
Undistributed	0	0	0	0	0

Technology Transfer

Selected Patents

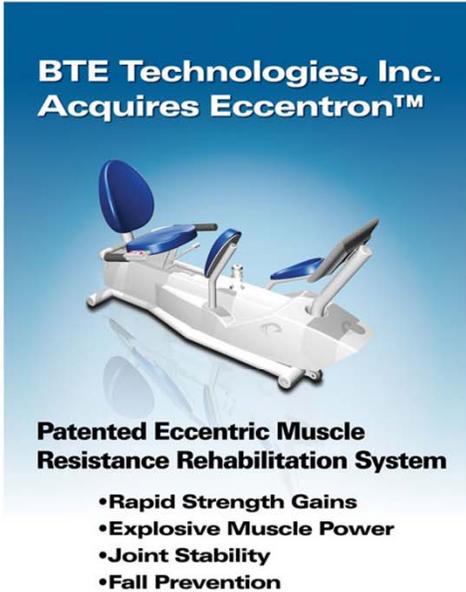


- No patents to report.

Technology Transfer

Selected Licenses and Options Executed

- In FY 11, the university signed a license agreement that will result in NAU's first commercial project being in the marketplace, the Eccentron. The Eccentron is a recumbent exercise machine that uses a motor to drive the pedals backward, allowing the user to work on pushing the pedals and resisting the force. BTE Technologies announced its acquisition of Eccentron in November of 2010 after a renegotiation, but the machine has been in development for 10 years.



**BTE Technologies, Inc.
Acquires Eccentron™**

**Patented Eccentric Muscle
Resistance Rehabilitation System**

- Rapid Strength Gains
- Explosive Muscle Power
- Joint Stability
- Fall Prevention

Technology Transfer

Selected Startup Companies

- In FY11, NAU and TGen licensed jointly-owned intellectual property to PathoGene, LLC, a molecular diagnostic start-up company established in 2008 and headquartered in Flagstaff.



Pathogene LLC scientist conducts work to help detection, surveillance and treatment of infectious diseases.

Technology Transfer

Other Notable Activities



- The university entered into its first international inter-institutional agreement with the University of Victoria, British Columbia, to manage intellectual property arising from collaborative research entitled, “Thyroid assays across indicator and sentinel species.”
- Northern Arizona University partnered with NACET to deliver a “Power of Angel Investing” series seminar, through the Angel Capital Education Foundation. This seminar provided a comprehensive overview of the angel investing process to faculty, students and members of the Northern Arizona entrepreneurial community.
- The university established relationships with a number of angel investors and signed more NDAs for this purpose than in any previous year.

This Page Intentionally Left Blank



THE UNIVERSITY
OF ARIZONA®

Annual Research Report - FY2011

I am delighted to bring you this report on the University of Arizona's research activity through fiscal year 2011. In this report we present key highlights of the UA research enterprise as well as specific performance metrics.

This year, to convey our achievements in research, I am using the concept of **Bold Ideas** – those creative sparks that inspire us to look at old problems in new ways or consider questions that have yet to be asked. Bold ideas are the catalysts for scientific advancement. When you add passion and creativity, those bold ideas can turn into bold research – research that's driven by the need to explore, question, understand, challenge, create, and innovate.

The passion that drives our research sometimes leads to unexpected discoveries – those breathtaking surprises that expand our collective knowledge or change forever the way we think about a problem. Other times, it leads to practical innovations – smarter, more effective, less expensive solutions to life's challenges.

Bold ideas lead to **Bold Results**. For example, we have had banner news in Space Sciences: a #1 national ranking in Astronomy and Planetary Science research expenditures; the award of our largest grant ever for OSIRIS-Rex, a NASA mission to pluck samples from an asteroid and return them to Earth; UA alumnus Prof. Brian Schmidt was awarded the 2011 Nobel Prize in Physics for his contributions to the 1998 discovery of the accelerating expansion of the Universe; Regents Professor Roger Angel was awarded the Kavli Prize in Astrophysics; and, Regents Professor George Rieke was elected to the National Academy of Sciences.

Bold results are also practical and can create opportunity: UA technology generated 8 new startup companies and a record 80 licensing and option deals last year, and we launched our exciting new BIO5 Oro Valley facility to fast-track innovation.

Across the University, our faculty made valuable advances and received prestigious recognition. From drug discovery to environmental policy, from preservation of vanishing languages to the exploration of other planets – we are working to make our region more prosperous, to create a world that is healthier and more sustainable, and to deepen our understanding of our universe.

We appreciate your interest in the **Bold Research** taking place at the University of Arizona.

Sincerely,



Leslie P. Tolbert
Senior Vice President for Research



Table of Contents

Enterprise Size

Introduction	6
Selected Accomplishments	7
Total Research Expenditures	8
Average Growth Rate in Total Research Expenditures Over 3 years	9
Federally Financed Research Expenditures	10
Average Growth Rate in Federally Financed Research Expenditures Over 3 years	11
Net Research Square Feet	12
Total Research Expenditures per Square Foot	13
Total Faculty Population	14
Total Research Expenditures per Faculty	15

Discovery and Scholarly Impact

Introduction	18
Selected Accomplishments	19
Invention Disclosures Transacted	20
Invention Disclosures Transacted per \$10 Million in Total Research Expenditures	21
U.S. Patents Issued	22
U.S. Patents Issued per \$10 Million in Total Research Expenditures	23

Economic Development

Introduction	26
Selected Accomplishments	27
Licenses and Options Executed	28
Licenses and Options Executed per \$10 Million in Total Research Expenditures	29
Intellectual Property Income	30
Intellectual Property Income per \$10 Million in Total Research Expenditures	31
Startup Companies	32
Startup Companies per \$10 Million in Total Research Expenditures	33
Doctoral Degrees Conferred	34
Doctoral Degrees Conferred per \$10 Million in Total in Research Expenditures	35

Leadership and Recognition

Introduction	38
Selected Accomplishments	39
National Academy Members	40
National Academy Members per \$10 Million in Total Research Expenditures	41

Technology Transfer Activity

Introduction	44
Technology Transfer Statistical Exhibits	45
Selected Patents Issued	46
Selected Licenses and Options Executed	47
Selected Startup Companies	48
Other Notable Activities	49

This Page Intentionally Left Blank



THE UNIVERSITY
OF ARIZONA®

Enterprise Size

Enterprise Size

Introduction

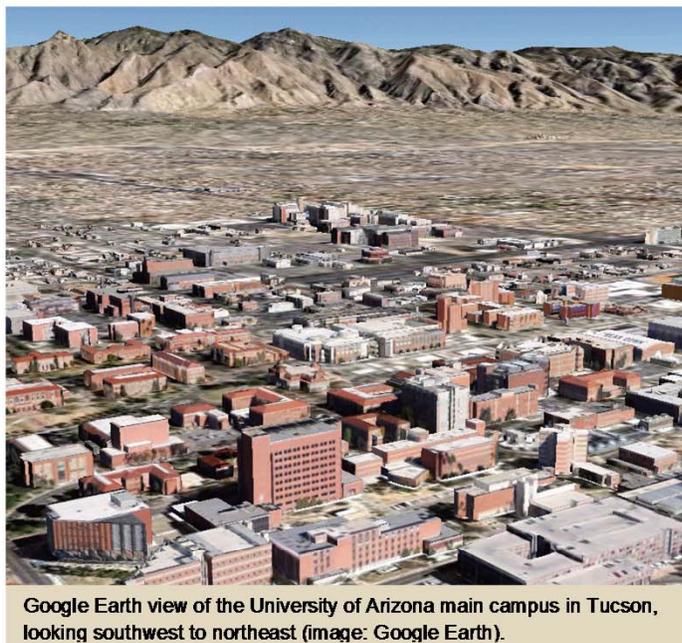
The University of Arizona continued on a course of **robust growth in research activity**, with notable increases that beat national patterns of tougher Federal funding in the last two years. The UA research portfolio spans a wide range of strengths that contributed to this success. We have embarked on a program of substantial **investments in strategic target areas** to further increase our overall performance, including:

- Environmental Science, Engineering and Policy;
- Translational Biomedical Research;
- Space Sciences;
- Arts, Humanities and Social Sciences;
- Core Research Facilities that broadly support high-tech research.

The UA has posted consecutive annual records in total research expenditures, with **FY 2011 exceeding \$600 million for the first time**. The UA ranks consistently among the top 20 public universities in this metric, based on the latest available National Science Foundation rankings of research expenditures.

Our year-to-year performance increased by \$14M in FY 2008 over the previous year, and this margin grew steadily to a \$24M in FY 2011 versus FY 2010. Expressed differently, this represents net growth in total research expenditures as high as 4.1% for FY 2011 as an annual rate, and 3.8% as a three-year metric.

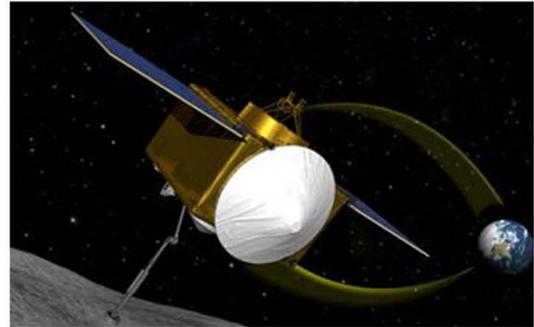
At \$328M in FY 2011, over half of our research expenditures are funded via a vigorous range of activity in obtaining Federal grants and contracts in support of research. The last two years have seen very strong growth as high as 7% annually and a three-year metric of 5.6% for 2011.



Enterprise Size

Selected Accomplishments

- Research expenditures in FY 2011 **exceeded \$600M** for the first time.
- UA is ranked **#18 nationally in R&D expenditures** among all public universities, and **#26** including all private and public institutions.
- UA is ranked **#1 in the nation** for R&D expenditures in Astronomy and Planetary Sciences, and has been in that position **since 1998**.
- **NASA has selected the University of Arizona to lead the OSIRIS-Rex mission** to return samples of pristine organic material from a near-Earth asteroid. Not only will we gain important new knowledge about the origins of life, but the mission will also study the feasibility of deflecting asteroids away from earth. The image (right) shows an artist's concept of the OSIRIS-Rex spacecraft collecting a sample from asteroid 1999 RQ36. The mission is **budgeted for approximately \$800 million** overall, excluding the launch vehicle; **about \$200 million will be spent in Arizona**.



Artist's rendition of OSIRIS-Rex (credit: NASA)

- ABOR approved plans for a **University of Arizona Cancer Center clinic at the Phoenix Biomedical Campus**. The \$135 million, 250,000-square-foot, six-story outpatient clinic and research building will be financed through gifts and university-issued bonds and is scheduled to be open for patient care by 2014.
- The National Science Foundation awarded a **grant of \$9.9 million to develop 'Super Rice'**, which will support the development of rice varieties more tolerant to drought, diseases, and poor soil conditions across the world. Dr. Rod Wing, professor of plant sciences (see image, right), serves as the lead UA investigator for the Super Rice project.
- The U.S. Department of Defense awarded a **\$6M grant to the UA to evaluate child-care and youth programs for military families**. Professor Lynne Borden of the UA's Norton School of Family and Consumer Sciences and her team will investigate how longer and more frequent deployments affect families and child behavior.
- Another Department of Defense award supports a **\$7.5M project to study how long-distance lasers, such as those used for special detection systems, pass through the earth's atmosphere**. Prof. Jerry Moloney is heading up a multidisciplinary and multi-institution research effort to investigate intense and short-lived laser pulses, how they work in the atmosphere at a basic level, and therefore how we might improve these technologies. In the image (right), a chamber is used to investigate the scattering of a terawatt femtosecond laser pulse through clouds.



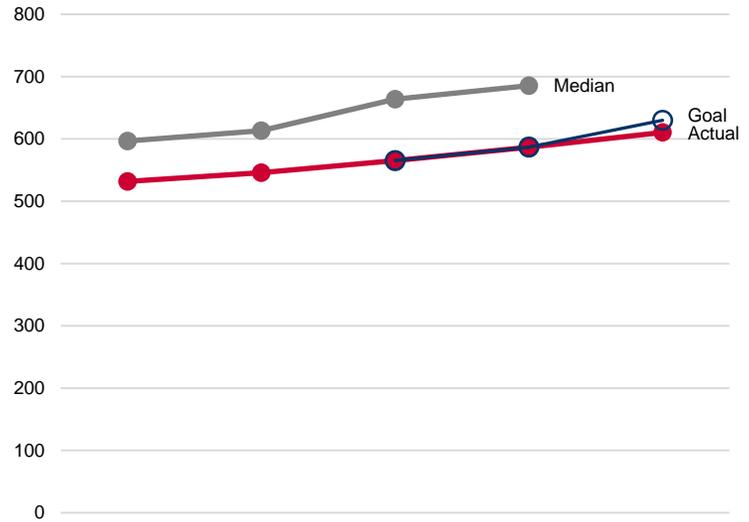
Dr. Rod Wing (Photo: Norma Jean Gargas/UAnews)



Cloud scattering of a laser (Photo: TERAMOBILE)

Enterprise Size

Total Research Expenditures (in Millions)

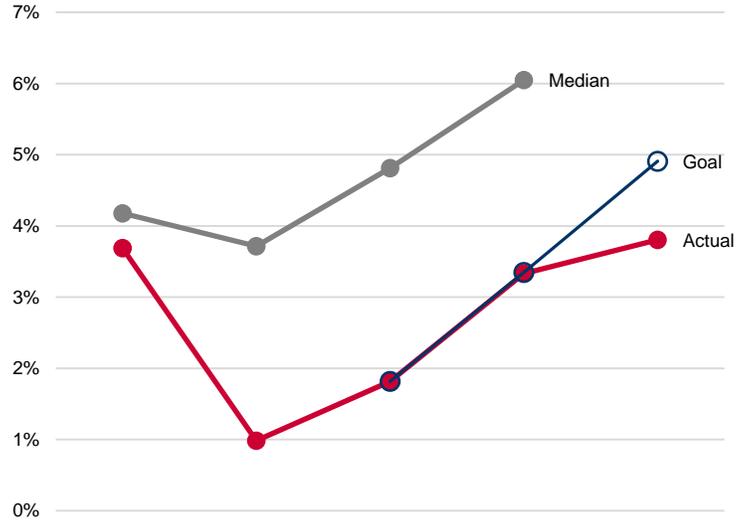


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	531.8	545.9	565.3	586.6	610.6
Goal			565.3	586.9	630.0
Difference			0.0	-0.3	-19.4

ABOR Peer Group	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
University of Wisconsin - Madison	X	840.7	881.8	952.1	1,029.3		1
University of Washington	X	756.8	765.1	778.0	1,022.7		2
University of California - Los Angeles	X	823.1	871.5	890.0	937.0		3
University of Minnesota	X	624.1	682.7	741.0	786.1		4
Pennsylvania State University, All Campuses	X	652.1	701.1	753.4	770.4		5
University of North Carolina - Chapel Hill	X	477.2	525.8	646.0	755.3		6
The Ohio State University	X	720.2	702.6	716.5	755.2		7
Texas A&M University		621.8	662.1	714.3	689.6		8
University of Florida	X	592.8	584.2	592.1	681.5		9
University of California - Davis	X	600.5	642.5	681.6	679.9		10
University of Texas - Austin		446.8	493.3	506.4	589.5		11
The University of Arizona	X	531.8	545.9	565.3	586.6	610.6	12
University of Illinois - Urbana - Champaign		473.9	501.3	563.7	515.1		13
University of Maryland - College Park		359.8	395.0	409.2	451.4		14
University of Iowa	X	363.2	293.6	329.9	444.0		15
Michigan State University	X	360.9	356.8	373.2	431.4		16
Median		596.7	613.3	663.8	685.6		

Enterprise Size

Average Growth Rate in Total Research Expenditures Over 3 Years

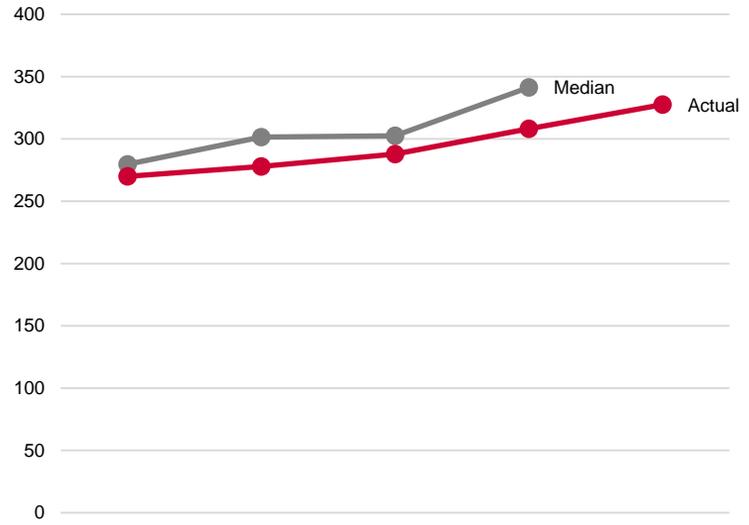


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	3.7%	1.0%	1.8%	3.3%	3.8%
Goal			1.8%	3.3%	4.9%
Difference			0.0%	0.0%	-1.1%

ABOR Peer Group	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
University of North Carolina - Chapel Hill	X	4.7%	6.1%	13.5%	16.7%		1
University of Washington	X	2.1%	2.8%	0.0%	11.4%		2
University of Texas - Austin		9.3%	6.3%	5.5%	9.8%		3
University of Iowa	X	5.1%	-3.6%	-0.6%	9.3%		4
University of Minnesota	X	5.9%	7.6%	7.6%	8.0%		5
University of Maryland - College Park		3.4%	5.3%	5.0%	7.9%		6
University of Wisconsin - Madison	X	3.3%	3.4%	4.6%	7.0%		7
Michigan State University	X	3.5%	2.3%	1.4%	6.4%		8
Pennsylvania State University, All Campuses	X	2.8%	3.9%	5.4%	5.7%		9
University of Florida	X	10.0%	3.3%	1.6%	5.0%		10
University of California - Los Angeles	X	2.1%	3.5%	3.1%	4.4%		11
University of California - Davis	X	5.5%	5.5%	6.0%	4.3%		12
Texas A&M University		6.1%	6.2%	7.9%	3.6%		13
The University of Arizona	X	3.7%	1.0%	1.8%	3.3%	3.8%	14
University of Illinois - Urbana - Champaign		-2.1%	0.2%	5.9%	3.2%		15
The Ohio State University	X	11.7%	5.0%	3.3%	1.6%		16
Median		4.2%	3.7%	4.8%	6.0%		

Enterprise Size

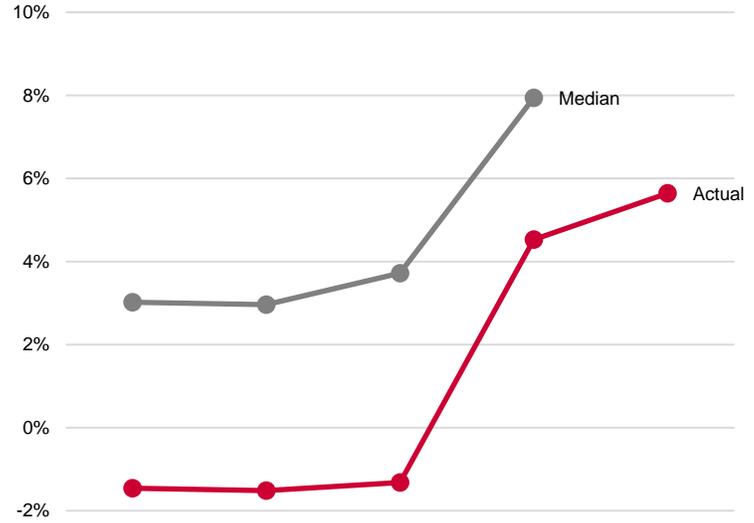
Federally Financed Research Expenditures (in Millions)



		2007	2008	2009	2010	2011	
Actual		269.9	277.9	287.9	308.2	327.6	
	Med. Sch. NSF Adj.						Rank
ABOR Peer Group							
University of Washington	X	620.4	614.1	619.4	829.9		1
University of North Carolina - Chapel Hill	X	346.7	373.1	431.8	546.0		2
University of Wisconsin - Madison	X	469.1	474.4	507.9	545.2		3
University of California - Los Angeles	X	488.8	471.9	467.5	538.5		4
Pennsylvania State University, All Campuses	X	370.8	406.5	439.2	464.8		5
University of Minnesota	X	338.0	364.1	390.6	426.4		6
The Ohio State University	X	313.2	335.1	339.8	399.9		7
University of Texas - Austin		289.3	324.3	309.1	350.3		8
University of California - Davis	X	257.0	269.0	295.9	332.3		9
The University of Arizona	X	269.9	277.9	287.9	308.2	327.6	10
University of Illinois - Urbana - Champaign		253.6	266.9	288.0	303.9		11
University of Maryland - College Park		219.0	236.4	247.0	297.9		12
Texas A&M University		263.4	278.7	288.5	288.2		13
University of Iowa	X	222.9	229.9	252.3	282.5		14
University of Florida	X	240.8	231.0	232.7	279.6		15
Michigan State University	X	170.4	152.9	164.2	214.1		16
Median		279.6	301.5	302.5	341.3		

Enterprise Size

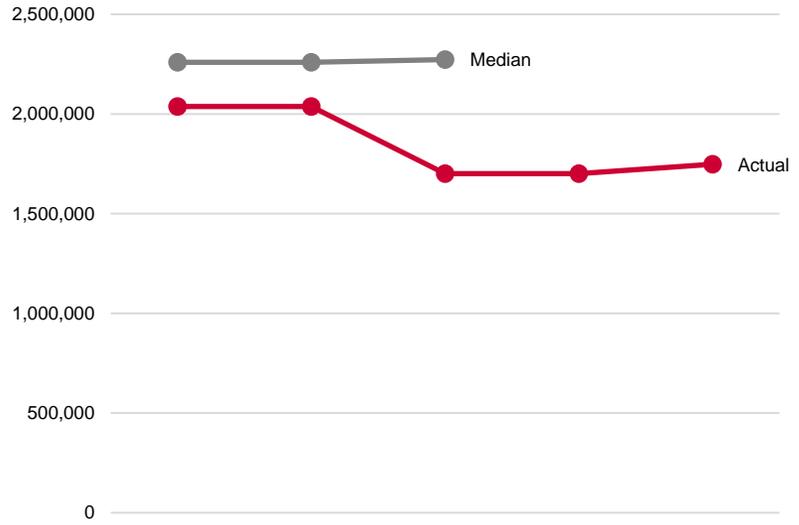
Average Growth Rate in Federally Financed Research Expenditures Over 3 Years



		2007	2008	2009	2010	2011	
Actual		-1.5%	-1.5%	-1.3%	4.5%	5.6%	
	Med. Sch. NSF Adj.						Rank
ABOR Peer Group							
University of North Carolina - Chapel Hill	X	4.5%	5.2%	9.6%	16.6%		1
University of Washington	X	-0.1%	0.5%	-1.6%	11.3%		2
University of Maryland - College Park		6.6%	6.5%	5.6%	11.0%		3
Michigan State University	X	6.0%	-0.5%	-0.7%	9.2%		4
University of California - Davis	X	5.0%	3.9%	6.1%	9.0%		5
The Ohio State University	X	3.3%	4.5%	2.5%	8.7%		6
University of Iowa	X	2.0%	2.1%	5.3%	8.3%		7
University of Minnesota	X	3.2%	4.5%	6.2%	8.1%		8
Pennsylvania State University, All Campuses	X	2.1%	4.3%	6.2%	7.8%		9
University of Texas - Austin		7.1%	8.4%	4.4%	6.9%		10
University of Illinois - Urbana - Champaign		-2.6%	-2.6%	3.0%	6.2%		11
University of Florida	X	2.9%	0.0%	-2.1%	5.6%		12
University of Wisconsin - Madison	X	2.8%	-0.2%	1.2%	5.2%		13
The University of Arizona	X	-1.5%	-1.5%	-1.3%	4.5%	5.6%	14
University of California - Los Angeles	X	2.0%	0.2%	-1.1%	3.6%		15
Texas A&M University		9.3%	4.4%	6.1%	3.1%		16
Median		3.0%	3.0%	3.7%	7.9%		

Enterprise Size

Net Assignable Square Feet

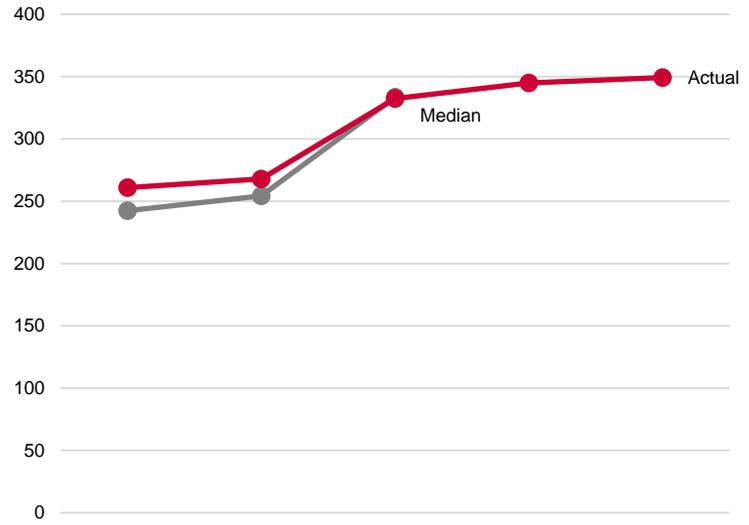


	2007	2008	2009	2010	2011
Actual	2,037,788	2,037,788	1,700,749	1,700,749	1,748,037

ABOR Peer Group	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
University of Illinois - Urbana - Champaign		4,319,500	4,319,500	4,561,500			1
University of Minnesota	X	3,678,316	3,678,316	3,684,378			2
University of Florida	X	2,877,352	2,877,352	3,081,524			3
Pennsylvania State University, All Campuses	X	2,913,138	2,913,138	2,997,579			4
University of Wisconsin - Madison	X			2,844,272			5
University of California - Davis	X	2,809,365	2,809,365	2,660,052			6
University of California - Los Angeles	X	2,229,683	2,229,683	2,496,563			7
Michigan State University	X	2,289,100	2,289,100	2,324,423			8
Texas A&M University				2,222,041			9
University of Washington	X	1,791,869	1,791,869	1,795,359			10
The University of Arizona	X	2,037,788	2,037,788	1,700,749	1,700,749	1,748,037	11
University of North Carolina - Chapel Hill	X	1,135,045	1,135,045	1,662,923			12
The Ohio State University	X	1,540,443	1,540,443	1,487,468			13
University of Texas - Austin		2,862,918	2,862,918	1,480,462			14
University of Maryland - College Park		987,352	987,352	712,085			15
University of Iowa	X	760,591	760,591	616,700			16
Median		2,259,392	2,259,392	2,273,232			

Enterprise Size

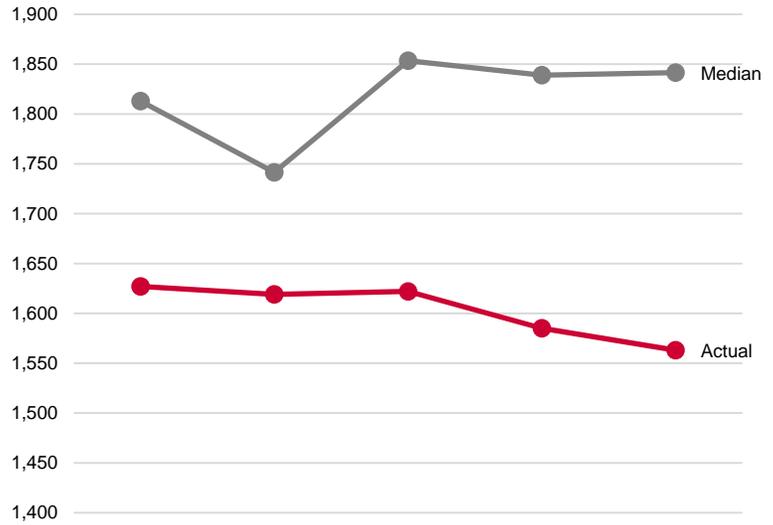
Total Research Expenditures per Net Assignable Square Foot



		2007	2008	2009	2010	2011	
Actual		261	268	332	345	349	
	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
ABOR Peer Group							
University of Maryland - College Park		364	400	575			1
University of Iowa	X	478	386	535			2
The Ohio State University	X	468	456	482			3
University of Washington	X	422	427	433			4
University of North Carolina - Chapel Hill	X	420	463	388			5
University of California - Los Angeles	X	369	391	356			6
University of Texas - Austin		156	172	342			7
University of Wisconsin - Madison	X			335			8
The University of Arizona	X	261	268	332	345	349	9
Texas A&M University				321			10
University of California - Davis	X	214	229	256			11
Pennsylvania State University, All Campuses	X	224	241	251			12
University of Minnesota	X	170	186	201			13
University of Florida	X	206	203	192			14
Michigan State University	X	158	156	161			15
University of Illinois - Urbana - Champaign		110	116	124			16
Median		242	254	334			

Enterprise Size

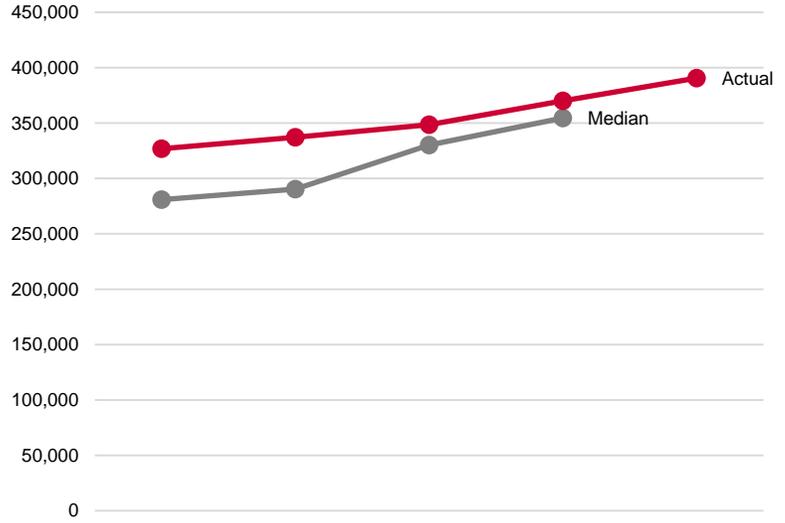
Total Faculty Population



		2007	2008	2009	2010	2011	
Actual		1,627	1,619	1,622	1,585	1,563	
	Med. Sch. NSF Adj.						Rank
ABOR Peer Group							
University of Florida	X	2,875	2,806	2,775	2,696	2,701	1
The Ohio State University	X	2,571	2,588	2,605	2,602	2,560	2
University of Minnesota	X	2,458	2,489	2,377	2,319	2,277	3
University of Wisconsin - Madison	X	2,081	2,064	2,053	2,047	2,057	4
University of Texas - Austin		1,876	1,887	1,913	1,981	1,954	5
Michigan State University	X	1,882	1,885	1,921	1,948	1,906	6
Texas A&M University		1,726	1,730	1,878	1,838	1,871	7
University of North Carolina - Chapel Hill	X	1,695	1,716	1,804	1,833	1,861	8
University of California - Los Angeles	X	1,750	1,753	1,829	1,840	1,822	9
University of Illinois - Urbana - Champaign		1,886	1,900	1,883	1,856	1,778	10
Pennsylvania State University, All Campuses	X	1,716	1,711	1,757	1,748	1,759	11
The University of Arizona	X	1,627	1,619	1,622	1,585	1,563	12
University of Washington	X	1,890	1,607	1,568	1,548	1,536	13
University of Iowa	X	1,574	1,549	1,599	1,572	1,527	14
University of California - Davis	X	1,465	1,452	1,466	1,498	1,467	15
University of Maryland - College Park		1,468	1,472	1,485	1,472	1,463	16
Median		1,813	1,742	1,854	1,839	1,842	

Enterprise Size

Total Research Expenditures per Faculty



		2007	2008	2009	2010	2011	
Actual		326,830	337,164	348,515	370,124	390,637	
	Med. Sch. NSF Adj.						Rank
ABOR Peer Group							
University of Washington	X	400,416	476,126	496,203	660,685		1
University of California - Los Angeles	X	470,333	497,135	486,602	509,236		2
University of Wisconsin - Madison	X	403,975	427,218	463,770	502,831		3
University of California - Davis	X	409,903	442,506	464,951	453,882		4
Pennsylvania State University, All Campuses	X	380,037	409,778	428,775	440,760		5
University of North Carolina - Chapel Hill	X	281,552	306,435	358,099	412,048		6
Texas A&M University		360,281	382,689	380,344	375,203		7
The University of Arizona	X	326,830	337,164	348,515	370,124	390,637	8
University of Minnesota	X	253,926	274,272	311,729	338,971		9
University of Maryland - College Park		245,068	268,368	275,549	306,668		10
University of Texas - Austin		238,148	261,417	264,699	297,578		11
The Ohio State University	X	280,127	271,481	275,033	290,236		12
University of Iowa	X	230,777	189,518	206,317	282,464		13
University of Illinois - Urbana - Champaign		251,267	263,831	299,368	277,550		14
University of Florida	X	206,203	208,186	213,363	252,800		15
Michigan State University	X	191,739	189,266	194,265	221,444		16
Median		280,840	290,353	330,122	354,548		

This Page Intentionally Left Blank



THE UNIVERSITY
OF ARIZONA®

Discovery and Scholarly Impact

Discovery and Scholarly Impact

Introduction

Discovery is central to the University of Arizona: it is an explicit and pivotal component of our mission as a research university. One way to recognize the extent and significance of our discoveries is to examine how we communicate the knowledge that we generate through professional publications, and the further recognition that work receives via citations by others. **Our research and creative activities led to over 4,000 publications per year. Within 5 years, these publications generated about 25,000 citations and an overall *h-index* of 61 (a widely-used measure of productivity and citation impact of published work).**

Discovery and scholarly activities also lead to real-life solutions. Many of the impacts of university research are not easy to count, such as improved public health or better agricultural methods. But, those involving new technology can be quantified in the form of inventions and patents. The number of **invention disclosures increased to 150 in FY 2011** following several prior years of strong growth. This number represents 15% growth over FY 2010 and exceeds our goal for FY 2011. Patent activity increased again, with the **number of patents issued rising to 19**, exceeding our goal and representing a 46% increase over FY 2010.



These stronger numbers of invention and patents reflect changes we have made as part of a new strategic direction in our innovation and technology commercialization enterprise. Over the last two years, the UA has been planning and putting in place a broader and more integrated vision in this area. An important emphasis is to encourage the process of identifying and patenting faculty inventions as part of the commercialization process.

We recently announced the formation of a new UA entity, Tech Launch Arizona (TLA), which will enable greater cohesion among the community, business sector and institutional inventors as well as the offices promoting the transfer of ideas and technology to market. TLA represents both a major restructuring and a repositioning of the University's technology commercialization efforts. TLA is grounded in a two-part mission: to more easily move beneficial knowledge creation and inventions into the public sphere while propelling economic development forward in Arizona and elsewhere.

Discovery and Scholarly Impact

Selected Accomplishments

- Both invention disclosures and patents issued exceeded our goals for these metrics in FY 2011. Examples of our patents are provided in the Technology Transfer section later in this report.
- Discovery and impact are, of course, far broader than inventions and patents. One visible way that the University of Arizona recognizes the exceptional achievements of our faculty is via the naming of **Regent's Professors**. During the 2010-11 academic year, we recognized the following faculty with this honor:

- **S. James Anaya, Regents' Professor of Law and the James J. Lenoir Professor of Human Rights Law and Policy** in the James E. Rogers College of Law. Prof. Anaya is also the United Nations' Special Rapporteur on the Rights of Indigenous Peoples. He wrote the leading treatise in the field and has spent years working to protect and preserve the rights of indigenous peoples around the world.
- **Edgar Dryden, Regents' Professor of English**. Prof. Dryden has been called one of the most important literary scholar critics in his field of American Literature. His studies on Nathaniel Hawthorne and Herman Melville, two American literary giants, are internationally recognized as classic analytical standards.
- **Marcia Rieke, Regents' Professor of Astronomy**. The history of the universe is becoming clearer thanks to the field of Infrared astronomy and the contributions of Prof. Rieke. Her research has changed the fundamental views of astronomers' on active galaxies and on the entire process of star formation. Many of her most-cited papers on radiation from galactic nuclei and starbursts in colliding galaxies are classics in the field of Astronomy.



Regents' Professors Anaya, Dryden and Rieke.

- The **Altarpiece of Ciudad Rodrigo**, one of the UA's treasures, was the subject of a **one hour PBS documentary that chronicled a five-year research project**. The altarpiece, part of the University of Arizona Museum of Art collection, consists of 26 fifteenth century Spanish paintings. Using modern technology such as x-radiography, infrared reflectograms, and ultraviolet light uncovered preliminary under-drawings beneath the final layers of the paintings that unlocked secrets involving art, literature, history, and religion.



The altarpiece in the lab (photo: Arizona Public Media)

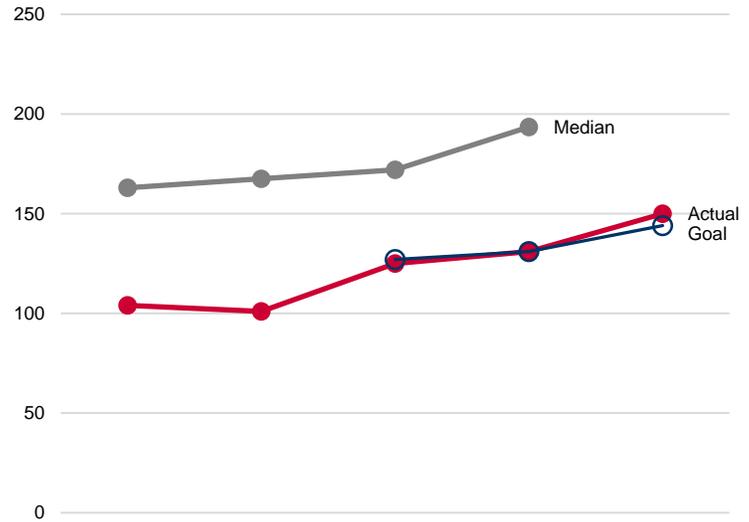
- **UA researchers have cracked one of the puzzles surrounding what has been called "the world's most mysterious manuscript" – the Voynich manuscript**. This volume, which makes the "DaVinci Code" look lackluster, is filled with drawings and writings nobody has been able to make sense of to this day. Using radiocarbon dating, a team led by Dr. Greg Hodgins in the UA's Department of Physics has found the manuscript's parchment pages date back to the early 15th century, making the book a century older than scholars had previously thought.



Voynich manuscript page (Photo: Arizona Public Media)

Discovery and Scholarly Impact

Invention Disclosures Transacted

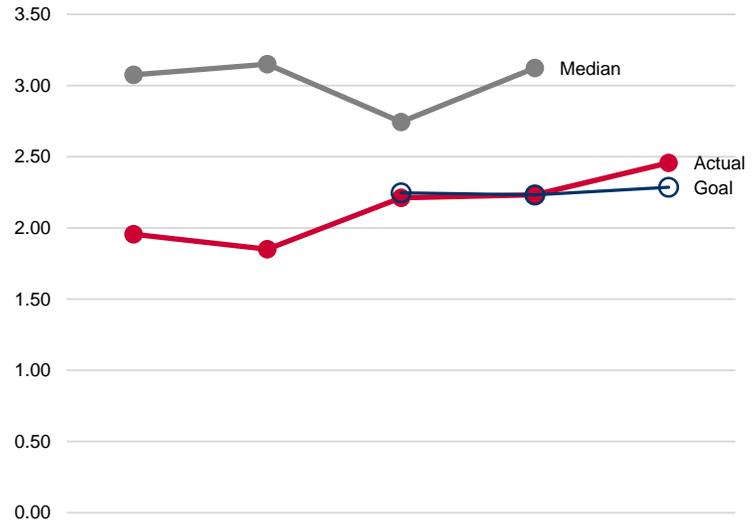


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	104	101	125	131	150
Goal			127	131	144
Difference			-2	0	6

ABOR Peer Group	Med. Sch. AUTM Adj.	2007	2008	2009	2010	2011	Rank
University of California - Los Angeles	X	267	314	333	379		1
University of Wisconsin - Madison	X	409	381	333	356		2
University of Washington	X	335	349	349	354		3
University of Florida	X	327	299	304	295		4
University of Minnesota	X	193	217	244	255		5
University of California - Davis	X	180	181	172	245		6
Texas A&M University		154	226	196	207		7
University of Illinois - Urbana - Champaign		201	243		180		8
The Ohio State University	X	165	142	163	173		9
Pennsylvania State University, All Campuses	X	121	143	119	133		10
The University of Arizona	X	104	101	125	131	150	11
University of North Carolina - Chapel Hill	X	113	122	137	125		12
Michigan State University	X	161	91	129	116		13
University of Iowa	X	87	68	70	70		14
University of Maryland - College Park		110	132				
University of Texas - Austin		139	154				
Median		163	168	172	194		

Discovery and Scholarly Impact

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

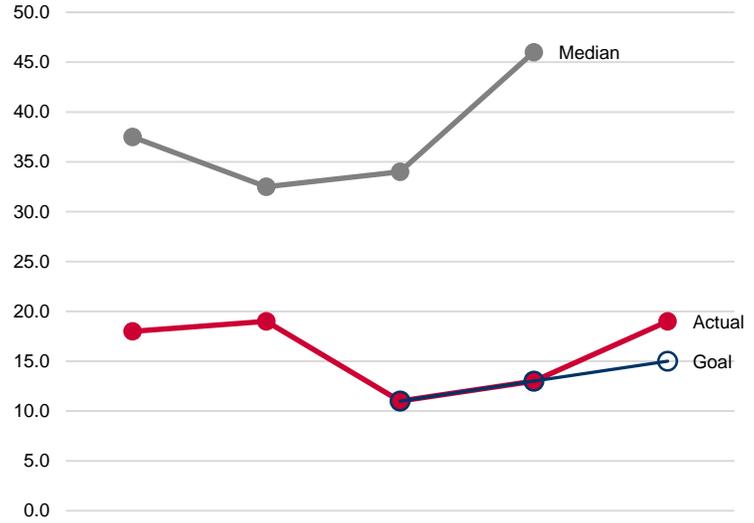


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	2.0	1.9	2.2	2.2	2.5
Goal			2.2	2.2	2.3
Difference			0.0	0.0	0.2

ABOR Peer Group	Med. Sch. NSF Adj. AUTM Adj.	2007	2008	2009	2010	2011	Rank
University of Florida	X	5.5	5.1	5.1	4.3		1
University of California - Los Angeles	X	3.2	3.6	3.7	4.0		2
University of California - Davis	X	3.0	2.8	2.5	3.6		3
University of Illinois - Urbana - Champaign		4.2	4.8		3.5		4
University of Washington	X	4.4	4.6	4.5	3.5		5
University of Wisconsin - Madison	X	4.9	4.3	3.5	3.5		6
University of Minnesota	X	3.1	3.2	3.3	3.2		7
Texas A&M University		2.5	3.4	2.7	3.0		8
Michigan State University	X	4.5	2.6	3.5	2.7		9
The Ohio State University	X	2.3	2.0	2.3	2.3		10
The University of Arizona	X	2.0	1.9	2.2	2.2	2.5	11
Pennsylvania State University, All Campuses	X	1.9	2.0	1.6	1.7		12
University of North Carolina - Chapel Hill	X	2.4	2.3	2.1	1.7		13
University of Iowa	X	2.4	2.3	2.1	1.6		14
University of Maryland - College Park		3.1	3.3				
University of Texas - Austin		3.1	3.1				
Median		3.1	3.2	2.7	3.1		

Discovery and Scholarly Impact

U.S. Patents Issued

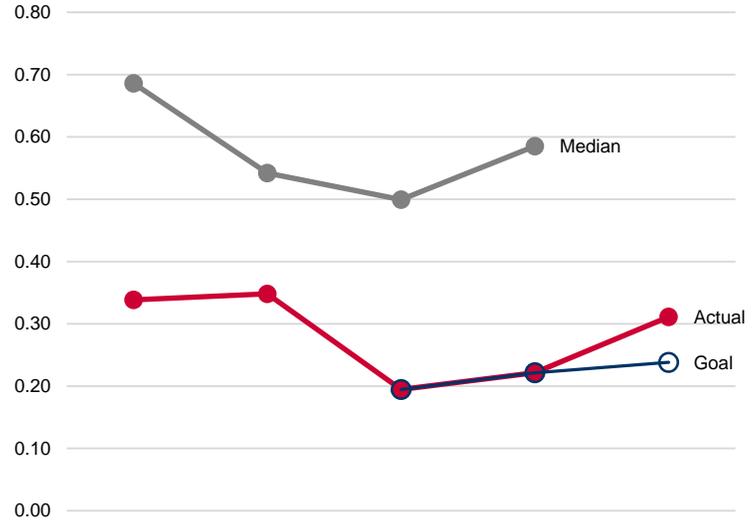


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	18	19	11	13	19
Goal			11	13	15
Difference			0	0	4

ABOR Peer Group	Med. Sch. AUTM Adj.	2007	2008	2009	2010	2011	Rank
University of Wisconsin - Madison	X	124	98	119	133		1
University of Washington	X	43	56	40	69		2
University of Florida	X	77	52	73	59		3
Pennsylvania State University, All Campuses	X	34	38	34	54		4
Michigan State University	X	35	48	41	52		5
University of California - Los Angeles	X	42	42	60	47		6
University of Minnesota	X	44	37	37	46		7
The Ohio State University	X	25	15	20	38		8
Texas A&M University		29	28	20	33		9
University of Iowa	X	30	24	30	32		10
University of California - Davis	X	45	21	24	29		11
University of North Carolina - Chapel Hill	X	31	17	19	27		12
The University of Arizona	X	18	19	11	13	19	13
University of Illinois - Urbana - Champaign		40	38				
University of Maryland - College Park		24	23				
University of Texas - Austin		40	25				
Median		38	33	34	46		

Discovery and Scholarly Impact

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



ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	0.3	0.3	0.2	0.2	0.3
Goal			0.2	0.2	0.2
Difference			0.0	0.0	0.1

ABOR Peer Group	Med. Sch. NSF Adj. AUTM Adj.	2007	2008	2009	2010	2011	Rank
University of Wisconsin - Madison	X	1.5	1.1	1.2	1.3		1
Michigan State University	X	1.0	1.3	1.1	1.2		2
University of Florida	X	1.3	0.9	1.2	0.9		3
University of Iowa	X	0.8	0.8	0.9	0.7		4
Pennsylvania State University, All Campuses	X	0.5	0.5	0.5	0.7		5
University of Washington	X	0.6	0.7	0.5	0.7		6
University of Minnesota	X	0.7	0.5	0.5	0.6		7
The Ohio State University	X	0.3	0.2	0.3	0.5		8
University of California - Los Angeles	X	0.5	0.5	0.7	0.5		9
Texas A&M University		0.5	0.4	0.3	0.5		10
University of California - Davis	X	0.7	0.3	0.4	0.4		11
University of North Carolina - Chapel Hill	X	0.6	0.3	0.3	0.4		12
The University of Arizona	X	0.3	0.3	0.2	0.2	0.3	13
University of Illinois - Urbana - Champaign		0.8	0.8				
University of Maryland - College Park		0.7	0.6				
University of Texas - Austin		0.9	0.5				
Median		0.7	0.5	0.5	0.6		

This Page Intentionally Left Blank



THE UNIVERSITY
OF ARIZONA®



Economic Development

Contributing to economic development through new venture growth remains a major goal of the University of Arizona. A strong entrepreneurial culture now exists within the UA with the result that, even in a highly unfavorable economy, we have seen strong increases in many of our economic development metrics. Our new **Tech Launch Arizona (TLA)** entity, mentioned earlier in this report, is aimed squarely at making a dramatic difference in the economic development benefits of the UA.

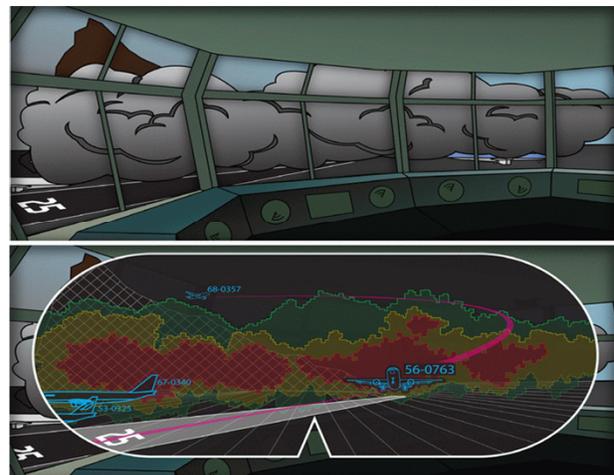
The TLA philosophy is to **combine the best entrepreneurial approaches from the private sector with world-class R&D, all in one unit, to elevate technology commercialization across the spectrum.** TLA will include funds and mechanisms to enable investment in promising early-stage technologies, and will combine greater access to human and financial capital with our technology transfer office, research parks, small-business incubator, accelerator and our corporate relations office to create an integrated whole.



TLA: elevating technology commercialization (photo: iStock)

We have reorganized the building blocks of this new venture, especially the orientation of our technology transfer operation, in recent years. As a result, we have fueled a **dramatic rise in the number of licensing agreements over the last five fiscal years, about 30% per year, reaching a record 80 agreements** in FY 2011. Our intellectual property income is not yet near where we want it to be, although it did show modest gains for FY 2011. Truly large IP income, such as that generated by a number of our peers, derives from long-term portfolio growth as small companies mature and gain value over multiple years.

Eight new startup companies were created in FY 2011 (for details, see the Technology Transfer section of this report). While the University contributes to startups into the Arizona economy from several University-associated programs, e.g. the McGuire Entrepreneurship Program and the Arizona Center for Innovation incubator, the startups tallied here are a conservative count: only those that conform to the Association of University Technology Managers (AUTM) definition of a start-up: a signed license to the company for foundational technology. The UA continues to participate in the financial upside of its startups not only through licenses but also through warrants, an equity-like financial instrument. UA holds warrants in 16 start-ups. One startup is Real Time Optical LLC, in Phoenix, that develops heads-up displays for air traffic control that can see through weather and identify aircraft.



Flight control view before and after heads-up display (Source: Real Time Optical)

In a five year analysis of the 30 start-ups formed by UA during the period one sees that financing is from many sources:

- o 23% are financed by Venture or Institutional Investors;
- o 37% are financed by Angel Investors;
- o 40% are SBIR-financed, Self-financed, or Customer-financed.

About 75% of these startups are located in Arizona, and UA personnel play a significant role in two-thirds of them.

Economic Development

Selected Accomplishments

- **The new University of Arizona BIO5 facility (right) opened in Oro Valley.** BIO5 Oro Valley is a technology accelerator, designed to enable UA researchers to get new medical therapies and drug discoveries into the market for patient use even faster than before. One of the projects that has moved to the new facility is the Arizona Drug Discovery Center. That 12-person group, led by associate professor Chris Hulme, works on finding chemical compounds that can be used as treatments for illnesses including cancer, Alzheimer's and heart disease. Additional Bio5 Oro Valley teams will work on cancer treatment. Eventually up to 150 people will work at the site, and **students will work alongside faculty as they do on campus.**



BIO5 Oro Valley (photo: Greg Bryan)

- **Valley Fever Solutions Inc.**, a company created in 2008 by University of Arizona researchers, will receive \$3M from the National Institute of Health for two years of clinical trials of a **drug that could cure Valley Fever.**
- **The UA Tech Park** won numerous awards in FY 2011, including three for the Solar Zone:
 - **Innovation in Economic Development Award – Innovation in Green Technology** from the US Department of Commerce, Economic Development Administration;
 - **Excellence in Economic Development** from the Office of the Governor, State of Arizona;
 - **Common Ground Award – Economic Development** from the Metropolitan Pima Alliance.

The Tech Park also received the **Common Ground Award – Architecture, Planning & Design** for the *Vail Academy and High School* from the Metropolitan Pima Alliance, and the **Excellence in Economic Development “The Next Big Idea”** from BizTucson magazine.

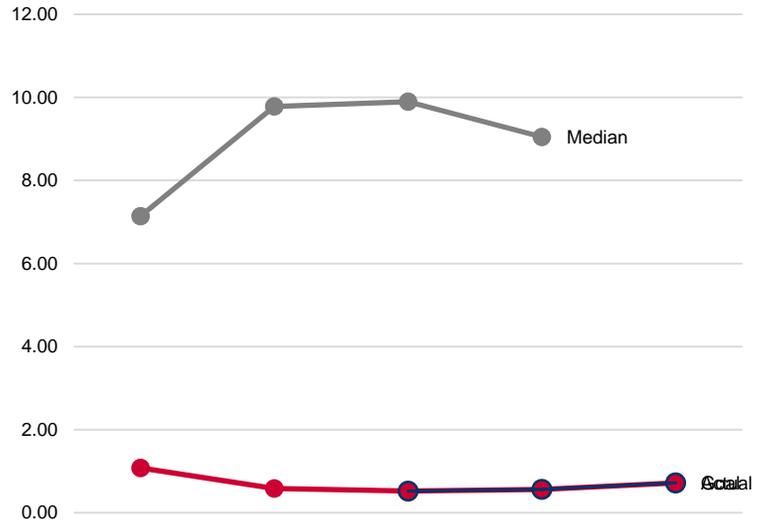


The Solar Zone at the UA Tech Park (Photo: Benjie Sanders / Arizona Daily Star)

- **The McGuire Center for Entrepreneurship in the Eller College of Management was ranked as the nation's No. 5** entrepreneurship program among public institutions by the Princeton Review and No. 5 by Entrepreneur Magazine in 2010. More than 300 businesses have been started by graduates of the center since it was founded in 1984. The College's **Management Information Systems program was ranked 3rd** by U.S. News & World Report in 2011.
- The following **13 graduate programs were ranked in the Top 10** by U.S. News & World Report in 2011: Geology, Speech-Language Pathology, Analytical Chemistry, Rehabilitation Counseling, Social Psychology, Information Systems, Atomic, Molecular and Optical Physics, Earth Sciences, Pharmacy, Ecology and Evolutionary Biology, Audiology, Entrepreneurship and Geochemistry.
- The prestigious **National Research Council of the National Academies rated 30 of our Ph.D. programs within the top 20 nationally** by field: Anthropology, Applied Math, Medical Pharmacology, Pharmaceutical Sci., Astronomy, Atmospheric Sci., Plant Sci., Sociology, Communication, Geography, Geosci., Nutritional Sci., Planetary Sci., Ecology & Evolutionary Biology, Nursing, Hydrology, Physiological Sci., Biomedical Engineering, Management, Philosophy, Systems & Industrial Engineering, Aerospace Engineering, Linguistics, Animal Sci., Neurosci., Soil Water & Environmental Sci., Environmental Engineering, Epidemiology, Genetics, and Immunobiology.

Economic Development

Intellectual Property Income (in Millions)

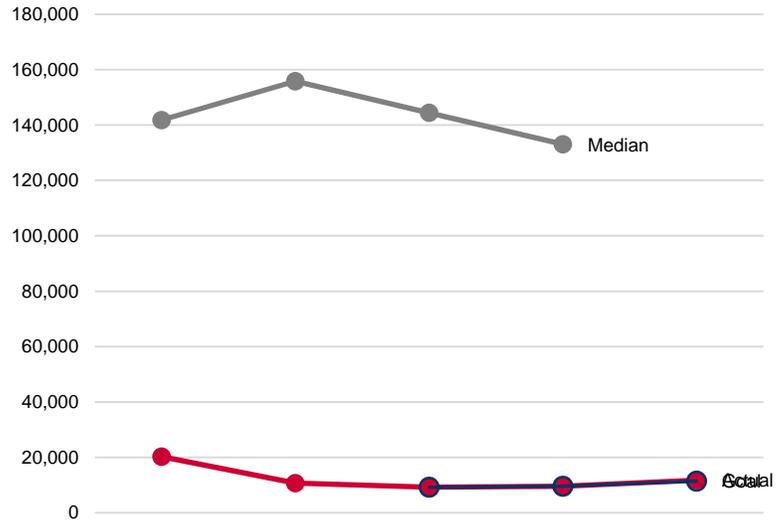


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	1.1	0.6	0.5	0.6	0.7
Goal			0.5	0.6	0.7
Difference			0.0	0.0	0.0

ABOR Peer Group	Med. Sch. AUTM Adj.	2007	2008	2009	2010	2011	Rank
University of Minnesota	X	63.3	84.7	95.2	83.9		1
University of Washington	X	63.3	80.3	87.3	69.0		2
University of Wisconsin - Madison	X	46.7	54.1	56.7	54.3		3
University of Florida	X	48.0	52.3	53.9	29.2		4
University of California - Los Angeles	X	20.9	32.8	22.6	27.5		5
University of Iowa	X	17.4	23.6	42.9	27.0		6
University of California - Davis	X	8.1	8.0	9.8	9.0		7
Texas A&M University		7.6	11.8	9.9	8.6		8
Michigan State University	X	5.6	4.8	4.4	4.0		9
University of North Carolina - Chapel Hill	X	2.1	2.8	3.1	2.6		10
Pennsylvania State University, All Campuses	X	1.8	1.5	1.2	2.3		11
The Ohio State University	X	1.2	2.1	1.7	1.9		12
The University of Arizona	X	1.1	0.6	0.5	0.6	0.7	13
University of Illinois - Urbana - Champaign		4.7	4.2				
University of Maryland - College Park		1.2	1.6				
University of Texas - Austin		6.7	11.6				
Median		7.1	9.8	9.9	9.0		

Economic Development

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

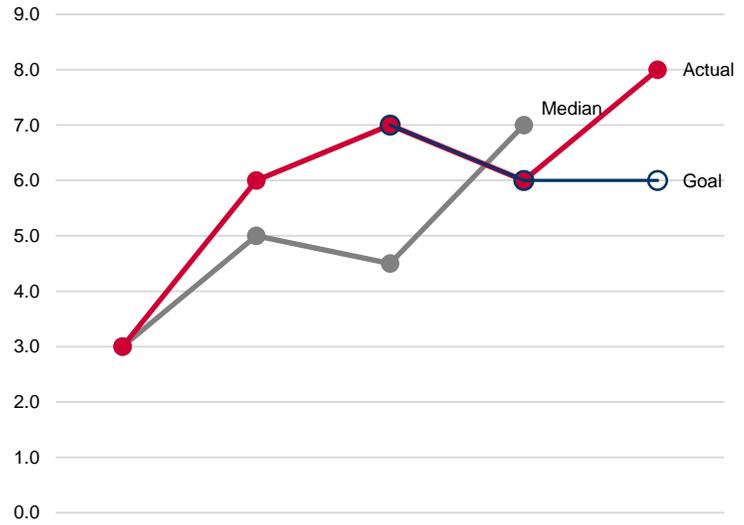


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	20,254	10,680	9,210	9,580	11,767
Goal			9,210	9,575	11,404
Difference			0	5	363

ABOR Peer Group	Med. Sch. NSF Adj. AUTM Adj.	2007	2008	2009	2010	2011	Rank
University of Minnesota	X	1,014,437	1,240,277	1,284,360	1,067,406		1
University of Washington	X	836,219	1,049,893	1,122,555	674,971		2
University of Iowa	X	478,825	802,551	1,301,059	607,859		3
University of Wisconsin - Madison	X	555,508	613,874	595,661	527,546		4
University of Florida	X	810,259	894,466	910,017	428,950		5
University of California - Los Angeles	X	254,057	376,797	253,451	293,331		6
University of California - Davis	X	134,719	124,681	144,436	133,075		7
Texas A&M University		122,667	178,037	138,566	125,010		8
Michigan State University	X	154,745	133,673	119,229	93,121		9
University of North Carolina - Chapel Hill	X	44,695	52,848	47,429	34,398		10
Pennsylvania State University, All Campuses	X	27,862	21,451	16,289	29,476		11
The Ohio State University	X	17,287	29,818	23,891	25,252		12
The University of Arizona	X	20,254	10,680	9,210	9,580	11,767	13
University of Illinois - Urbana - Champaign		98,968	84,604				
University of Maryland - College Park		32,577	39,363				
University of Texas - Austin		148,893	234,221				
Median		141,806	155,855	144,436	133,075		

Economic Development

Startup Companies

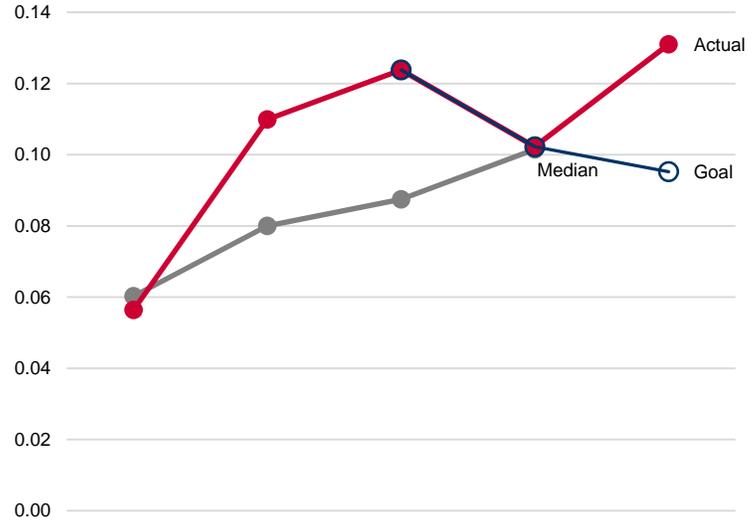


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	3	6	7	6	8
Goal			7	6	6
Difference			0	0	2

ABOR Peer Group	Med. Sch. AUTM Adj.	2007	2008	2009	2010	2011	Rank
University of California - Los Angeles	X	3		22	27		1
University of California - Davis	X	2		2	9		2
University of Florida	X	9	14	10	9		2
The Ohio State University	X	3	5	7	8		4
University of Minnesota	X	4	1	3	8		4
Texas A&M University		1	1	6	7		6
University of Washington	X	11	9	10	7		6
The University of Arizona	X	3	6	7	6	8	8
Pennsylvania State University, All Campuses	X	3	1	3	5		9
University of Illinois - Urbana - Champaign		7	6		5		9
University of North Carolina - Chapel Hill	X	0	5	1	5		9
University of Wisconsin - Madison	X	6	6	1	5		9
University of Iowa	X	2	0	3	3		13
Michigan State University	X	5	3				
University of Maryland - College Park		7	3				
University of Texas - Austin		3	10				
Median		3	5	5	7		

Economic Development

Startup Companies per \$10 Million in Total Research Expenditures

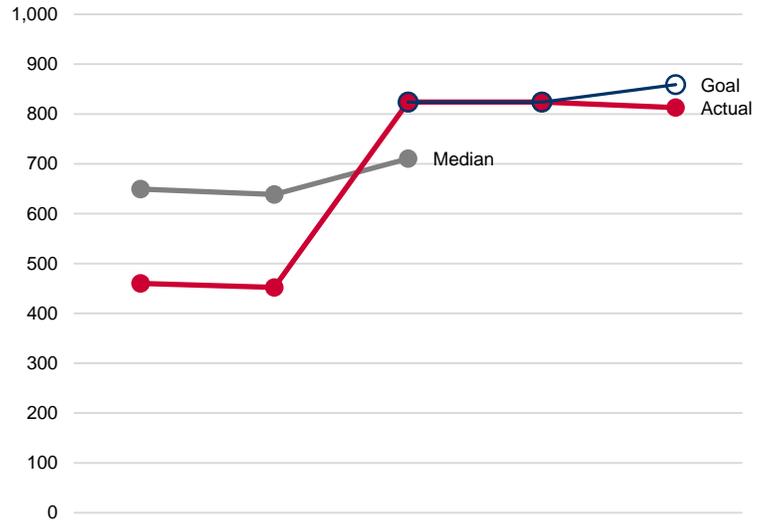


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	0.1	0.1	0.1	0.1	0.1
Goal			0.1	0.1	0.1
Difference			0.0	0.0	0.0

ABOR Peer Group	Med. Sch. NSF Adj. AUTM Adj.	2007	2008	2009	2010	2011	Rank
University of California - Los Angeles	X	0.0		0.2	0.3		1
University of California - Davis	X	0.0		0.0	0.1		2
University of Florida	X	0.2	0.2	0.2	0.1		3
The Ohio State University	X	0.0	0.1	0.1	0.1		4
The University of Arizona	X	0.1	0.1	0.1	0.1	0.1	5
University of Minnesota	X	0.1	0.0	0.0	0.1		6
Texas A&M University		0.0	0.0	0.1	0.1		7
University of Illinois - Urbana - Champaign		0.1	0.1		0.1		8
University of Washington	X	0.1	0.1	0.1	0.1		9
University of Iowa	X	0.1	0.0	0.1	0.1		10
University of North Carolina - Chapel Hill	X	0.0	0.1	0.0	0.1		11
Pennsylvania State University, All Campuses	X	0.0	0.0	0.0	0.1		12
University of Wisconsin - Madison	X	0.1	0.1	0.0	0.0		13
Michigan State University	X	0.1	0.1				
University of Maryland - College Park		0.2	0.1				
University of Texas - Austin		0.1	0.2				
Median		0.1	0.1	0.1	0.1		

Economic Development

Doctoral Degrees Conferred

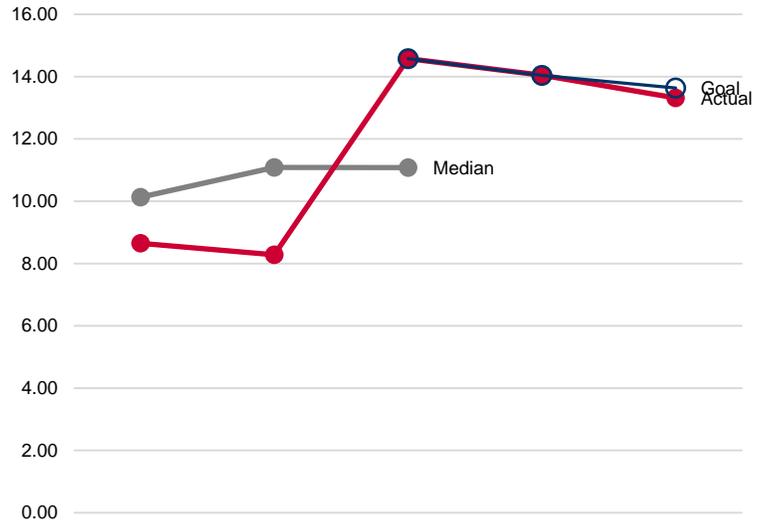


ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	460	452	824	824	813
Goal			824	824	859
Difference			0	0	-46

ABOR Peer Group	Med. Sch.	2007	2008	2009	2010	2011	Rank
University of Minnesota	X	819	775	879			1
University of Florida	X	794	857	841			2
The University of Arizona	X	460	452	824	824	813	3
University of Texas - Austin		779	868	824			3
University of Wisconsin - Madison	X	775	763	794			5
University of Illinois - Urbana - Champaign		698	759	784			6
University of California - Los Angeles	X	734	752	760			7
The Ohio State University	X	667	760	738			8
University of Washington	X	631	622	683			9
Pennsylvania State University, All Campuses	X	646	620	632			10
Texas A&M University		598	594	597			11
University of Maryland - College Park		653	655	587			12
University of California - Davis	X	474	500	500			13
Michigan State University	X	493	446	489			14
University of North Carolina - Chapel Hill	X	512	600	483			15
University of Iowa	X	376	413	404			16
Median		650	639	711			

Economic Development

Doctorate Degrees Conferred per \$10 Million in Total Research Expenditures



ABOR Enterprise Plan	2007	2008	2009	2010	2011
Actual	8.7	8.3	14.6	14.0	13.3
Goal			14.6	14.0	13.6
Difference			0.0	0.0	-0.3

ABOR Peer Group	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
University of Texas - Austin		17.4	17.6	16.3			1
The University of Arizona	X	8.7	8.3	14.6	14.0	13.3	2
University of Maryland - College Park		18.2	16.6	14.3			3
University of Florida	X	13.4	14.7	14.2			4
University of Illinois - Urbana - Champaign		14.7	15.1	13.9			5
Michigan State University	X	13.7	12.5	13.1			6
University of Iowa	X	10.4	14.1	12.2			7
University of Minnesota	X	13.1	11.4	11.9			8
The Ohio State University	X	9.3	10.8	10.3			9
University of Washington	X	8.3	8.1	8.8			10
University of California - Los Angeles	X	8.9	8.6	8.5			11
Pennsylvania State University, All Campuses	X	9.9	8.8	8.4			12
Texas A&M University		9.6	9.0	8.4			13
University of Wisconsin - Madison	X	9.2	8.7	8.3			14
University of North Carolina - Chapel Hill	X	10.7	11.4	7.5			15
University of California - Davis	X	7.9	7.8	7.3			16
Median		10.1	11.1	11.1			

This Page Intentionally Left Blank



THE UNIVERSITY
OF ARIZONA®



Leadership and Recognition

Leadership and Recognition

Introduction

Recognition by others, especially one's peers, for leadership and innovation in knowledge discovery are among the highest accolades that a University can receive. International and national academic awards are made to honor achievements that change how we understand and see the world.

Such recognition comes in many forms. The Nobel Prizes are justifiably known as the most prestigious and visible research awards, making international headlines each year when they are announced. **UA alumnus Prof. Brian Schmidt was awarded the 2011 Nobel Prize in Physics** for his contributions to the 1998 discovery of the accelerating expansion of the Universe. Schmidt received a double BS in Astronomy and Physics from the UA in 1989 before moving on to Harvard University and later the Australian National University. UA Nobel Prize recipients include Prof. Willis Lamb (Optical Sciences; 1955 Nobel Prize for Physics; deceased 2008), Prof. Nicolaas Bloembergen (Optical Sciences, 1981 Nobel Prize for Physics), UA alumnus Prof. Vernon Smith (2002 Nobel Prize for Economics; UA 1975-2001, now at George Mason University), UA Adjunct Prof. and Harvard University Prof. Roy Glauber (Optical Sciences, 2005 Nobel Prize for Physics), and Prof. Jonathan Overpeck (Geosciences, 2007 Nobel Peace Prize, with the United Nations Intergovernmental Panel on Climate Change).



Nobel winner Prof. Brian Schmidt (photo: Belinda Pratten, ANU)

Many advanced fields have their own equivalent international honors. **Regents Prof. Roger Angel was awarded the Kavli Prize in Astrophysics in 2010** (it is awarded every two years) for innovations in telescope and mirror design that have made possible the world's most powerful astronomical telescopes, including the Large Binocular Telescope and the planned Giant Magellan Telescope. Prof. Angel (4th from left in the photo) and the other U.S. recipients met with President Obama in the Oval Office on June 6, 2011. Several other notable honors and recognition awards are listed on the following page, including a newly-elected member of the U.S. National Academy of Sciences and other major research accomplishments of the UA.



Prof. Roger Angel meets the President in the Oval Office (Official White House Photo by Pete Souza)

The **Arizona Telemedicine Program's Dr. Ronald S. Weinstein Received the Distinguished Service Award** from the Association of Pathology Chairs. Dr Weinstein was the **founding director** of the Arizona Telemedicine Program, and was cited for making major contributions in the fields of cell biology and experimental pathology, for his contributions to organized medicine through his presidencies of six professional organizations, for his invention of telepathology and for his work as an innovator in medical education.

The latest (2010) national ranking by the **Center for Measuring University Performance at ASU places the UA at 16th among public universities, with 7 of the 9 measures in the top 25 and 1 in the top 50.** To move into the top echelon of schools in this metric will require roughly a doubling of our endowment and a dramatic upward shift in undergraduate selectivity to achieve an approximately 80-point increase in the median of our entering undergraduate SAT scores.

Leadership and Recognition

Selected Accomplishments

- **Regents Prof. Diana Liverman** received two honors in recognition of her contributions to understanding the human dimension of climate change:
 - Prof Liverman was awarded the **Founders Gold Medal of the Royal Geographical Society**, approved by Queen Elizabeth II, in recognition of her contributions to understanding the human dimensions of climate change. The Founders Medal was initiated through a gift by King William IV in 1831. Previous holders include Sir David Attenborough, Sir Edmund Hillary, Rev David Livingstone and Henry Morton-Stanley. Prof. Liverman is one of only a handful of women to be awarded the medal, which was presented by Sir Michael Palin, President of the RGS.
 - Prof. Liverman also received **Distinguished Scholarship Honors from the Association of American Geographers**, an award recognizing significant career achievements.



Prof. Diana Liverman and Sir Michael Palin (photo: Oxford Univ.)

- Secretary of the Interior Ken Salazar announced that the **Department of the Interior selected the University of Arizona as the lead institution for a new regional Climate Science Center for the Southwest**. The center, thanks to a \$3.1 million five-year grant, will address the current and future effects of climate change on the region's natural and cultural resources. The consortium includes major research institutions from neighboring states, as well as ASU and NAU, and brings a wide range of scientific and impact assessment capabilities including issues such as coastal management, drought impacts, and water management in the Colorado and other Southwest rivers.

- Senior and junior scholars at the UA have been recognized by the National Academies:
 - **George Rieke**, Regents' Professor of Astronomy and deputy director of the University of Arizona's Steward Observatory, was **elected to the National Academy of Sciences** in recognition of his pioneering work in infrared astronomy to understand the origins of the universe, particularly the formation of stars and planets.
 - **Armin Sorooshian**, a UA assistant professor of chemical and environmental engineering, is among 85 engineers across the nation selected by the **National Academy of Engineering** to participate in the invitation-only Frontiers of Engineering symposium, convened to determine ways to sustain and enhance the nation's ability to draw on scientific knowledge and technology to further expand technological advancements. Prof. Sorooshian, who studies the effects of atmospheric aerosol particles on public health, climate change and the water cycle, is among those the National Academy of Engineering is calling the "nation's brightest young engineers."



Prof. George Rieke (top) and Prof. Armin Sorooshian (bottom)(Photos: www.ozel.cz & UANews)

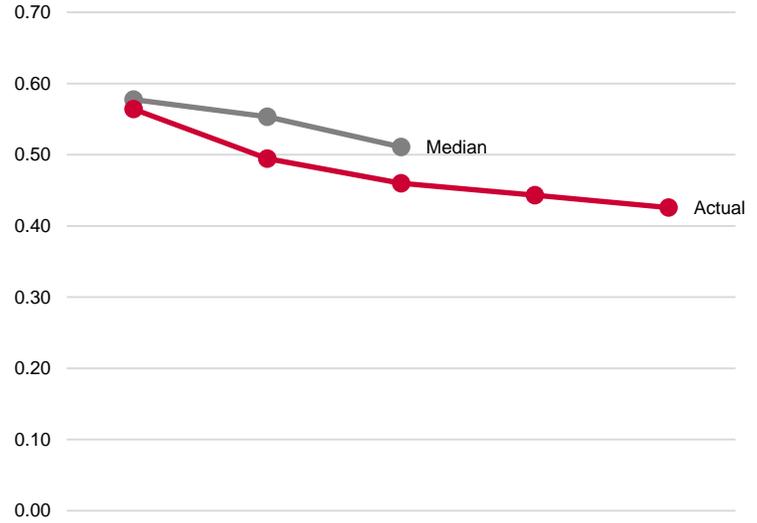
- **Rafe Sagarin**, a marine ecologist at the UA's Institute of the Environment, has received a prestigious **Guggenheim Fellowship**. Dr. Sagarin will use his award to help complete two books. The first book centers on how sciences, such as ecology, are returning to their roots in observation of the natural world with the aid of new technologies, to study large-scale environmental and social problems. The second book summarizes five years of research and development Sagarin has conducted on biological adaptation to help society better understand and respond to security threats such as terrorism, infectious diseases and natural disasters.



Guggenheim Fellow Dr. Rafe Sagarin (Photo: R. Sagarin)

Leadership and Recognition

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



		2007	2008	2009	2010	2011	
Actual		0.6	0.5	0.5	0.4	0.4	
	Med. Sch. NSF Adj.	2007	2008	2009	2010	2011	Rank
ABOR Peer Group							
University of Washington	X	1.2	1.3	1.3			1
University of Texas - Austin		1.3	1.3	1.3			2
University of Illinois - Urbana - Champaign		1.2	1.1	1.0			3
University of California - Los Angeles	X	0.9	0.9	1.0			4
University of Wisconsin - Madison	X	0.9	0.8	0.7			5
University of Maryland - College Park		0.7	0.7	0.7			6
University of Iowa	X	0.6	0.7	0.6			7
University of Minnesota	X	0.6	0.5	0.5			8
University of North Carolina - Chapel Hill	X	0.7	0.6	0.5			9
University of California - Davis	X	0.6	0.5	0.5			10
The University of Arizona	X	0.6	0.5	0.5	0.4	0.4	11
University of Florida	X	0.4	0.4	0.4			12
The Ohio State University	X	0.3	0.3	0.4			13
Pennsylvania State University, All Campuses	X	0.4	0.4	0.3			14
Texas A&M University		0.4	0.3	0.3			15
Michigan State University	X	0.2	0.2	0.2			16
Median		0.6	0.6	0.5			

This Page Intentionally Left Blank



THE UNIVERSITY
OF ARIZONA®



Technology Transfer

In FY 2011, the UA Office of Technology Transfer (OTT) further built on the notable achievements of FY 2010. Among many accomplishments, in FY2011 we:

- i. closed on a **record 80 licensing and option deals**, a +25% growth over FY 2010, that bring UA technology into use with Arizona and global companies and make the UA OTT one of the most productive offices in the nation in terms of per-person licensing;
- ii. continued strong outreach and service to the faculty to maintain the significant increases in key metrics, including 150 invention disclosures (+15%) and patents issued 19 (+46%), that fuel the technology transfer process;
- iii. created a **record eight new Arizona companies based on UA technology** in one of the toughest economic climates in decades (30 total startups over the past five fiscal years);
- iv. demonstrated a +34% increase in license and option revenues by emphasizing effective deal making and value.

These successes were fueled by a continued focus on utilizing resources efficiently, enhancing industry contacts and market knowledge, and by partnering with investors to support UA's entrepreneurial culture. Working early with the faculty to identify intellectual property and support the translation of cutting-edge research into new products and services, the OTT continues its throughput and portfolio-based approach to technology transfer activities with particular emphasis on identifying early stage innovations, building faculty satisfaction and creating sustainable returns to the University.

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

The Technology Transfer Pipeline



Transactions

Licenses, options, and other major agreements represent a key step in the technology transfer pipeline: *idea creation, technology translation, product realization and royalty generation*. These agreements involve considerable effort by OTT's six licensing professionals in Intellectual Property (IP) management, team marketing and deal execution. In FY 2011, OTT professionals executed a record 80 licenses and options with a total output of 88 major agreements. The number of licenses and options represents a +25% increase over FY 2010 and a five year increase of 167% showing the profound effect of incremental resources added to the OTT in FY 2009. More importantly, these agreements represent the highly efficient placement of faculty innovations into the technology transfer pipeline: in the past three fiscal years, 45% of all disclosures received by the OTT have been licensed or optioned.

Revenues & Distributions

FY 2011 total revenues from licensing activity and related legal reimbursements rose +12 % to just over \$1.41 million reflecting a strong increase licensing revenue of +28% and Option revenue of +67% which were offset by a decrease in legal reimbursements compared to last year's exceptional showing. The improving financial performance reflects the strong showing by the OTT in rebuilding the active licensing portfolio. The OTT's contributions to sponsored research activity increased strongly for a fourth straight year. FY 2011 legal reimbursements as part of transactions decreased reflecting a weaker first quarter compared to the exceptional fourth quarter of the prior year. We maintain our diligent management of the patent portfolio: a substantially increased 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 our disciplined approach to patent asset management; the median ratio for UA's peers is 33%.

Technology Transfer

Statistical Exhibits



Technology Transfer Activities	2007	2008	2009	2010	2011
Invention Disclosures Transacted	104	101	125	131	150
Invention Disclosures Transacted Year/Year Percentage Change		-3%	24%	5%	15%
New Patent Applications	61	68	99	67	104
New Patent Applications Year/Year Percentage Change		11%	46%	-32%	55%
U.S. Patents Issued	18	19	11	13	19
U.S. Patents Issued Year/Year Percentage Change		6%	-42%	18%	46%
Licenses and Options Executed	28	37	49	64	80
Licenses and Options Executed Year/Year Percentage Change		32%	32%	31%	25%
Other Major Agreements	14	10	20	13	8
Other Major Agreements Year/Year Percentage Change		-29%	100%	-35%	-38%

Licensing and Other Revenue	2007	2008	2009	2010	2011
Licensing Revenue (Including Options)	\$1,076,989	\$583,007	\$520,634	\$562,014	\$718,449
Licensee Legal Reimbursements	\$310,358	\$435,700	\$301,988	\$540,324	\$432,790
Other Revenue	\$114,141	\$107,183	\$166,476	\$156,013	\$263,046
Total	\$1,501,488	\$1,125,890	\$989,098	\$1,258,351	\$1,414,285

Sponsored Research Facilitated	2007	2008	2009	2010	2011
Total	\$459,929	\$1,001,716	\$1,857,451	\$4,701,776	\$5,918,193

Royalty Distribution	2007	2008	2009	2010	2011
Inventors	-\$414,724	-\$242,770	-\$225,842	-\$248,107	-\$346,698
Laboratories and Units	-\$338,497	-\$188,146	-\$171,589	-\$188,505	-\$231,132
University	-\$323,424	-\$176,008	-\$157,873	-\$173,437	-\$192,609
Undistributed	\$114,485	\$83,266	\$131,807	\$107,977	\$211,056

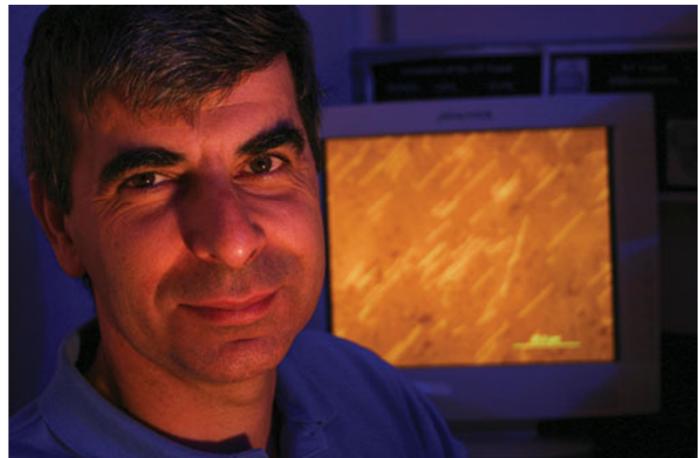
Two examples from the **19 U.S. patents** that were granted to UA in FY 2011 are:

- **U.S. Patent No. 7,919,258 Issued: 4/5/2011**
Rapid Tuberculosis Detection Method
Inventors: Richard Friedman, Linoj Samuel
This patent describes a method that can both rapidly diagnose cases of tuberculosis, the single largest infectious cause of mortality in the world, as well as detect the presence of antibodies to the *Mycobacterium tuberculosis* antigen in patient sera. This method helps the identification of patients actively infected with tuberculosis as well as patients infected at an earlier time. This reliable diagnostic test is rapid, sensitive and accessible enabling use worldwide for the control, treatment and prevention of tuberculosis in the human population. Almost one third of the world's population suffers from tuberculosis of which nearly three million people die yearly.



The UA is advancing biomedical science and healthcare through research and technology transfer (image: <http://www.healthnews.com/resources/images/world%20map%20stethoscope.jpg>)

- **U.S. Patent No. 7,682,585 Issued: 03/23/2010**
Directional Self-Assembly of Biological Electrical Interconnects
Inventors: Pierre Deymier, Roberto Guzman, James Hoying, Ian Jongewaard, Srin Raghavan
This patent describes a novel method for integrating biotechnology with semiconductor manufacturing technology to enable the next generation of feature reduction in electronic chips. The natural assembly processes of microtubules in living cells has been modified to form, in situ, nano-sized connections between multiple, varied devices (both micro and nano) and interfaces through directed and controlled assembly and disassembly of microtubules. Once in place, the assembled microtubules serve as a template for additional functions using biochemistry, such as forming 15 nm diameter electrical interconnects via copper metallization of the microtubule inner core.



Prof. Pierre Deymier (photo: Deymier lab)

Technology Transfer

Selected Licenses and Options Executed

The OTT Licenses and Options included, in addition to the start-ups outlined in the following pages, 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 Snyder Biomedical Corporation. 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, particularly in the area of vision and ophthalmology include:

- **Nitto Denko Corporation**

NDC is a world leader in new materials and has exclusively licensed patents related to new holographic materials.



- **Raptor Therapeutics Incorporated**

Raptor and the UA have entered into an exclusive license agreement for use of patented biomarkers in their drug discovery program.



- **Snyder Biomedical Corporation**

SBC has exclusively licensed the rights to patents related to the treatment of advanced macular degeneration.



- **Vistakon**

Vistakon, a Johnson & Johnson company, has non-exclusively licensed technology related to contact lens metrology to enable it to enhance its quality control during production.



- **Alcon, Ltd**

Alcon, a vision care company, has optioned patents and know how associated with certain intraocular trifocal lenses being developed at the University.



- **Tucson Trace Detection, LLC (Tucson, AZ)**
Chemistry Professor M. Bonner Denton and Dr. R. Sperline, Assistant Staff Scientist, Chemistry & Biochemistry and Mr. Wit Wisniewski, Electrical Engineer, Chemistry & Biochemistry
Tucson Trace Detection, LLC, (TTD) is a technology company funded by the Government and the founders focused on developing new monitoring and analytical instrumentation for ultrasensitive detection and analysis of trace materials. TTD's instrumentation has applications in safety monitoring and homeland security.
- **Real Time Optical, LLC (Phoenix, AZ)**
Optical Sciences Associate Professor H. Hua
Real Time Optical is a new subsidiary of Real Time Companies and is dedicated to bringing next generation heads up display technology from the University of Arizona into the avionics and flight safety markets.
- **Wildcap Energy Corporation (Reno, NV)**
Aerospace and Mechanical Engineering Professor I. Wygnanski
Wildcap Energy Corporation is an investor-backed technology company focused on bringing compelling new wind turbine technology developed at the University into widespread use.
- **Caduceus Intelligence Corporation (Tucson, AZ)**
Management Information Systems Professor Hshinchun Chen
Caduceus Intelligence Corporation (CIC), is a Tucson-based investor-backed health information technology company that aims to be the leading medical business intelligence and healthcare analytics company for hospitals and healthcare providers in China, Taiwan and the US. The company provides advanced medical business intelligence and healthcare analytics platforms, systems, and services for high-quality patient care, effective cost containment, healthcare process improvement, and medical risk mitigation.
- **Polar Laser Laboratories (Tucson, AZ)**
Pavel Polynkin, Associate Research Professor of Optical Sciences, and Jerome Moloney, Professor of Mathematics and Optical Sciences
Polar Laser is developing pulsed fiber lasers and laser systems in both commercial and military markets. The initial target market for Polar Laser Laboratories' products is the semiconductor inspection and marking industry mating the company's high-powered laser system with a high-speed scanner for marking applications.
- **Next Phase Energy, LLC (Tucson, AZ)**
Staff Scientist: Lon Huber
Next Phase Energy provides utilities and other companies financial modeling software for photovoltaic systems.
- **K-Photonics, LLC (Tucson, AZ)**
Khanh Kieu, Assistant Research Professor of Optical Sciences
Kphotonics, LLC, is a Tucson-based niche start-up company focused on fiber laser systems and unique optical components for fiber laser systems and amplifiers.
- **GAAS Corporation (Tucson, AZ)**
College of Pharmacy Professor B. Timmerman
GAAS is a corporation focused on developing new stabilized natural product extracts for nutraceutical, cosmeceutical and therapeutic uses. The first product is a tumeric extract useful in nutraceuticals and cosmeceuticals targeted towards lessening the effects of arthritis.

Technology Transfer

Other Notable Activities

- The Office of Technology Transfer (OTT) continues its **highly successful interactions with the UA's Eller College of Management** to commercialize select inventions and leverage internal relationships to extend the reach of technology transfer. Supporting the Advanced Technology Transfer Program under the Bi-national Consortium between UA and the government of Mexico's CONACYT Institutes, personnel from the OTT provide on-site training at the participating institutes and support of Eller's summer project teams. The OTT staff also continues to aid the McGuire Entrepreneurship Program and the MBA program in expanded experiential exercises in high tech entrepreneurship.
- The OTT staff continued their **service to the community** both in the State of Arizona and nationally through volunteer professional service activities. In addition to OTT licensing professionals speaking at local and national events, they continue to help organize external activities, such as Southern Arizona's IdeaFunding seminar attended by approximately 200 new Southern Arizona entrepreneurs. Dr. Nina Ossanna of the OTT and the BIO5 Institute continues her service as Chair of AZ BIO, BIOSA and member of the State's bioindustry.
- The University of Arizona's **Technology Transfer structure is currently being reorganized to form Tech Launch Arizona** during FY 2012.

This Page Intentionally Left Blank

This Page Intentionally Left Blank

Arizona Board of Regents
2020 North Central Avenue, Suite 230
Phoenix, AZ 85004
602-229-2500
www.azregents.edu