NEW RETURNS ON INVESTMENT IN THE KNOWLEDGE ECONOMY

PROPOSITION 301 AT ARIZONA STATE UNIVERSITY, FY 2003

MORRISON INSTITUTE FOR PUBLIC POLICY
SCHOOL OF PUBLIC AFFAIRS / COLLEGE OF PUBLIC PROGRAMS
ASU ARIZONA STATE UNIVERSITY

This publication updates a portion of the April 2003 study, Seeds of Prosperity: Public Investment in Science and Technology Research.

Morrison Institute for Public Policy will periodically publish new material to keep you informed of the status of Proposition 301 investments at Arizona State University.

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NEW RETURNS ON INVESTMENT IN THE KNOWLEDGE ECONOMY: PROPOSITION 301 AT ARIZONA STATE UNIVERSITY, FY 2003

Morrison Institute for Public Policy has analyzed returns from Arizona's Proposition 301-supported public investments in science and technology research at Arizona State University since 2001.

NEW RETURNS 2003:

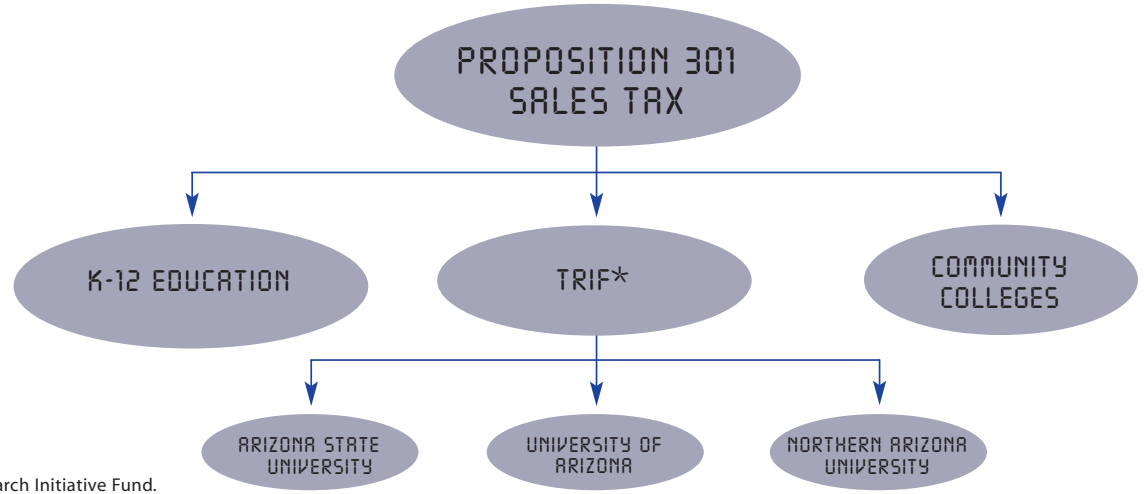
- Presents a new way of looking at ASU's results from the second year of Proposition 301-supported research
- Analyzes data from the August 2003 ASU report to the Arizona Board of Regents and interviews with key Proposition 301 managers and observers
- Complements Morrison Institute's ongoing development of the CAT measures, a new model of assessment for public investment in science and technology research (see page 10)

ARIZONA'S ONGOING INVESTMENT: PROPOSITION 301 AND TRIF

Arizona voters set in motion a substantial new public investment in university science and technology research when they passed Proposition 301 in November 2000.

- Proposition 301 established a 20-year-long 0.6% increase in state sales taxes primarily to support K-12 education, public university science and technology research, and community college workforce development programs.
- The public university share of FY 2003 Proposition 301 revenue was $46 million — to be split among Arizona's three public universities. It is anticipated to cumulatively total $1 billion by FY 2021.
- Revenue from Proposition 301 for the state's three public universities flows through TRIF, the state's Technology and Research Initiative Fund, which is administered by the Arizona Board of Regents as part of an economic development strategy for the state.
- The goal of the Proposition 301 investment in Arizona's public universities is to build the state's science and technology portfolio to provide both a foundation for and stimulus to a competitive knowledge economy in Arizona.

GENERAL DISTRIBUTION OF PROPOSITION 301 REVENUE



* Technology and Research Initiative Fund.

ANNUAL FUNDING: ASU'S PROPOSITION 301 ALLOCATIONS AND EXPENDITURES

ASU's Proposition 301 revenue totaled $25.2 million in FY 2003.

- $14.8 million in FY 2003 revenue and $10.4 million carried forward from FY 2002 allocations

ASU's expenditures totaled $20.7 million.

- $17.9 million for operating expenses and $2.8 million for capital expenses related to Proposition 301 projects

FY 2003 Proposition 301 revenue was lower than in FY 2002 due to reduced sales tax collections; however, expenditures were higher because:

- FY 2002 startup status for TRIF-supported projects prevented expenditure of all FY 2002 funds by June 30, 2002
- Unspent FY 2002 funds were carried forward to FY 2003

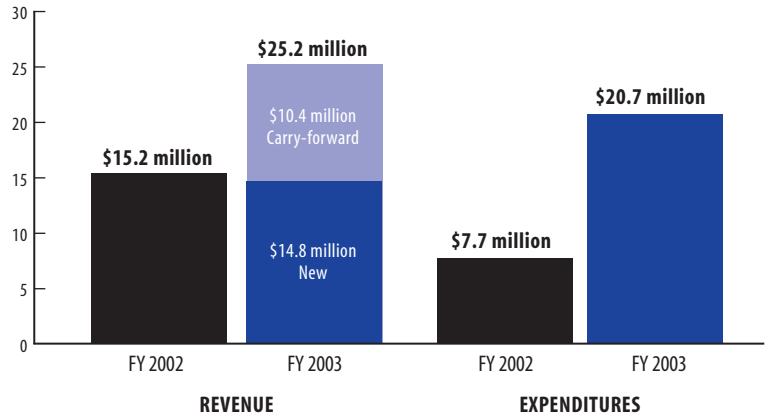
ASU PROPOSITION 301 REVENUE AND EXPENDITURES

	FY 2002 (millions)	FY 2003 (millions)
Total Revenue	**$15.2**	**$25.2**
New	(n/a)	$14.8
Carry-forward	(n/a)	$10.4*
Total Expenditures	**$7.7***	**$20.7**
Operating	$5.0	$17.9
Capital	$2.7	$2.8

Source: Morrison Institute for Public Policy, 2004.

Data: *Technology and Research Initiative Fund (TRIF) Annual Report,* Arizona Board of Regents, September 1, 2003.

* Includes FY 2002 encumbrances paid in FY 2003.



UNIVERSITY ACCOUNTABILITY: REPORTS AND ANALYSIS OF PROPOSITION 301 RESEARCH

The Arizona Board of Regents requires Arizona's three public universities to collect data on specific performance measures for Proposition 301-supported research.

- The universities' performance results are reported annually to the Arizona Board of Regents, the Governor of Arizona, and the Arizona Legislature.
- FY 2002 and 2003 Technology and Research Initiative Fund annual reports can be found at the Arizona Board of Regents web site (see page 11 for links).

Morrison Institute for Public Policy provides ongoing, value-added analysis of ASU's performance.

- The Institute's first report, *Seeds of Prosperity: Public Investment in Science and Technology Research*:
  - Described ASU's FY 2002 Proposition 301-supported activities
  - Presented ASU's Proposition 301 results in light of current thinking on the knowledge economy
  - Explained the economic and industrial context for ASU's high tech research
  - Introduced the CAT measures — a new model for determining public return from state investment in university-based high tech research — that analyzes the value of Connections, Attention, and Talent
- *Seeds of Prosperity* can be obtained at Morrison Institute's web site (see page 11 for links).

Accountability is not isolated to one sector, one industry, or one type of program. The public sector is one area in which accountability is just beginning to grow — but is growing rapidly.

Patricia Pulliam Phillips,
Editor of *Measuring ROI in the Public Sector*

ASU RESEARCH IMPACTS: RESULTS FOR THE KNOWLEDGE ECONOMY

ASU's Proposition 301-supported research activities in FY 2003 produced numerous impacts directly relevant to the knowledge economy, including:

- $9.1 million collectively in new external funding, new products, and company startups
- 17 new patents, 3 new startup companies, and 13 new research collaborations with industry and national labs
- 19 ASU post-doctoral fellows and 33 graduate students added to the workforce
- 227 high school students trained in software design
- An internationally recognized R&D and business leader hired to direct Arizona Biodesign Institute
- 5 new senior faculty, 22 research faculty, and 24 post-doc researchers successfully recruited, and 4 visiting scientists appointed

FY 2003 IMPACTS FROM ASU PROPOSITION 301-FUNDED RESEARCH

NEW MONEY	NEW PROGRAMS	NEW VENTURES	NEW SKILLS	NEW TALENT
$7.3 million in federal awards	6 new courses in Bio, IT, and Nano	13 new research collaborations with industry and national labs	48 new post-doctoral students in pipeline	Internationally renowned research scientist and business executive hired to lead AzBiodesign
$1.3 million in industrial contracts and donations	A manufacturing research road map in collaboration with industry	1 new nationwide industry-university research consortium under development	19 new post-doctoral students entering workforce	5 new senior tenured faculty successfully recruited
$400,000 in new products to ASU	6 proof-of-concept grants to faculty	6 new software packages distributed	120 new graduate students in pipeline	22 research faculty hired
$92,000 in value of new startups to ASU	13 technology transfer portal inquiries from industry	3 new products in marketplace	33 graduate students earning degrees and entering workforce	24 post-doctoral research associates hired
		3 new companies started	84 undergraduate students with research experience	4 visiting scientists appointed
		20 licenses/options signed	10 more graduates in Computer Science and Engineering	
		17 patents approved and 106 patent applications filed	227 high school students completing software design material	
		91 inventions disclosed	88 internships in industry or Software Factory	
		6 business plans written		

Source: Morrison Institute for Public Policy, 2004.

Data: *Technology and Research Initiative Fund (TRIF) Annual Report*, Arizona Board of Regents, September 1, 2003.

NEW DIRECTIONS IN FY 2003: CONSOLIDATION OF RESEARCH UNDER ARIZONA BIODESIGN INSTITUTE

First-year (FY 2002) Proposition 301 projects at ASU were concentrated in 6 separate areas:

- 4 emerging research fields — biosciences, information technology, advanced materials, and manufacturing
- 2 support areas — access/workforce development and technology transfer

For FY 2003, most research efforts were refocused on larger, more encompassing interdisciplinary research projects that were consolidated under an expansion of the Arizona Biodesign Institute.

ARIZONA BIODESIGN INSTITUTE IN FY 2003:

- Oversaw 8 research centers comprised of interdisciplinary teams representing bioscience, nanotechnology, and information technology
- Linked ASU with TGen (Translational Genomics Research Institute – a biomedical research institute in Phoenix) through affiliated faculty, joint faculty appointments, and supercomputing facilities

GOALS OF ARIZONA BIODESIGN INSTITUTE'S 8 RESEARCH CENTERS, FY 2003

NAME OF RESEARCH CENTER	RESEARCH GOALS
Infectious Diseases and Vaccinology (IDV)	Study selective pathogens, identify vaccine antigens, and use transgenic plants as low-cost, efficient systems for producing oral vaccines
Protein and Peptide Pharmaceuticals (CP3)	Identify, characterize, and optimize biologically active protein derivatives for use as pharmaceuticals
Bio-Optical Nanotechnologies (BON)	Integrate biomolecular sciences with materials engineering and solid-state electronics to develop the next generation of biosensors, implants, pharmaceuticals, biomaterials, and nanoscale power sources
Single Molecule Biophysics (SMB)	Examine the physical processes of life at the molecular level to develop new health care tools
Applied NanoBioscience (ANBC)	Apply advances in nanoscience, molecular biology, and genomics to understand disease at the molecular level
Neural Interface Engineering (NIE) *Formerly Neural Interface and Brain Control (NIBC)*	Develop neural interface and brain control technologies to rehabilitate motor function disorders caused by central nervous system disease or injury
Rehabilitation Neuroscience & Rehabilitation Engineering (RNRE)	Design and develop technologies to mitigate the effects of neurological disorders, and therapeutics and devices for improved health, fitness, and assistance with daily activities
Evolutionary Functional Genomics (EFG)	Understand how genes, gene families, and genomes change over time and clarify the gene interaction networks responsible for development of a single fertilized egg cell

Source: Morrison Institute for Public Policy, 2004.
Data: Arizona Biodesign Institute and *Technology and Research Initiative Fund (TRIF) Annual Report,* Arizona Board of Regents, September 1, 2003.

NEW DIRECTIONS IN FY 2003: BUILDING CAPACITY FOR THE FUTURE

Proposition 301-related lines of research that did not become part of Arizona Biodesign Institute were reorganized as "Capacity Building Projects" in information science, advanced materials, and manufacturing. The goal of this reorganization is to increase focus, interdisciplinary connectivity, and economic impact.

- Information science links affiliated research centers and research consortia, and has created InCISE — the Institute for Computer Information Science and Engineering — as the focal point for interdisciplinary collaboration and entrepreneurial activity in IT.
- Advanced materials builds on strengths in nanoelectronics, nanoscience, and technology to develop new technologies in areas including wireless nanosensing and communications.
- Manufacturing focuses on streamlining high tech manufacturing supply networks using current technologies, and investigating potential increases in efficiency that will be made possible by new generations of wireless and embedded systems being developed at ASU.

RESEARCH FOCUS OF CAPACITY BUILDING PROJECTS, FY 2003

CAPACITY BUILDING PROJECTS	CENTER OR RESEARCH AREA	FOCUS
Information Science	Institute for Computer Information Science and Engineering (InCise)	Provide core research capability and supporting infrastructure for multidisciplinary research projects and enhance interdisciplinary and entrepreneurial activity
	Center for Research in Arts, Media, and Engineering (AME)	Integrate communications and multimedia technologies and ideas with the arts to enable new ways of expression
	Center for Advancing Business through Information Technology (CABIT)	Partner with industry in the emerging E-economy business management arena by providing leadership research and education
	Consortium for Embedded and Internetworking Technologies (CEINT)	Partner with high tech industry to expand capacity in embedded systems through an integrated program of short and long-term research, curriculum development and delivery, for-credit internships and scholarships, and local, regional and national marketing
	ASU Software Factory	Provide a hands-on learning experience in software engineering for student interns; and offer software development services to projects across campus, including in AzBio
Advanced Materials	Integrated Micro/Nanosystems	Create new applications in sensing and communications technologies
	Wireless Nanotechnologies (WINTECH)	Work with Connection ONE — a new National Science Foundation/University Cooperative Research Center at ASU with 12 member companies and 2 academic partners — to identify and develop new technologies that enable fully autonomous nano-integrated circuit communication devices, such as wireless biomonitoring and wireless environmental sensing
Manufacturing	High Tech Manufacturing Supply Networks	Collaborate with academic and industry partners to conduct basic research in semiconductor manufacturing operations, develop curriculum and internships for undergrad and grad students in manufacturing, and develop a roadmap to guide further research activities in high tech manufacturing supply networks

Source: Morrison Institute for Public Policy, 2004.

Data: *Technology and Research Initiative Fund (TRIF) Annual Report,* Arizona Board of Regents, September 1, 2003.

NEW DIRECTIONS IN FY 2003: REDESIGN OF TECHNOLOGY TRANSFER

Proposition 301 monies allowed the university's tech transfer office to begin a series of creative initiatives that culminated in FY 2003 with the establishment of Arizona Technology Enterprises (AzTE), a new limited liability corporation affiliated with ASU. It replaces ASU's former technology transfer unit. As a limited liability corporation, AzTE can be more flexible in structuring licensing and partnership deals with companies, and is able to act more quickly to fit the time-sensitive development demands of the technology industry. AzTE's business friendly model of "technology venturing" should provide faster licensing and commercialization of new inventions than the more passive and protective handling of university intellectual property that has been practiced by traditional university tech transfer offices.

ARIZONA TECHNOLOGY ENTERPRISES:

- Actively assesses and markets ASU inventions through entrepreneurial partnerships, relationships with investors, and business development services for new startup companies
- Will receive no TRIF monies for operations starting in FY 2004,* but will remain an outlet for TRIF-supported research at ASU and NAU

NEW VERSUS OLD APPROACH TO COMMERCIALIZING UNIVERSITY INVENTIONS

PROPOSITION 301 TECH VENTURING	TRADITIONAL TECH TRANSFER
Actively assesses new technologies for commercial value and marketability	Provides passive protection of new technologies
Bundles related inventions together as a portfolio to simplify and speed licensing	Licenses new inventions individually
Offers business development services and risk-sharing through partnerships with entrepreneurs	Does not assist companies after inventions are licensed
Provides entrepreneurial assistance for promising faculty startups	Follows a "hands off" policy regarding faculty involved with startups
Run by individuals with business experience including venture capital and product and business development	Staffed with university personnel

Source: Morrison Institute for Public Policy, 2004.
Data: Arizona Technology Enterprises and ASU Office of the Vice President for Research and Economic Affairs.

*Proof-of-concept grants for faculty inventors will continue to be funded by TRIF.

FOR POLICYMAKERS: CAT MEASURES TO ASSESS "EN ROUTE" RETURN ON INVESTMENT

As a complement to ASU's annual reporting to the Arizona Board of Regents, Morrison Institute for Public Policy is refining a new assessment tool called the CAT measures. The initial description of this new measurement technology — presented in *Seeds of Prosperity* — gained substantial national attention.

THE CAT MEASURES:

- Assess CONNECTIONS, ATTENTION, and TALENT generated by science and technology research and the role they play in enabling and stimulating knowledge economy growth and development
- Provide ongoing feedback on the lasting value of research activities to inform policy decisions on public investments
- Will be field tested in early 2004

SAMPLE CAT INDICATORS

 CONNECTIONS	 ATTENTION	 TALENT
Partnerships and joint ventures with industry	University exposure in print and broadcast media	Successful hiring and retention of top research faculty
Public and private grants for university research	Presentations by university researchers	Top science and technology grad students attracted and retained
Licenses and joint ventures inspired by research	Articles published by university researchers	Private sector individuals trained through university research projects
Research consortia with other universities	Awards and recognition won by university researchers	Visiting faculty associated with university research projects
Interactions between university researchers and peers	Industry recruitment of science and technology students	K-12 outreach by university research projects

Source: Morrison Institute for Public Policy, 2004.

FOR ADDITIONAL INFORMATION: RELATED LINKS ON PROPOSITION 301, TRIF, AND CAT

TOPIC	WEB SITE
Arizona Biodesign Institute	www.azbio.org/
Arizona Technology Enterprises (AzTE)	http://techtransfer.asu.edu
FY 2002 TRIF report	www.abor.asu.edu/1_the_regents/TRIF/TRIF_FY2002.pdf
FY 2003 TRIF report	www.abor.asu.edu/1_the_regents/TRIF/1TRIF%20FY2003.pdf
"It Pays When Investment Foresight Is 20-20"	www.asu.edu/copp/morrison/investmentoped.htm
Proposition 301 funding and projects at ASU	http://researchnet.asu.edu/prop301/
Science and technology reports at Morrison Institute for Public Policy	www.asu.edu/copp/morrison/public/public2s.htm
Seeds of Prosperity: Public Investment in Science and Technology Research; A Study of the Economic Potential of Proposition 301 at Arizona State University and a New Model for Assessing its Long-Term Value	www.asu.edu/copp/morrison/Prop301.pdf
TRIF enabling legislation	http://researchnet.asu.edu/prop301/ars15-1648.html

ACKNOWLEDGEMENTS

Special thanks to the following people for their insights:
Mike Mobley, *Arizona Biodesign Institute*; Jay Murphy, *ASU Budget Planning and Management*;
Julia Rosen, *ASU Office of the Vice President for Research and Economic Affairs*; Peter Slate, *Arizona Technology Enterprises*

We gratefully acknowledge the assistance of:
Karen Leland, Rob Melnick, Cherylene Schick, *Morrison Institute for Public Policy*; Karen Heard, *Chalk Design*

Finally, we thank the many reviewers who certified the accuracy of data and analyses or provided other important feedback.

Morrison Institute for Public Policy conducts research that informs, advises, and assists Arizonans. A part of the School of Public Affairs (College of Public Programs) at Arizona State University, the Institute is a bridge between the university and the community. Through a variety of publications and forums, Morrison Institute shares research results with and provides services to public officials, private sector leaders, and community members who shape public policy. A nonpartisan advisory board of leading Arizona business people, scholars, public officials, and public policy experts assists Morrison Institute with its work. Morrison Institute was established in 1982 through a grant from Marvin and June Morrison of Gilbert, Arizona and is supported by private and public funds and contract research.

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JANUARY 2004

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