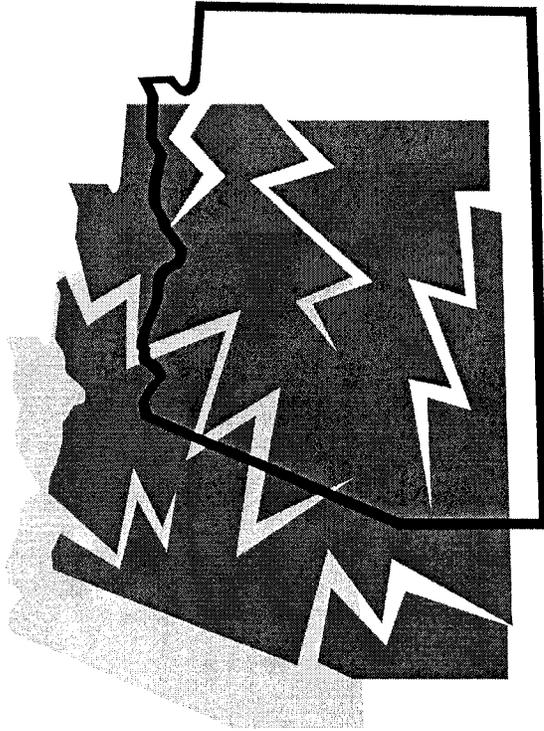


**Supplement to
“Arizona at
Risk: An
Urgent Call For
Action”**

**The Report of The
Governor’s
Task Force on
Higher Education**

*Possible Approaches to
Implementing the Recommendations of
The Governor’s Task Force on Higher Education*

DECEMBER 2000

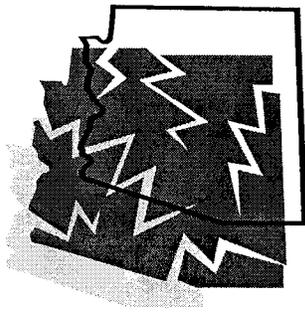


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As we enter this era of knowledge-based industries and work, a strong system of higher education is absolutely vital to achieving a vibrant social and economic future for the State of Arizona. I am delighted that policy-makers, for years to come, will now have a comprehensive blueprint from which they can shape Arizona's university and community college system.

-- Governor Jane Dee Hull

This document provides supplemental information to the report of the Governor's Task Force on Higher Education titled *Arizona at Risk: An Urgent Call for Action*. Both this supplement and the report are available at WWW.GTFHE.STATE.AZ.US or may be obtained by calling (602) 229-2516.

Forward: Arizona at Risk

The future of Arizona is at risk. While the rapid growth of a new, global, information-based economy provides tremendous opportunities for all of Arizona's citizens, the state is at risk of missing out on the potential benefits of this economic revolution.

The risk factors for Arizona are real, and they are alarming. In the face of these challenges, and the lost opportunity costs they imply, the Governor's Task Force on Higher Education recommends an urgent plan of action and requests the support of citizens and leaders.

The Task Force plan is based on statements of principle and is consistent with other recommendations, including those of the Seventy-Sixth Arizona Town Hall and the *Education 2000* ballot referendum proposed by Governor Jane Dee Hull, referred by the Arizona Legislature and approved by the voters.

Given the speed with which the current window of opportunity may close, this request for support, like the calls for action echoed in other reports, is offered with a sense of great urgency.

RISK FACTORS FOR ARIZONA

- Alarming high rates at which students drop out of the educational pipeline;
- A growing economic gap between "haves" and "have-nots";
- An information-based economy that is narrowly concentrated in a few technology sectors;
- A dramatic "brain drain" of top research faculty, scientists, and technicians; and
- Stiff competition from other states that are investing heavily in higher education.

THE ACTION PLAN

The action plan developed by the Task Force calls for a significant strengthening of Arizona's higher education system through three key strategies to achieve desired outcomes:

INCREASE PARTICIPATION--Raise the level of participation in higher education;

INCREASE RESEARCH AND BUSINESS DEVELOPMENT--Increase the amount of targeted research, technology transfer and business development provided by higher education; and

INCREASE CAPACITY AND PRODUCTIVITY--Enhance the human, physical, and technological capacity of institutions of higher education.

Commitment and investment are needed at all levels and by all sectors in order for Arizona to succeed in a competitive new environment. The support needed to implement this action plan for higher education includes enhancement of capital formation and revenue sources, along with the improvement of current funding mechanisms. There is also a need for increased collaboration between education sectors, continued contribution to the productivity of the state, and accountability for results.

Advances in the current economy and the transition to the New Economy will contribute to future economic development. *Arizona must act now to make a statewide commitment to economic development that . . .*

- Relies on knowledge-based businesses and industries that employ workers who understand technology and know how to process and generate information, engage creatively in research and design, and provide services to people;
- Recognizes that people are the most important raw material, and services and information are the most important products;
- Relies on strengths in multiple knowledge-based businesses and industries, including software and communication services; computer and electronics industries; healthcare technologies; innovation services; and financial services; and
- Acknowledges global competition recognizing the potential of a worldwide market, especially the market for services provided by knowledge-based businesses and industries, and acts to target markets around the globe.

THE URGENT NEED FOR ACTION

There is a revolution at hand in the economy of Arizona, the nation, and the world—an information revolution. At all levels the economy is becoming more global, more competitive and more infused with technology. The basis of wealth in this new economy is information, the new ideas and innovation on which this economy thrives. People are the raw material for the production of information. It is their knowledge and ability to access and communicate information that fuels the economic engine.

Education is a key to participation in this economic revolution, offering the knowledge that is essential for workers to succeed. It provides the well-trained and highly skilled labor force that is essential for business and industry to be competitive. It helps to produce the research and develop the innovations and techniques that fuel the new, knowledge-based economy.

In the face of this historic economic revolution, Arizona stands at risk—at risk of marking time, at risk of slipping backward, at risk of losing out. Key educational

benchmarks and trends in the state are negative, and the competition from other states and countries is formidable. Yet Arizona has a strong foundation on which to build. Great strides are being made to improve education at the K-12 level while Arizona's institutions of higher education are already strong. The people of Arizona are now faced with a compelling choice—whether or not to utilize these strengths and mount a vigorous effort to compete for economic success.

Arizona must take urgent and bold steps to lead and benefit from a growing national economy. Procrastination, in the face of increasingly aggressive competition supported by significant public investment in other states, will surely cause Arizona to fall further and further behind. Unless these steps are taken and unless current trends in the state's support of higher education are reversed, Arizona will remain at risk.

In responding to the challenge of creating a plan for Arizona Higher Education, the Task Force was mindful of the two distinct trends that will characterize the future:

- An increasing population of learners will desire and need more postsecondary education; and
- A growing economy will require a workforce composed of lifelong learners who will continually need to update skills and competencies.

RESPONDING TO THE GOVERNOR'S CHARGE

In her 1999 charge to the Task Force on Higher Education, Arizona Governor Jane Dee Hull noted that a high quality education system is important to the future of Arizona. She emphasized that Arizona is a growing state and that continued growth makes it vital to position the higher education system to improve the quality of life for every citizen.

Her charge posed five pressing questions:

- **How will we serve the higher education needs of Arizona until 2020?**
- **How will we structure higher education to maximize Arizona's economic development potential?**
- **What kinds of facilities are needed and where?**
- **How will we better use technology?**
- **How will we fund Arizona's higher education needs (operation and capital) until 2020?**

At its initial meeting in October 1999, the Task Force generated a number of possible outcomes for higher education in the coming decades. The Task Force decided to focus on three desired outcomes that held the most promise for fulfilling the Governor's charge:

- Economic Development;
- Workforce and Business Development; and
- Educational Development.

The Task Force then established a statement of purpose and proceeded to develop several principles to guide their deliberations in pursuit of these broad outcomes.

STATEMENT OF PURPOSE

It is the purpose of the Governor's Task Force on Higher Education to fulfill its charge by developing a plan that will help move Arizona into an economic position of national and global prominence by reexamining, refining, and significantly strengthening the evolving role and capacity of the state's higher education institutions as drivers for development of the new, globally-competitive, knowledge-based economy.

GUIDING PRINCIPLES

To achieve the desired outcomes for the State of Arizona of workforce development, economic development, and educational development, the Governor's Task Force on Higher Education has recommended initiatives and performance measures for higher education that are guided by the following principles:

- 1) **URGENCY**—It is imperative that the state recognize the crucial role of higher education as a driver for Arizona's New Economy and increase the financial support required for higher education to effectively fulfill this role. The result will be an enhanced contribution by higher education to quality of life and the economy of the state.
- 2) **ACCESS**—Promote universal, continuing access to higher education by overcoming barriers of time, place, and social or economic circumstance and expanding the capacities of campuses and delivery systems. This will help to achieve a better educated citizenry, a better prepared workforce, and a larger, more diverse economy.
- 3) **HUMAN RESOURCES**—Conserve and enhance essential human resources by increasing faculty and staff salaries to competitive levels in order to hire

and retain top faculty and critical staff, and attract world-class scientists and technicians.

- 4) **CAPITAL ASSETS**—Address chronically deferred maintenance problems by renewing buildings and infrastructure, retrofitting older facilities for information technology, and expanding academic and research facilities at existing sites. This will help to provide optimal use of existing facilities, and integrate information technology with campus-based instruction.
- 5) **NEW ECONOMY**—Transform higher education into a driver for the knowledge-based, global economy by assessing and addressing the needs of Arizona's industry clusters, the needs of Arizona's workforce and the learning outcomes required for the effective engagement of Arizona higher education graduates in the economy. Targeting resources to university research and business development, implementing e-education for on-campus and off-campus programs, utilizing e-commerce for business functions, and increasing the use of public/private partnerships will stimulate innovation and the transfer of technology to Arizona business and industry. Higher education will be student-focused, outcomes-based, technologically integrated, globally competitive, flexible, agile, and market-driven.
- 6) **EXCELLENCE**—Provide quality higher education by matching the preparation levels and aspirations of learners and the needs of society with the appropriate missions, roles and scope of Arizona's public and private postsecondary institutions. This approach will achieve productive academic programs that are responsive to workforce needs; certificate and degree recipients prepared for cultural, intellectual and civic life and the workforce; and world-leading research and technology transfer for Arizona's New Economy.
- 7) **INFORMATION TECHNOLOGY**—Increase the use of new technological delivery channels for academic degree and certificate programs as well as noncredit coursework and workshops. The aim is to achieve integration of electronic education with traditional delivery systems, to enhance administration and support services, and to prevent unnecessary duplication of resources through collaboration between and among educational institutions and sectors.
- 8) **LEARNER-CENTERED PROGRAMS**— Focus existing and new academic programs on the learning needs of students and the knowledge, abilities and skills they require for success in the New Economy and in their family and civic lives. As a result of this effort, learning will be more outcomes-based, self-paced, team-centered, active, and experiential.
- 9) **CAPITAL FORMATION**—Enhance the formation of investment through new funding approaches, including public/private partnerships, private

contributions, mutual leveraging of funds from multiple sources and levels, and new approaches to public funding.

- 10) **FUNDING MECHANISMS**—Transform the incentives inherent in funding to include quality, productivity, efficiency, and collaboration. Do so by such means as improving or replacing the current funding formulas, reviewing university and community college capital allocation practices, keeping the net price of instruction for Arizona students as low as possible, and pricing to market for non-resident students.
- 11) **PRODUCTIVITY**—Improve the contribution of higher education to the productivity of the state by ensuring the effectiveness and efficiency of academic programs and the coordination of delivery systems between and among individual institutions and sectors.
- 12) **ACCOUNTABILITY**—Strengthen the accountability of higher education by defining and implementing performance measures for recommended initiatives. Accountability measures should be incorporated into the plan and systematically pursued for each new initiative advanced in higher education.
- 13) **COLLABORATION**—Further strengthen the coordination among state education boards, and the communication between state and local district boards, in order to enhance policy coordination on educational issues, develop and implement an articulated master plan for higher education, and present unified proposals for support to the legislature and the public.

THE NEW ECONOMY

It is no coincidence that the Task Force's desired outcomes, statement of purpose, and guiding principles all reflect the role of Arizona's higher education system in positioning the state and its citizens for economic success. The Task Force recognizes that the State of Arizona faces a crucial decision regarding the role it is to play in what observers have labeled "*The New Economy*."

What is this "New Economy?" As a result of the tremendous worldwide influence of telecommunications and computers, a new global economy has emerged; one based more on information and knowledge than on product and location. The old Industrial Age is giving way to a new digital age, and at the dawn of this new age a window of opportunity has opened for a few states to emerge as world leaders. To become such a leader, Arizona must act with great urgency to:

- Develop a kindergarten-graduate school education system that will create, attract, and retain diverse clusters of knowledge-based and information-based business and industry;
- Provide access for all citizens to education that produces a highly educated and well trained workforce consisting of lifelong learners who

possess the skills and general educational competencies necessary to be competitive in the New Economy; and

- Provide incentives to attract and retain scientific and technical talent.

The extent to which Arizona thrives in the New Economy will rely heavily on whether the state is able to provide a productive workforce; one adequately trained for immediate success, but also sufficiently motivated to participate in lifelong learning activities to stay current and competitive. Arizona must act now to make a statewide commitment to workforce development that . . .

- Will generate a diverse workforce where all genders, races, and ages are equitably represented at any level of the workforce to which they aspire.
- Will educate citizens to their highest potential for participation in the New Economy at all levels of the workforce including trades workers, entrepreneurs, managers, scientists, technicians, and researchers.

Education beyond high school is the key to a trained workforce. It ensures that all citizens are prepared to participate in and benefit from the New Economy. Arizona must act now to make a statewide commitment to educational development that . . .

- Relies on enhanced capacity to serve the projected growth of students through both traditional campus classrooms and technology; and
- Provides student access, not only for traditional-age students, but also for lifelong, returning, and all other learners, in particular those who are place-bound in rural areas and those are time-constrained by family and work responsibilities.

A STRONG FOUNDATION

Fortunately, Arizona has a strong foundation on which to build a successful effort to compete in the New Economy. The state's postsecondary education system is blessed with nationally ranked university research and instructional programs and nationally recognized community college districts, campuses, and skills centers. These institutions, together with their faculty and students, are a tremendous resource to help raise Arizona to the next level of economic achievement.

The Governor's Task Force on Higher Education hopes that its report and recommendations will inspire citizens and leaders to make the best use of the state's higher education resources in helping Arizona emerge as a world leader in the New Economy.

The supplement that follows is a companion document to the report of the Governor's Task Force on Higher Education: *Arizona at Risk: An Urgent Call for Action*. This supplement describes the choices facing Arizona and provides rich detail regarding possible approaches that could be followed to implement the Task Force's recommendations. The supplement outlines specific initiatives and approaches to implementation and closes with a declaration of the need for investment, accountability, and outcomes to accomplish initiatives. Important background documents are included in an appendix including a summary of Task Force recommendations, the Governor's charge, a list of committees and participants, and two additional reports on funding and projected enrollments in higher education.

The Task Force recommends that the State of Arizona choose to compete in the new, knowledge-based economy by adopting a plan of action that recognizes the central role of higher education in the preparation of the workforce and the development of innovation. This plan should outline ways in which Arizona's institutions of higher education can be utilized to lift the state to a new, competitive level. It should describe both the benefits of such an effort and the support that is urgently needed for the effort to succeed.

**15 States Where the Poor Grew Poorer
and the Rich Grew Richer**

State	Bottom Fifth		Top Fifth	
Connecticut	-\$6,160	-25.9%	\$26,138	17.7%
Rhode Island	-\$3,781	-25.8%	\$35,146	28.1%
New Hampshire	-\$2,767	-14.1%	\$12,497	9.2%
Oregon	-\$2,067	-13.8%	\$39,798	38.1%
New York	-\$1,969	-15.5%	\$19,675	14.8%
Arizona	-\$1,914	-15.1%	\$24,511	21.0%
Vermont	-\$1,857	-11.4%	\$846	0.7%
Wyoming	-\$1,764	-11.8%	\$4,988	4.8%
Washington	-\$1,485	-8.9%	\$22,645	19.5%
Massachusetts	-\$1,412	-8.4%	\$12,101	8.4%
California	-\$1,408	-10.3%	\$12,017	9.0%
New Jersey	-\$1,339	-7.1%	\$13,639	9.0%
Montana	-\$1,142	-10.5%	\$13,078	15.1%
Kansas	-\$1,142	-7.3%	\$32,850	30.1%
New Mexico	-\$1,134	-11.5%	\$7,447	7.2%

*Dollar and Percent Change in Average Income of
Bottom and Top Fifth of Families, 1988-90 to 1996-98*

*Source: Economic Policy Institute/Center on Budget
and Policy Priorities, January 2000.*

**THE PLAN FOR HIGHER EDUCATION:
Recommended Strategies and Initiatives**

STRATEGY I

INCREASE PARTICIPATION

Universal Continuing Access

An Excellent System of Higher Education

Workforce Development Through Learner-Centered Academic Programs

Universal Continuing Access

The community colleges and universities should strive to increase the rate at which Arizona high school graduates, especially from underrepresented groups, participate in higher education. The goal should be a rate of participation above the national average.

The State Board of Directors for Community Colleges and the Board of Regents should work with the State Board of Education and with local school and community college district governing boards to ensure that all high school students have access to the courses, teachers, and curriculum necessary to achieve the highest possible levels of academic preparation for higher education and the workforce.

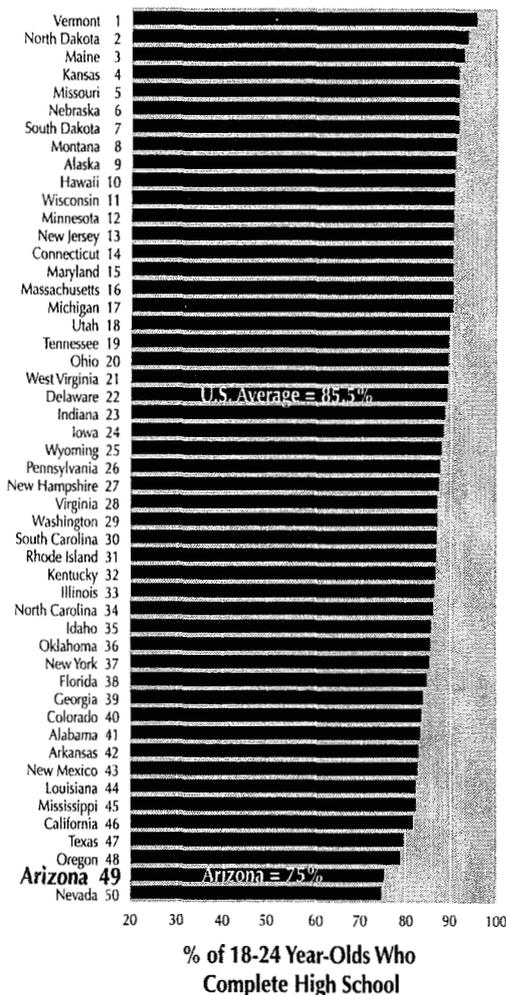
The Task Force endorses the plan of providing universal access to education for all graduates of Arizona high schools and all incumbent workers in need of further education or training. Universal access will require the State of Arizona to make the following commitments:

- **Improve the college-going rate of Arizona high school graduates** through increased programs of early intervention and outreach to children of all grades.
- **Remove financial barriers currently limiting universal access** through the adoption of Arizona College Education (ACE) grants of \$1,000 to supplement federal Pell Grants, with the Basic Level awarded to full-time community college students for each of two years immediately following graduation from Arizona high schools.
- **Sustain and increase universal applicability of transfer course credit between public institutions in Arizona** through existing transfer articulation agreements and support systems, and by inter-college and inter-university transfer programs.
- **Extend access to ACE grants for Arizona high school graduates eligible for direct and unconditional admission to Arizona's public or private universities** through Continuation Level awards of \$1,000 to supplement federal Pell Grants as well as university and state grant programs where applicable, for each of two years after students complete a transfer program at a community college, or Achievement Level awards in the same amount for four years immediately following graduation from high school.

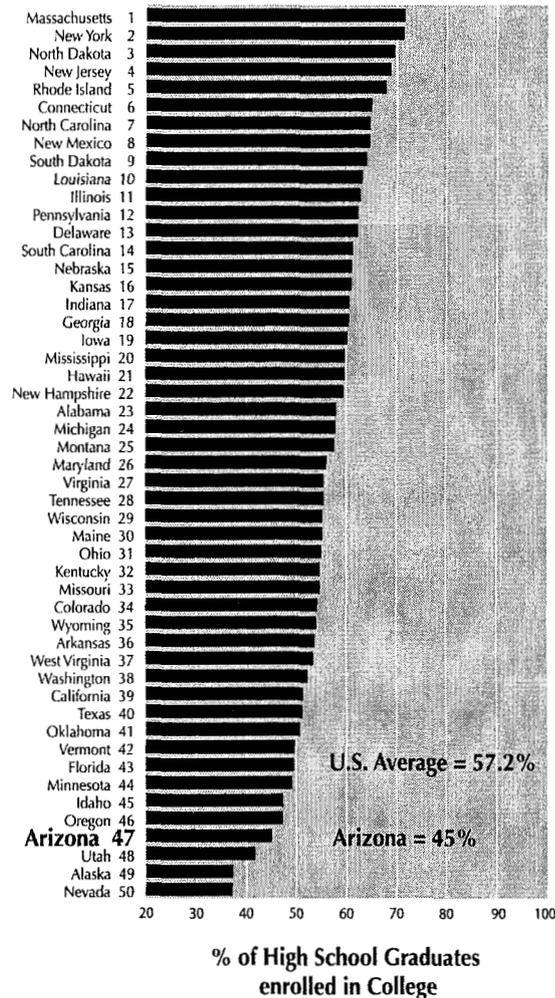
In order to meet these commitments, the Task Force proposes several specific initiatives to allow Arizona high school graduates or Arizona home school

completers and Arizona community college graduates to achieve universal access to Arizona public university baccalaureate programs.

High School Completion Rate by State 1997-1999



College Continuation Rate by State, 1998



Source: *High School Completion Rate by State 1997-1999*. Dropout Rates in the United States: 1999, U.S. Department of Education, National Center for Education Statistics, November 2000.
College Continuation Rate by State, 1998. Postsecondary Education Opportunity, July 2000.

Note: The horizontal scale for these charts begins at 20% and not at 0%.

The State of Arizona is ranked 49th in the nation for high school completion and 47th in the college-going rate of high school graduates. The Task Force recognizes that increasing the number of students who complete a high school education and are prepared to go on to postsecondary education is critical to the development of a highly trained work force for the New Economy. To achieve this goal of increasing high school graduation rates and enrollment in postsecondary education, a two-pronged approach is required. First, there must be a strategy to maximize academic efforts through outreach and early

intervention programs, high school enrichment programs, and transfer education at the postsecondary level. This strategy will increase the number of students who pursue an education and prepare those students to achieve their educational and career goals. Second, there is a need for additional financial support for successful high school graduates who demonstrate financial need to enable them to attend an institution.

Academic Strategies

Early Intervention/Outreach to Improve Academic Success. There are numerous programs that provide early intervention and outreach for children in K-12 to increase academic success and opportunities for education beyond high school. Successful existing programs could be considered for expansion based on demonstrated outcomes. These programs would have the essential components of early intervention programs including mentoring, counseling and advising, information about higher education opportunities and financial aid, developmental education and preparation, visits to campuses, programs to increase parental support, career exploration, role modeling and avoidance of negative behaviors. It is proposed that the state would become a partner in programs such as these by providing matching funds.

Arizona has provided students with academic enrichment opportunities through concurrent enrollment of high school students in high school and community college courses. Students are able to obtain credit toward high school diplomas and college degrees at the same time. The courses are offered by the community college districts and are articulated for transfer credit to the public universities and community colleges. Dual enrollment programs also motivate students to pursue a postsecondary education immediately.

Transfer Articulation. As an alternative to starting at the universities, Arizona students have the opportunity to begin their baccalaureate degree programs at the public community colleges. Students are ensured access to education through the open admission policies of the public community colleges. They are able to improve their skills through developmental coursework, prepare for occupations through the vocational and technical programs, and complete the General Education and lower-division requirements for a baccalaureate degree. Through the collaborative efforts of the community college and public university faculty and administration, Arizona has developed and implemented a model transfer articulation program for students who pursue the prescribed pathways, a seamless transfer of community college coursework toward the completion of a baccalaureate degree at the public universities. The transfer model together with the Arizona Transfer Articulation Support Systems (ATASS) provides the essential components for the continued access of all of Arizona's students to baccalaureate degrees. Continued state support for ATASS is necessary to sustain statewide access for the completion of a baccalaureate degree.

Student Financial Support Strategies

A grant program is proposed which is intended to 1) increase high school retention and graduation rates, 2) improve the level of preparation of high school graduates, 3) decrease the economic barriers to college attendance, and 4) increase community college-to-university transfer rates.

For all levels of the grant program, additional funds from federal Pell Grants will be used to leverage state dollars to support students. Students who attend any postsecondary institution and who are not eligible for the Pell Grant may rely on the federal HOPE tax credit for up to \$1,500 each year for the first two years of education and the federal Lifelong Learning Tax Credit for attendance beyond two years.

Arizona College Education Grant (ACE Grant). The ACE Grant has three levels, depending on the student's preparation.

1) Basic Level: Students meeting the eligibility criteria for a Basic Level grant would receive a \$1,000 grant each year for two years of attendance at a public community college in Arizona. Basic Level grants provide an incentive for students as they prepare for and enter high school and motivate them to pursue a postsecondary education. The grant would be used to supplement the federal Pell Grant, which currently is not sufficient to meet all of the costs of attendance. Student eligibility for the Basic grant would include:

- The student must be an Arizona resident who begins education at a public community college within one year of graduation from high school, completion of high school through home schooling, or receipt of a GED; and
- The student must be enrolled full-time and demonstrate eligibility for a federal Pell Grant.

2) Continuation Level: Students who received a Basic Level grant and who successfully completed a transfer program at a community college would receive a \$1,000 grant each year for an additional two years of attendance at a public university in Arizona. Continuation grants provide an incentive for Basic Level grant recipients to persist in their community college program and to pursue a baccalaureate degree. Student eligibility for the continuation grant would include all three of the following components:

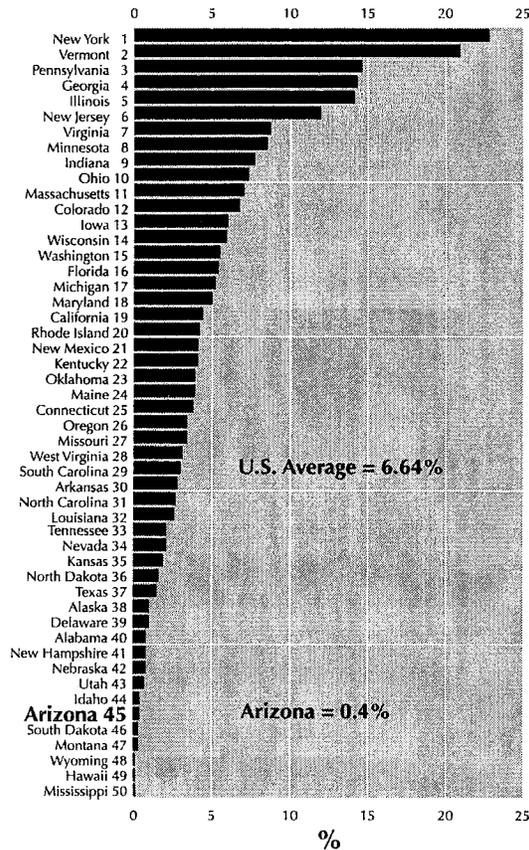
- The student must have received a Basic Level grant within the previous three years;
- The student must have graduated with an Associate Degree from an Arizona Community College; and

- The student must continue to be enrolled full time in a baccalaureate degree-granting institution and demonstrate eligibility for a Pell Grant.

3) Achievement Level: Students need incentives beginning in elementary school and continuing through high school to choose the courses that would provide a strong preparation for the pursuit of a baccalaureate degree. The Achievement Level grant is designed to provide that incentive. Students meeting the eligibility for an Achievement grant would receive a \$1,000 grant each year for four years. Students may use the Achievement grant at a community college for two years and then transfer with two years of remaining eligibility at a public or private baccalaureate degree granting institution, or they may choose to begin their postsecondary education at a public or private baccalaureate degree-granting institution. Student eligibility for the achievement level would include:

- The student must be eligible for a Basic grant; and
- The student must be eligible for unconditional admission to a public university in Arizona.

Arizona ranks 45th in the relative amount of state financial aid awarded to undergraduates



State appropriations for state student grant and other financial aid programs as a proportion of each state's higher education appropriation – FY 1997

Source: Postsecondary Education Opportunity, July 2000.

The following initiatives are recommended:

Early Intervention /Outreach to Improve Academic Success. Establish a fund to provide matching state funds for the expansion of outreach efforts by community colleges and universities, to be awarded on the basis of competitive grants. The grant fund should be \$500,000 for the initial biennium, with the future appropriation levels determined by the success of the program.

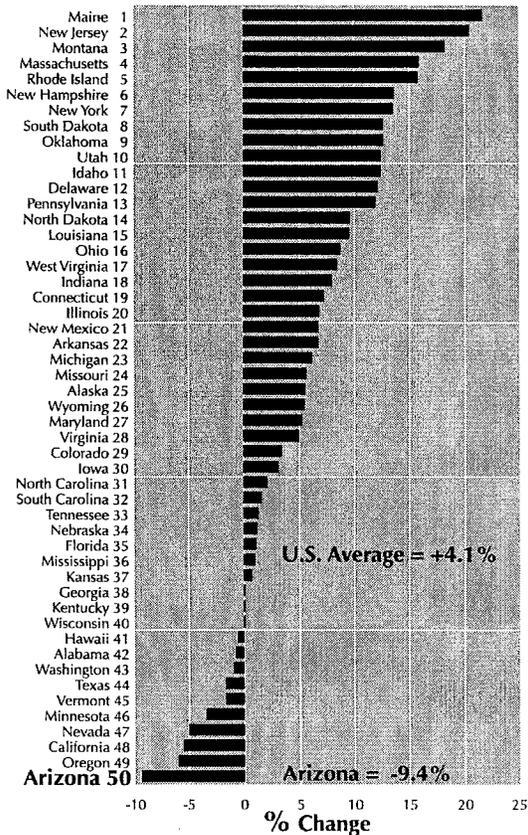
Transfer Articulation. Continue and expand the Arizona Transfer Articulation Support Systems (ATASS). Current funding levels for ATASS will call for \$992,400 for the next biennium, an increase of approximately \$250,000 over the current biennium.

Arizona College Education (ACE) Grants. Establish and financially support ACE grants. The initial baseline costs for the ACE grants include \$4.9 million per year for the Basic Level, \$600,000 for the Continuation Level, and \$1.5 million for the Achievement Level. In the fourth year of implementation, when all three programs would be fully enrolled, the total cost would be approximately \$12.5 million. Future costs would depend on enrollment growth.

Implications

Successful implementation of these initiatives will ensure broader student access to education for more Arizona residents. They would provide a better-educated citizenry and a better-prepared workforce and promote the efficient use of state resources. Some high school graduates would be redirected from enrollment at the universities to the community colleges. Because state appropriations are lower for community colleges than for the public universities, total costs to the state could be lowered depending on the number of redirected students.

**Change in College Continuation Rates
by State between 1988-1998**



The Task Force recommends that the state promote early awareness of the benefits and implications of higher education and increase financial assistance for qualified students. This financial assistance should be targeted at needy high school graduates and structured to provide incentives for preparation at high school and for completion of academic programs at the community colleges and at the universities, by both originating freshmen and transfer students.

The state should promote more participation in higher education by working adults through financial incentives and training programs focused on preparing the workforce for the new global, knowledge-based economy.

In Arizona, the chances of a 19-year old enrolling in a college or university declined between 1988-1998, to 27.7%. Arizona was last and had the greatest decline in the percent changes in the chance for college by age 19 with a negative rate of -9.4%. The national average increased by 4.1% for the same period.

Source: *Postsecondary Education Opportunity, August 2000.*

- Possible Performance Measures**
- Increase in the participation rate of Arizona high school graduates in higher education
 - Increase in the percentage of high school students fully prepared for admission to the universities

An Excellent System of Higher Education

The Task Force endorses the plan to provide access to an excellent system of higher education. This plan suggests that each individual community college and university in Arizona should promote excellence in the performance of the students at that institution. At the same time, the state's system of higher education should provide universal, lifelong access for all high school graduates. Academic excellence can be enhanced by the following specific proposals:

Redirect Some Baccalaureate-Seeking Students within the University System

Some university campuses are nearing the practical limits of their capacity to accommodate students. In order to optimize the utilization of campus and faculty resources, the Board of Regents should also permit the universities to redirect students within and beyond the university system in a manner that maintains as much flexibility as possible, both for individual campuses and prospective students.

Direct Some Baccalaureate-Seeking Students through the Community Colleges

About half of the students who enter one of the public universities as freshmen leave before completing a degree program at that university. If some of the students who are most likely not to complete baccalaureate degrees were redirected instead to the community colleges, they would be given the opportunity to earn certificate or associate's degrees before entering the workforce. Some might be encouraged by a successful lower-division experience and transfer to complete baccalaureate degrees. The Board of Regents should consider the use of more rigorous admission standards for university freshmen in order to increase the percentage of students who continue pursue academic programs at either a community college or a university.

The recommendation should be targeted toward those students who seek a university degree and would benefit from a community college foundation. The implementation of this recommendation is contingent upon changes in funding mechanisms to ensure that the loss of potential students does not adversely affect the universities' funding base.

Maintain Open Admission to the Community Colleges for High School Graduates

The community colleges are encouraged to retain their traditional policy of open admissions for all high school graduates. Information about changes to university admission standards under consideration by the Board of Regents should be shared with the State Board of Directors so that the community colleges can make necessary adjustments to accommodate the impact of such changes on student enrollments and curricular requirements.

These recommendations underscore the need to ensure that all community college students who seek a baccalaureate have access to information on how to transfer to the public universities without loss of credits toward graduation.

Implications:

Successful implementation of these strategies will lead to policies regarding admission requirements which should help improve the persistence and completion rates of Arizona postsecondary students.

The Task Force recommends that the Arizona Board of Regents and the State Board of Directors for Community Colleges craft policies for admission that help improve student success.

Possible Performance Measures

- Increase in the percentage of certificate-seeking or degree-seeking students who complete an academic program at each institution.
- Increase in the percentage of baccalaureate degree-seeking students who begin at a community college, transfer successfully, and complete their program at a university.

Workforce Development Through Learner-Centered Academic Programs

The Task Force supports current plans for the community colleges and universities to focus academic programs more thoroughly and systematically on the needs of learners and their prospective employers. The Task Force also recommends that the institutions of higher education develop specific programs to better meet the workforce needs of the state as it transitions into the New Economy.

In keeping with their historic and continuing focus on learner-centered education, the community colleges offer three initiatives targeted to increase opportunities for learners who need additional education and training to obtain, retain, and enhance their contributions to the Arizona workforce. Faculty at the public universities have been incorporating learner-centered education into individual courses for a number of years. Together with the Board of Regents, the universities are now promoting learner-centered education in a more systematic and deliberative fashion throughout all academic programs. For example, the university mission and strategic plans have been revised to support these changes, and faculty representatives have developed a Web site to promote the communication of best practices in learner-centered education. The two state higher education boards have met jointly to share information and plans for promoting learner-centered programs. In addition, as described in the section on Enhancement and Utilization of Information Technology, both community colleges and universities utilize information technology to address needs of life-long learners for education any time and any place.

LEARNER-CENTERED PROGRAMS AT THE COMMUNITY COLLEGES

Since their inception in the 1960's, Arizona's community colleges have focused their instructional efforts on learners. In the 1990's the colleges began a more systematic transformation toward becoming learning-centered organizations. Through this transformation the traditional teaching paradigm was replaced with a learning paradigm. This mindset placed learning first in policy for academic programs, student services, and instructional practices. The colleges emphasized assessment of the value added to learners through academic success. College missions began to focus more sharply on learning and on measurable outcomes of student academic success.

The learning-centered community college is based on a vision in which:

- 1) Academic programs and student services create substantive change in each individual learner;

- 2) Learners are engaged as full partners in the learning process;
- 3) Learners are provided varied options for learning;
- 4) Learners are encouraged to participate in collaborative learning activities;
- 5) The instructor becomes a learning facilitator whose role is defined by the needs of the learner;
- 6) All college employees have a role in supporting learning; and
- 7) Learning is measured and documented to encourage continuous improvement in the learning process.

The community colleges have established strong programs of placement testing and procedures for challenging and testing-out of material in which a learner can already demonstrate mastery. Dedicated academic, career, and personal counselors assist every learner in achieving his or her potential to complete these measurements. Policies granting credit for prior learning allow students to obtain recognition for learning achieved outside of enrollment at a postsecondary institution, such as in the workplace and the military. Open-entry, open-exit procedures allow students to move into learning sequences at their own pace and depart when their knowledge and skill goals are attained.

There is little, in fact, that occurs on a community college campus that is not centered directly and effectively on the needs of learners and their quest to achieve knowledge and skills. In keeping with its historic and continuing focus on learner-centered education, the community colleges offer three initiatives targeted to increase opportunities for learners who need additional education and training to obtain, retain, and enhance their contributions to the Arizona workforce.

ARIZONA COMMUNITY COLLEGE INITIATIVE: ENHANCING ADULT EDUCATION

Arizona has long recognized the dynamic relationship between adult education and workforce development. Adult education has always been a keystone of the Arizona community college mission and, as Arizona prepares to compete in the New Economy, the traditional community college role of supplying a much needed, expanded pool of trained employees takes on new urgency. As the New Economy surges forward, vulnerable adults with interrupted and minimal education will be among the most likely to be passed by. The societal and economic implications of Arizona's failure to meet the needs of adult learners are profound.

Arizona is home to nearly 800,000 adults who are marginally literate and in pressing need of basic education to improve their socioeconomic status. As a group these adults are vastly over represented in nearly every category of social dysfunction, including prison populations, public assistance recipients, unemployment, and other indicators of poverty. Such adults are also over

represented among parents of children who are struggling in school and grappling with the pervasive cycle of poverty.

Less than 8% of these adults (a total of around 60,000 individuals) are being served by current education programs. This leaves nearly three-quarters of a million Arizona citizens still in need. This is not merely an exercise in comparative numbers; there is in Arizona a lengthy waiting list of adults who need and desire learning services. Meanwhile, the number of marginally literate adults is steadily growing, fueled in part by Arizona's unacceptable rate of high school completion (one of the nation's lowest) and the immigration to Arizona of more and more people with limited English proficiency. Arizona employers are continually frustrated by the lack of basic skills in potential and existing employees, and postsecondary institutions are encountering more and more students unprepared for college-level study.

The need for adult education has clearly outpaced Arizona's ability to respond. Current funding for adult basic education of approximately \$4.6 million from the state and \$5.3 million from the federal government provides an average annual student expenditure of \$130 per year for those served and is woefully inadequate relative to the need and the complexity of the task. The unmet need for adult education is one of Arizona's most pressing issues and by contributing to the gap between haves and have-nots, it amounts to a society fracturing along educational fault lines.

In an effort to meet a sizeable need with limited resources, Arizona's public community colleges have long shared the mission of educating adults with the Arizona Department of Education. A number of exemplary community college programs have been nationally recognized and this same level of recognition has been accorded to several Arizona Department of Education and community based organization programs. All of Arizona's ten community college districts are actively involved in adult education. In its statement of philosophy, the State Board of Directors for Community Colleges of Arizona encourages state colleges to provide programs of continuing education targeted to adults of all ages.

Lack of Adult Education Is Fracturing Arizona Society

"Arizona is faced with a society fracturing along educational fault lines. If Arizona wishes to remain competitive economically with other states and countries; if it wishes to decrease its childhood poverty rate; if it wishes to improve its tax base and grow its own economy; and if it wishes to significantly affect the performance of some of its most vulnerable school children, the State must make a concerted effort to improve and expand educational opportunity for hundreds of thousands of marginally literate adults."

—Robert Jensen, Chancellor, Pima County Community College District

Arizona must bridge the gap between its educated and literate citizens and those who are struggling with the most basic skills required to survive and flourish in the New Economy. Two immediate steps will assist in this effort:

- 1) Align adult education with the community college system by transferring administration of the state's adult basic education programs from the Arizona Department of Education to the State Board of Directors for Community Colleges of Arizona; and
- 2) Dramatically increase the state share of funding for adult basic education.

The transfer of adult basic education from the Arizona Department of Education to the community colleges would help refocus Arizona's efforts. This transfer builds upon the traditional vision of community colleges as a natural home for adult education. It also echoes the recommendation of the 76th Arizona Town Hall that community colleges should have primary responsibility to address the adult basic education needs of Arizona.

Arizona Town Hall Speaks on the Importance of Adult Education

All of Arizona's institutions for higher education share some responsibility for adult literacy, developmental education, workforce training and the re-education of adults. The importance of improving these areas of adult learning in the New Economy cannot be over-emphasized. Collaboration and partnerships among the universities, community and tribal colleges, employers and other community-based organizations are vital to these efforts.

It is important to allocate responsibility for areas of learning to the components of the system that are best able to address the particular issue. The community and tribal colleges have primary responsibility and the best ability to address the basic adult education needs of Arizona, including the areas of adult literacy and developmental education. Success for the adult learner at the community college level, while in partnership with other elements of the higher education system and employers, will lead to overall enhanced education for the adult learner. The universities, private postsecondary schools and employers play major roles in adult workforce training and adult continuing education at baccalaureate and post baccalaureate levels.

--Recommendations of the Seventy-Sixth Arizona Town Hall, May 2000

This initiative also reflects a trend evident in other states that have moved the administration of adult education programs from K-12 statewide boards to community college statewide boards. Community college boards have exclusive

statewide responsibility for adult education in Illinois (effective 2001), Kansas, Mississippi, North Carolina, Wisconsin, and Wyoming. In Georgia, the same state-level board manages the state technical college system, adult basic education, and other workforce development programs.

Meanwhile, where responsibility for adult education is shared (as it is in Arizona) between the community colleges and the State Department of Education, the colleges remain a primary site for instruction and service. Furthermore, community colleges are often primary providers in major metropolitan areas, counties, and other regions. Finally, there appear to be few states where the placement of adult education in the community college arena has not been given recent consideration as an essential response to the workforce needs of the New Economy.

It is proposed that a joint study committee be formed to discuss a process whereby the Arizona community colleges will, in the future, assume primary responsibility for the administration of adult basic education and literacy services. The primary thrust of this proposal would be to move adult basic education services currently provided through the Arizona Department of Education, Division of Adult Education, to the State Board of Directors for Community Colleges of Arizona. Discussion should be conducted by a joint study committee composed of representatives from:

- Arizona Department of Education;
- State Board of Education/Vocational Education;
- State Board of Directors for Community Colleges of Arizona;
- Local county community college District Governing Boards;
- Local K-12 District Governing Boards; and
- Governing boards or other representatives from community-based organizations.

Ultimately, a statutory change would be required to support the proposed movement of adult education programs and services.

In addition to this structural change, state funding for adult education needs to increase dramatically to meet the social and economic expectations of three-quarters of a million Arizona adults who are marginally literate and therefore at risk of societal stagnation and of missing opportunities to benefit from the New Economy.

Implications

Certain aspects of adult education, in particular federally mandated services in Adult Basic Education (ABE), might not move exclusively to the community colleges. For one thing, the community colleges are already providing around 70% of Arizona ABE services. For another, federal law requires the granting of local ABE funds through a competitive application process open to all eligible applicants including community-based literacy organizations of demonstrated effectiveness.

The community college-centered adult education effort proposed by this initiative would operate in partnership with other agencies. The intent would be to complement, supplement, enhance, and expand access on the part of adults in need of further education, not to supplant or disrupt successful existing programs.

Arizona would benefit from a coordinated and focused effort by the community colleges to help adult learners achieve their goals. Increasing the educational achievement of a greater number of unemployed and under-employed adults will have far-reaching effects on the strengthening of Arizona's workforce as the state positions itself for success in the New Economy.

Such consolidation may result in noticeable cost savings and efficiencies of effort. Not only would the community colleges be able to concentrate on serving the adults so central to their mission, but the Arizona Department of Education would be able to more fully focus their efforts on preparing youngsters for the world of work and other postsecondary transitions. However, given the growing unmet need for adult education, it is likely that a significant increase in state resources may be needed in the near future.

Based on severity and urgency of need, and the need to "jump-start" the transfer of services to the community colleges, state funding for adult basic education should be nearly doubled in the first year of the new budget biennium. This would mean an increase from \$4.6 million to \$8.2 million for FY 2002. To comply with mandates of Federal legislation for adult education services, Arizona has developed the "Five Year State Plan for Adult Education", which has been approved by the State Board of Education and the Governor. To fully implement this plan, and to expand system capacity to serve an ever-growing need, funding should be increased in similar increments until the total state appropriation for adult education reaches \$25 million over four years. Such funding would allow Arizona to focus essential efforts on increasing the basic skills and New Economy employability of a significant portion of the state's adult population.

Deliberations should begin at once to discuss a process whereby the Arizona community colleges will, in the future, assume primary responsibility for services to adult learners.

The Governor and the Arizona Legislature work together to dramatically and steadily increase state funding for adult education. The Arizona Department of Education has requested \$2 million for the next biennium; this request should be granted and leveraged with further state funding commitments.

Possible Performance Measures

- Increase in the number of adult basic education students served
- Increase in the number of recipients of the Arizona High School Equivalency Diploma

The Cycle of Poverty and Socioeconomic Distress

The correlation between low levels of educational attainment among adults and negative social phenomena makes a clear and convincing case for action to increase support for adult education.

- ✓ *Arizona's child poverty rate of 26% is the third highest among the states. 64% of children in poverty have parents with less than a high school education (National Center for Children in Poverty, 1998). Providing adult education to help parents become more economically secure will directly impact children living in poverty. Hundreds of thousands of parents and parents-to-be need adult education opportunities to enter the economic mainstream.*
- ✓ *At least 50% of Arizona's 25,000 adult prison inmates have less than a high school education. Over 70% of inmates nationwide function at the lowest literacy levels (Arizona Department of Corrections). Arizona's rate of incarceration is one of the highest in the nation, with annual costs per prisoner approaching \$30,000. Investing in adult basic education will not empty our prisons, but if even 1,000 people per year were able to pursue life (rather than a life of crime) using newly acquired literacy skills, it would save the state millions of dollars.*
- ✓ *About 20% of America's workers have low basic skills, and 75% of unemployed adults have reading or writing difficulties. The number of companies reporting skilled worker shortages nearly doubled between 1995 and 1998, from 27% to 47% and a recent poll of Fortune 1000 executives found that 90% are concerned that low literacy rates are hurting their businesses. (Source: National Institute for Literacy) Arizona, with its special demands for adult literacy, is already losing its competitive edge while other states and other countries are making concerted and targeted efforts to attract businesses and industries that need literate workers capable of learning high tech skills. The economic and social consequences of failing to address the educational needs of hundreds of thousands of Arizona residents are profound.*
- ✓ *The single most powerful predictor of a child's success in school is the educational level of the parents, in particular the mother. Children with parents who have dropped out of school are themselves four times more likely to drop out (National Center for Family Literacy). The role of parental influence in shaping their children's attitudes toward education is an essential ingredient in K-12 school success. Parents who are marginally literate must themselves be engaged in improving themselves educationally as a means of ensuring the success of their children. There is no surer way to stop the generational cycle of educational disadvantage and poverty.*

ARIZONA COMMUNITY COLLEGE INITIATIVE: NEW ECONOMY TRAINING FOR GAINFUL EMPLOYMENT (NET-GAIN!)

The emergence of the New Economy offers Arizona an opportunity to develop public policy to increase the likelihood that all of the state's citizens and communities will share in future economic prosperity. A key premise of the New Economy is that long-term economic health will be driven by knowledge, relationships, and services rather than by physical assets such as inventory and location. This premise is reflected in key characteristics of the New Economy including:

- Knowledge builds wealth;
- Technology is a given; and
- Alliances are the way to get things done.

Workforce education which prepares workers for success in a dynamic, technology-oriented economy is viewed as the key to maintaining the competitive advantage of Arizona business, and as a means to ensure that under-educated "have not" workers do not miss out on New Economy opportunities. Arizona must ensure access to training and education so that all citizens will obtain marketable skills and gainful employment.

Preparing workers to meet real world challenges and changes in the workplace is, by definition, a vibrant form of learner-centered education. The learner/worker comes to an occupationally related learning process with a clear goal in mind and a strong incentive to succeed. The community college centers attention on that learner through affordable access, flexible scheduling, quick turn-around from the classroom to the workplace, and a relevant curriculum of practical, competency-based instruction.

Arizona community colleges are a primary provider of workforce education with semi-professional and advanced technical preparation offered in over 250 career areas. As an example, surveys confirm that community colleges are the provider of choice for computer training vital to the New Economy. Businesses and workers recognize that Arizona's accessible and affordable community college programs offer the best hope of leveling the technological playing field.

Today, community colleges throughout Arizona are facing increasing demands to remain current in technology and curriculum while delivering programs that are relevant for evolving and emerging industries. In the spirit of the New Economy, alliances among educators, business, and government represent a key approach to addressing these issues and to leveraging intellectual and capital resources.

Several alliances are already in place, but additional incentives are needed to ensure that colleges and businesses expand and enhance their collaborative efforts to meet increasing demand for well-trained workers.

Incentives for Workforce Partnerships: NET-Gain!

Consistent with the concept that alliances are a key characteristic of the New Economy, it is proposed that the state provide financial incentives to encourage and support training partnerships in which the community colleges, businesses, and governmental entities collaborate to provide training to enhance Arizona's New Economy workforce. The funding mechanism could be similar to the 1993 Arizona Workforce Recruitment and Job Training Program. However, there would be notable differences in objectives and administration.

The existing Job Training Program is administered through the Department of Commerce. Job training assistance is provided to businesses locating to Arizona from outside the state, existing businesses that are expanding and adding net new jobs, and Arizona businesses that are undergoing economic conversion. While this approach addresses workforce training for specific employers and jobs, it does not ensure or provide incentives for college participation. Nor does this program apply to the large population of potential learners who are not employed or who are under-employed and need information and access to workforce training and education.

It is proposed that Arizona enact a program to provide incentive funding in support of collaborative partnerships leading to New Economy workforce development programs. For purposes of discussion, this program will be called New Economy Training for Gainful Employment (a.k.a. NET-Gain!).

The basic objectives of NET-Gain! are to facilitate collaborative training partnerships among Arizona public community colleges, Arizona businesses, and other agencies that:

- Leverage intellectual, capital, and human resources;
- Promote shared responsibilities for student competency attainment (so that, for example, business and industry internships and on-the-job training complement instruction);
- Target job-critical positions. (One determination of "job-critical" is inclusion by Local Workforce Investment Boards on their list of Occupations in Demand); and
- Address continuing education requirements for the existing and emerging workforce.

The mission and purposes of Arizona's community colleges are strongly oriented toward workforce development and on-the-job training. There are already many diverse partnerships that community colleges have created with business and industry. However, these efforts could function much more effectively with an infusion of monetary and human resources to coordinate and implement partnerships.

Through NET-Gain!, the state could provide funding to:

- 1) Develop programs and curriculum to train workers for New Economy jobs;
- 2) Identify and prioritize the skills and knowledge needed for specific New Economy jobs through job profiling;
- 3) Develop marketing plans to attract interested candidates, including non-traditional applicants, to take part in New Economy job training;
- 4) Assess student aptitudes and competencies in occupational skills;
- 5) Provide faculty professional development through industry experience and internships;
- 6) Recruit and retain learners through scholarships and for-credit/paid internships; and
- 7) Develop tracking and monitoring systems to ensure program completion, placement in employment, and productivity improvements.

Implications

To advance the NET-Gain! concept, sufficient state funding is needed to promote partnership activities throughout the state. One vital need for funding will be to promote workforce partnerships in rural areas with less dense employer concentrations and smaller percentages of high-tech, high-wage industries. It is vital that these rural areas, which are closely served by Arizona community colleges, be encouraged through funding and other incentives to establish partnerships to provide access to workforce training skills in order to avoid large populations of "have not" employees. It is estimated that an expenditure of \$3.5 million would be required to fully fund NET-Gain! activities. With a generous state allocation and/or if the state provided other incentives to businesses and colleges, a portion of this necessary funding could be leveraged from other funding sources.

Community college occupational educators should be provided with a Legislative allocation of "seed capital" to develop a comprehensive, learner-centered action plan to implement NET-Gain! This action plan would include detailed descriptions of NET-Gain! activities; a timeline for implementation; a projection of costs and levels of participation; a process for leveraging resources from other funding sources; an exploration of other incentives (in addition to direct funding) which the state might provide to promote NET-Gain! activities; and strong performance measures for documenting the number of people who, as a result of

the collaborative programs, obtain skills and knowledge to effectively contribute as employees in the New Economy workforce. Results can be measured by a number of factors including employment and productivity gains, evidence of leveraged resources, business development and retention, and community perception of enhanced quality and opportunity.

Possible Performance Measures

- ❑ Increase in the number of workforce partnerships, especially in rural areas
- ❑ Increase in the number of people who, through these programs, obtain marketable skills

ARIZONA COMMUNITY COLLEGE INITIATIVE: GLOBALLY COMPETENT WORKFORCE

The growth and development of Arizona businesses is increasingly reliant on doing business and trade with other nations. Arizona has emerged from the 1990's with a running start. In June 2000, *The Arizona Republic* reported that exports to Mexico alone increased from \$2.3 billion in 1995 to \$3.2 billion in 1999. *The New Economy: A Guide for Arizona*, a comprehensive primer on the New Economy published in 1999 by the Morrison Institute for Public Policy stated that the dollar value of the state's exports doubled from 1991 to 1997. In 1992, 21%—fully one in five—of Arizona's manufacturing jobs were dependent on exports and these figures were for goods only, not including the value of exported services. The state is in a particularly advantageous position to benefit from the potential positive effects of the North American Free Trade Agreement (NAFTA).

Arizona's role as a player in the realm of global business requires the state to have on hand a strong cadre of employees with transnational skills and competencies. In practical terms, to survive and compete in the global economy, the Arizona workplace needs to be able to function in an international and cosmopolitan marketplace. Workers must handle correspondence, email, and phone calls with cultural sensitivity; design products to meet the standards of global acceptance; negotiate international contracts; and obtain health care for international guests. Furthermore, while the ability to travel around the planet may be the most desirable way to do world-wide business, it is probable that many members of state's global workforce will encounter these and other situations requiring transnational competencies without ever leaving Arizona.

Perhaps no aspect of education and training requires such a learner-centered approach as does instruction for global and multicultural competence. To succeed, such instruction must truly envelop the learner so that change occurs in fundamental ways. It is important that community colleges as well as universities develop a global curricula that requires learners to embrace technology, business and communications across borders, and also leads them to understand the implications of environmental issues, space exploration, poverty, resource allocation, and international conflicts.

Accomplishing these goals with a community college student body that is not affluent and not free to travel the world due to work, family, and home obligations is truly a challenge. While it is possible to develop very short-term study abroad opportunities, it is necessary to create other approaches to accomplish the ambitious learner-centered goal of global competence.

Resources are needed to support the following efforts to internationalize learning in Arizona's community colleges and address the need of Arizona companies for workers with global competence:

- Faculty exchange programs between Arizona community college faculty/staff and faculty/staff at colleges and universities in other countries. An example is the Maricopa Community College District (MCCD) faculty fellowship program with Wuyi University, Jiangmen, China. Faculty from MCCD spend the summer at Wuyi University living in an international dormitory, teaching classes at the university, taking classes in Chinese history and culture, visiting in local homes, and traveling in the area. Later in the year faculty from Wuyi University replicate this experience at MCCD. Maricopa faculty draw upon these experiences and include them in their instruction, no matter the discipline they teach, so that students' understanding of culture, adaptation, and geography is strengthened. The student emerges more globally aware, more understanding of world events, and more capable of developing a true "transnational sense." The objective is to infuse global education throughout the curriculum. The benefits of global education extend to the student's employer and the ability of the company to conduct business globally.
- Partnerships with Arizona companies that conduct business internationally. Export/import enterprises and multi-national corporations increasingly need employees with strong international and intercultural abilities. Community colleges, in partnership with local corporations and organizations such as the World Affairs Council, help workers achieve global competency. Community colleges can provide language training, diversity and cultural awareness, and preparation for trade missions, as well as global literacy in such areas as geography, geopolitics, environmental science, human culture, economics, and technology.
- Collaboration with International Organizations. Community colleges also need to collaborate with organizations such as the Border Trade Alliance that helps to promote international trade and understanding of the North American Free Trade Agreement (NAFTA) between the United States and Mexico.

Implications

An issue paper in the New Expeditions series funded by the W.K. Kellogg Foundation published in 2000 and entitled "Charting the Future of Global Education in Community Colleges" recommends that community colleges engage in following strategies:

- Provide staff development experiences to help them deal with diversity and achieve global competency;

- Establish incentives to encourage community college employee (faculty) participation;
- Develop partnerships with business and industry for (international) leadership development; and
- Utilize international students as a resource.

The proposed initiative follows these recommended strategies as a direct means of developing a globally competent workforce, and proposes to coordinate activities through an Institute for International Leadership.

An Institute for International Leadership in Arizona's Community Colleges should be established in conjunction with Arizona businesses to provide experiences and programs to develop transnational skills in current and future employees. A steering committee composed of equal representation from Arizona business/industry and Arizona public community colleges would direct the Institute by establishing guidelines and procedures for developing collaborative college/business/industry programs. Committee members should largely be individuals with international experience. Arizona businesses would be asked to contribute a minimum of 20% cash and in-kind services annually in support of the Institute. The state would be asked to provide an 80% contribution to match the 20% business/industry contribution. Costs are estimated at \$2 million annually.

Possible Performance Measures

- Increase in the number of faculty/staff exchange programs between Arizona and other countries
- Increase in community college partnerships with Arizona companies that conduct business internationally

LEARNER-CENTERED PROGRAMS AT THE UNIVERSITIES

Faculty at the public universities have been incorporating learner-centered education into individual courses for a number of years. Programs in the performing arts and professional colleges are naturally focused upon alternative teaching methods and the needs of the professions. Together with the Board of Regents, the universities are now beginning to promote learner-centered education in a more systematic, overt, and deliberative fashion. In addition to accepting a *Statement of Principles* and a *Definition of Learner-Centered Education*, the Regents have modified the *Arizona University System Mission* and *System Strategic Directions* to reflect the importance of learning. The university missions and strategic plans are currently being revised to support these changes, and the university faculty have developed a Web site to promote the communication of best practices in learner-centered education.

Last spring, the Arizona public universities proposed to develop and monitor activities to accomplish six key strategies:

- 1) Incorporate learner-centered education throughout academic programs;
- 2) Develop learner-centered academic programs and initiatives to produce the workforce required for Arizona to be competitive in the new, knowledge-based, global economy;
- 3) Expand strategic partnerships between corporate and higher education communities;
- 4) Create cooperative initiatives designed to support Arizona's industry clusters;
- 5) Identify and measure learning outcomes from learner-centered programs and initiatives; and
- 6) Implement information technology for the delivery of learner-centered education at all levels throughout the state.

ARIZONA UNIVERSITY INITIATIVE: WORKFORCE DEVELOPMENT IN ENGINEERING AND SCIENCE

America leads the world in the total number of undergraduate degrees awarded per year, but is fourth in the world in the number of undergraduate engineering degrees behind China, Russia, and Japan. In China, 45.7% of all undergraduate degrees awarded are in engineering. Russia awards 32.4% and the Slovak Republic students earn 31.1%. In the U.S., only 5.4% of all undergraduate degrees awarded are in engineering. In this statistic, the U.S. does not rank in the top 15 countries worldwide. Across the globe, 13.8% of all undergraduate degrees are in engineering. (Sources: Educational Statistics Worldwide, National Science Foundation, and the White House Office of Science and Technology Policy.)

The commercial advances in computing seen today are driven by expertise in engineering, computer science, and information systems. Information technology is driving the recent growth of the U.S. economy. Alan Greenspan estimates that at least 1/3 of the total growth of the U.S. economy since 1992 proceeds from both the expansion of the information technology sector of the economy and the increased efficiencies and rates of productivity that advancing information technology enables.

The major advances in biotechnology, nanotechnology, and other new technologies are occurring at the interface between engineering and other fields of study (biology, physics, chemistry, and material science). The state's engineering colleges have established many successful partnerships to address specific needs in advancing the state's economy. Examples include the Center for Environmentally Benign Semiconductor Manufacturing (UA and ASU), the Center for Low Power Electronics (UA and ASU), and the Master of Engineering degree (ASU, NAU, and UA). Aside from the Center for Low Power Electronics, the State of Arizona has not been a major player in these partnerships outside of the standard university budget appropriations. Arizona ranks in the bottom 20% (at best) of all states in per-capita spending on cooperative technology programs.

All major high-tech industries in the State of Arizona (Motorola, Intel, IBM, Allied Signal/Honeywell, Raytheon, etc.) depend on the availability of engineering and science (including information technology) talent. The relocation to Arizona of new high-tech industries and the expansion of existing Arizona high-tech industries hinge to a great extent on the state's colleges' and universities' ability to supply a well-educated workforce, primarily in engineering, science and business.

Stimulating the enrollment, graduation, and employment of people in engineering and science provides benefits to the state and to private industry. Arizona has a strong incentive to partner with industry in sponsoring programs to achieve these goals.

Knowledge Industry Employment Concentrations

State	Software Communications Services	Computer/Electronics	Healthcare Technology	Innovation Services	Financial Services	No. of Clusters Above 1.1
Maine	1.51	2.14	1.97	1.63	1.67	5
California	1.32	2.15	1.50	1.21	0.93	4
Colorado	1.84	1.90	1.22	1.39	0.99	4
New Jersey	1.61	0.64	2.25	1.13	1.39	4
Minnesota	0.90	1.82	1.39	0.65	1.33	3
Texas	1.12	1.28	0.71	1.11	0.85	3
New York	0.99	0.76	1.12	1.02	1.85	2
Pennsylvania	0.80	0.65	1.07	1.24	1.30	2
Arizona	0.87	1.96	0.59	0.97	0.79	1
Illinois	0.89	0.94	1.02	1.01	1.23	1
Florida	0.93	0.75	0.96	0.91	0.96	0
Michigan	0.73	0.24	0.7	1.06	0.74	0
North Carolina	0.67	0.66	0.99	0.59	0.58	0
Washington	1.04	0.89	0.76	1.09	0.83	0

An employment concentration above 1.1 means that the area's share of the state's jobs is at least 1.1 times higher than the national average. Arizona has just one area of strength: computer/electronics.

Source: *Index of the Massachusetts Innovation Economy, 1998.*

Proposed Programs

Professional Workforce Development Program. Arizona should establish a Professional Workforce Development Program at each university. The program would reward the universities for each new engineering and science graduate in approved majors (including math and science education). The state should provide a \$1,000-5,000 contribution per student to the program at each university for each new approved graduate who is employed in Arizona or who enrolls for an advanced degree in Arizona in an approved field within one year of graduation. These funds would be used to expand recruiting and retention efforts and to upgrade educational infrastructure unique to the technical fields.

Student Internships in High-Tech Fields. The state should provide partial support for high-tech field internships for college and university students in selected majors. For example, in the proposed "Engineering and Science Apprentice Program", the state's share might be 67% for sophomores nearing the successful completion of their first two years in college, and 33% for juniors nearing graduation. Corporate partners, in addition to providing and partially funding these internships, will also financially support faculty who will assist in the mentoring of these interns, particularly between the freshman and sophomore years.

Scholarship Support. The state should match corporate contributions to support scholarships for students successfully pursuing degrees in engineering and science.

Outreach Programs for Pre-College Students. The state should provide financial incentives to colleges offering engineering and science degrees who participate in pre-college outreach programs. Example programs include:

- Expanded support for middle school outreach programs to encourage disadvantaged youth to continue their education in math and science and interest them in careers in engineering and science (e.g., Math, Engineering and Science Achievement - MESA);
- Support for university faculty mentoring of elementary and middle school teachers. College faculty would develop source materials to teachers for inclusion in their curricula that would interest children in engineering and science; and
- Internships for high school students in high-tech fields.

Public Relations. The state should develop a public relations (imaging) campaign (statewide and preferably nationwide) highlighting Arizona's commitment to and development of engineering and science talent. The State of Pennsylvania offers a program to emulate.

Possible Performance Measures

- Increase in the number of engineering and science degrees awarded at the universities
- Increase in the number of internships for university students in high-technology fields

**ARIZONA COMMUNITY COLLEGE AND UNIVERSITY
JOINT INITIATIVE:
MATH AND SCIENCE TEACHER PIPELINE**

Arizona is experiencing a shortage of teachers in key subject and geographical areas. At the same time, to provide students with the competencies required for success in the New Economy, the state needs more qualified teachers than ever, especially in areas such as mathematics and science. This initiative addresses the policy issue of how the State of Arizona can stimulate enrollment, graduation, and employment of teachers in Arizona, especially in the areas of mathematics and science.

Even with the current efforts to increase the number of teachers in mathematics and the sciences, Arizona's public and private colleges and universities are not meeting the needs of the state with regard to the supply of teachers. The numbers of teaching positions unfilled at the start of the school year and the resulting use of emergency certifications, long-term substitutes and teachers assigned to classes out of their area of certification have begun to grow dramatically.

Future concerns include the fact that many current teachers are close to retirement while at the same time, the population growth will cause an increased need for experienced teachers. Turnover rates among new teachers are already high, and alternative employment is increasingly attractive for students with an interest in teaching math or science.

During the 1990s, more than a third of first year teachers in Arizona public schools came from outside the state, even though the public universities graduated over 2000 teacher education students each year and the private colleges and universities contributed several hundred more. However, the teacher shortage experienced in Arizona is also occurring on a national level. Data necessary to project the future need for math and science teachers are not available in most states, including Arizona. However, the U.S. Department of Education estimates that the U.S. needs to recruit 2.2 million educators in the next decade and 200,000 will be needed as specialists in mathematics or science.

To address this problem, there is an urgent need to enhance the status of teaching as a profession. Some states have begun to raise the salaries of teachers to more competitive levels. Unfortunately, salaries offered to teachers in Arizona have slipped to 33rd out of the 50 states over the last decade. As a result, it is becoming increasingly more difficult to fill the unmet need in Arizona by attracting teachers from other states. The passage of Proposition 301 in the 2000 General Election should help with teacher salaries.

The need for more qualified math and science teachers in Arizona is further underscored by the high percentage of students admitted to the public universities with deficiencies in these areas and by the workforce needs of the New Economy for employees with competencies in math, science, technology, and engineering.

In the past, Arizona has implemented two scholarship programs to encourage students to go into teaching. The Paul Douglas Teacher Scholarship program was implemented with federal funds from 1986 to 1994/95 and resulted in 178 students going into teaching over a nine-year period. Arizona Teacher Incentive Program provided state funding for scholarships for aspiring teachers and also ended in 1994/95. Through this program, 18 students went into teaching. The record suggests that scholarship programs alone will not make a significant difference in the number of teachers awarded degrees in Arizona.

Last year, Arizona amended ARS 15-1802, "In-State Student Status," to allow non-resident teachers and teacher aides to pay resident tuition for courses required for Arizona teacher certification. The goal of this effort is to help schools recruit needed teachers by lowering the cost for new Arizona residents to become certified. The Board of Regents has amended its policies to implement the statute.

The Arizona Partnership for the New Economy (APNE) is promoting the use of e-learning throughout Arizona and has identified teacher development (education, development, and support network) as a leverage point for systemic change.

Current Activities in Arizona

State efforts to address the growing shortage of math and science teachers should build upon, strengthen, and complement current activities at university and community college campuses as well as relevant statewide articulation programs.

Arizona State University Main. The main campus of ASU offers programs to inspire students to prepare for a teaching career in math and science through both traditional and alternative certification programs, as well as professional development initiatives to help retain teachers and improve their teaching skills. Students are attracted to the field through a mobile microscope laboratory, ongoing and summer workshops for girls and women in imaging technologies, direct interaction with university scientists involved with NASA's Mars projects, and a consortium of educators and scientists who bring cutting edge nano-visualization techniques into the classroom.

The Center for Research on Education in Science, Mathematics, Engineering and Technology (CRESMET), an alliance of the colleges of Education, Engineering and Applied Sciences and Liberal Arts and Sciences, coordinates several major, externally funded projects in teacher education and professional

development. These include partnerships to develop critical thinking in student-centered, inquiry-oriented classrooms and encourage the professional development of high school physics teachers. CRESMET also coordinates the Arizona Teacher Education Collaborative (AzTEC), a coalition to improve preparation and support of science and mathematics teachers, and supports projects charged with quickly supplementing the teaching pool by drawing mid-level math, engineering and science practitioners with baccalaureate degrees into the teaching field and promoting teacher retention.

Arizona State University West. ASU West recruits students for math and science teaching through a number of venues. First, the Arizona Teacher Education Collaborative (AzTEC) provides opportunities to aggressively recruit teachers into math and science teaching through a "2+2+2 program" involving the last two years of high school, two years of community college work, and two years of university coursework culminating in a baccalaureate degree. Two notable programs, *Inspire.Teach* (read Inspire-dot-Teach) and *Aspire 2 Teach* start in West Valley high schools where high school students are mentored and supported as they matriculate into community colleges. The AzTEC grant also facilitates partnerships between ASU West and Glendale, Phoenix, Estrella, and South Mountain Community Colleges to provide activities and courses for math and science students. Second, through an Eisenhower grant, *Tune In and Turn On to Geometry*, the College of Education holds workshops to increase teachers' content and instructional knowledge. Third, a large grant funded through the National Science Foundation (NSF), *Learn While Teaching Math and Developing Children's Math World Curriculum*, recruits minority students to become teachers and encourages practicing teachers to increase their skill levels. Students are specifically attracted to the field through NSF-funded math workshops, summer classes, and a math conference as well as through Substitute Teaching Seminars and workshops and a mentoring program in Desert Ecology. Fourth, *Preparing Tomorrow's Teachers for Technology*, a grant from the United States Department of Education, pairs ASU West College of Education interns and student teachers with mentors to develop skills in technology. New fast-track programs for post baccalaureate students, with a special emphasis in math and science, are in final stages of preparation.

Northern Arizona University. A centerpiece of teacher education at NAU is recruitment and preparation of teachers in math and science. Strengthened by external funding agencies such as the National Science Foundation, the National Institute of Health, the Flinn Foundation, and the Howard Hughes Medical Institute, NAU focuses on teacher training at every level. The imaginations and talents of pre-service teachers are captured in several ways: 1) new lab and computer programs with hands-on activities designed for the classroom help future teachers apply teaching techniques; 2) students are placed in classrooms in their second and third year of math and science study for early real-school experience; and 3) an interactive television wet lab connects science instruction with schools in remote areas of the state, most recently with Hopi High School

and Northland Pioneer Community College. Professional development programs through the Science and Mathematics Learning Center are reaching teachers statewide, making it possible to extend models of best teaching practices from one school to many. Those practices will be shared as part of the new Middle School Science Education Initiative, a collaboration of the Arizona Community Foundations, the Arizona Board of Regents, and the Arizona K-12 Center. The new Walkup Distinguished Professor in Math and Science Education has been established to provide expanded support to pre-service and in-service teachers. In addition, NAU offers early outreach programs such as day camps, summer workshops, mobile instructional units and community classrooms. New initiatives include accelerated emergency certification and a Master of Science in Teaching.

The University of Arizona. UA offers programs in early outreach, recruitment, traditional teacher preparation, alternative teacher preparation and professional development. Undergraduate teacher preparation is provided through three colleges: Education, Science, and Agriculture. The College of Education offers an undergraduate degree leading to teacher certification where aspiring science teachers take a minimum of 30 hours of coursework in a specific science discipline through the College of Science. An undergraduate program for students who have or are working on a science degree is offered by the College of Science, and the College of Agriculture offers the only agriculture science teacher preparation program in the state. New initiatives include *Teach for Tucson*, a partnership with seven school districts to recruit individuals with a science or mathematics degree to become teachers through a one calendar year master's degree program. A new Masters of Education with a Science emphasis is also offered. Retention of new teachers is supported by a number of programs in the colleges of Education and Science, including the Alternative Support for the Induction of Secondary Teachers program as well as courses, summer programs and camps. Programs to enhance the teaching of science, mathematics and engineering are offered through the Science and Mathematics Education Center (SAMEC). In addition, the Collaborative for the Advancement of Teaching Technology and Science (CATTs) provides fellowships to promote the integration of science, math, engineering, and technology research into K-12 education and create opportunities for undergraduate and graduate students to be active participants in K-12 education.

Arizona Community College Districts. The community college districts are working with many school districts and the state's universities in a variety of ways for teacher preparation. Arizona Western College, Central Arizona College, Coconino Community College, Mohave Community College, Northland Pioneer College, and Yavapai Community College help to prepare teachers through various partnerships with Northern Arizona University. In addition, Arizona Western College is an active partner in the Yuma Math and Science Regional Training Center. Central Arizona College works directly with high school teachers in attracting students into teaching. Coconino Community College offers math courses on the Northern Arizona University campus. The Maricopa

Community College District is implementing a Transfer Partnership Degree for elementary education and has customized math and science courses to attract students into secondary education. Northland Pioneer College works with school districts to help teaching assistants complete transfer AA degrees. Yavapai College offers a mentoring program to assist students in entering the teaching profession. Eastern Arizona College hosts a science workshop for area high school students to encourage entry into math and science teaching. The Maricopa Community College District, with the assistance of Arizona State University and Phoenix urban school districts, has been implementing an National Science Foundation funded program to reform mathematics and science instruction. The Maricopa Community College District also has initiated a study of the key role that community colleges can play in addressing teacher shortages, and is forming a Commission on Teacher Education to provide leadership in this area, including the development of a National Center for Teacher Education. The Pima Community College District is endeavoring to develop agreements with the universities to provide seamless transfer career ladder options for teacher assistants, especially in math and science. Pima also offers courses for professional development and helps to reduce turnover by meeting teacher needs for re-certification.

Statewide Articulation and Development Programs. Under the guidance of the Joint Conference Committee of the two state higher education boards and through the work of the Transfer Articulation Task Force, the Academic Program Articulation Steering Committee (APASC), and the Education Articulation Task Force (ATF), a new model for statewide articulation has been implemented in the area of education. This model begins with an Arizona General Education Curriculum (AGEC) that transfers as a block and satisfies general education requirements at any of the public universities. It includes as well a set of common courses that is accepted by any of the public university education programs, and a transfer Associate Degree. Students who complete the transfer degree are accepted with junior status into any of the universities and have satisfied all coursework requirements for admission into the education programs at the public universities. Grade point average requirements for programs may differ by university. Work is continuing on the common courses to ensure that aspiring teachers, including those interested in mathematics and science, have the best possible preparation at the lower-division level. In addition, the Arizona Board of Regents oversees a university plan to align teacher preparation programs with the Arizona's Professional Standards for teachers. ABOR also administers the federal Eisenhower Professional Development Program through which up to fifteen collaborative projects are funded each year for the professional development of K-12 teachers, with an emphasis on math and science. Finally, the State Board of Directors for Community Colleges has identified the following as one of its key action plans for the coming year: "The State Board shall sponsor/advocate a statewide initiative to address the coming critical shortage of K-12 classroom teachers."

Private Colleges and Universities. Many private institutions in the state offer teacher preparation programs, including American Indian College, Chapman University, Grand Canyon University, International Baptist College, Ottawa University, University of Phoenix, Prescott College, and Wayland Baptist University.

Initiative to Increase the Supply of Teachers Through Traditional Teacher Preparation Programs

The universities, community colleges and high schools should work together to create “2+2+2 programs” that encourage students to explore teaching as a profession and ensure that teacher preparation is provided at all levels of instruction. The state should provide funding for tuition assistance for teachers aides or teachers with emergency certifications who are working toward full certification, also known as “grow your own” programs.

Initiative to Increase the Supply of Teachers Through Alternative Teacher Preparation Programs and Alternative Teacher Certification

The university, community college, and K-12 systems should work together to expand the offering of alternative certification programs for students who have a bachelor's degree in an academic subject other than education and may want to earn a teaching certificate through accelerated certification programs. The state should provide funding for two semesters of paid service as mentored teachers as well as funding for teachers to serve as mentors to post-baccalaureate degree student teachers.

Initiative to Stimulate and Support Teacher Preparation Through Both Traditional and Alternative Preparation Programs

To address the issue of distributional shortages, the state should provide funding for college scholarships (or loan forgiveness programs) for aspiring teachers who prepare to teach in a high need subject area. The state should provide funding for college scholarships (or loan forgiveness) for aspiring teachers who agree to teach in a geographic area with shortages or in a low performing school after obtaining certification. The state should also support a centralized data collection function to enable projection and tracking of teacher supply, demand, and shortages throughout the state.

To increase the overall supply of qualified teachers in Arizona, the state should identify the funding necessary to offer competitive salaries for teachers in Arizona. State funding should be sought to leverage existing and new federal teacher preparation grants. Tax credits should be made available to corporations that partner with school districts to offer math and science teachers summer jobs that relate to their expertise. Finally, the state should provide tax credits for public and private school teachers with at least four years of service as an incentive to reduce turnover rates.

Finally, to provide increased access to education, development, and support for aspiring, new, and continuing teachers, teacher preparation programs should consider greater utilization of information technology. At the same time, these programs can serve to demonstrate to teachers and others the use and benefits of e-learning.

Possible Performance Measures

- ❑ Increase in number of math and science teaching degrees awarded at universities
- ❑ Increase in the number of alternative certification options and availability of electronic delivery of courses and programs

**THE PLAN FOR HIGHER EDUCATION:
Recommended Strategies and Initiatives**

STRATEGY II

**INCREASE RESEARCH AND
BUSINESS DEVELOPMENT**

Preparation for the New Economy

University Research and Technology Transfer Initiatives

Community College Business Development Initiatives

Preparation for the New Economy

Arizona is faced with a crucial decision regarding the role it is to play in the New Economy. Arizona's higher education system is a vital resource in meeting the state's urgent need to prepare for success. The old Industrial Age is giving way to a new digital age, and a narrow window of opportunity has opened for a few states to emerge as world leaders. To become such a leader, Arizona must act with great urgency to position the state and its citizens for economic success.

The Task Force is committed to the principle that the state must prepare to be competitive in the new, knowledge-based, global economy. Two major approaches to that task have been identified. The first approach is to make a major public and private investment in university research, so that the intellectual capital and technology that results from that research can be effectively transferred to the private sector in the form of patents, products, and spin-off firms. The second approach is to enhance and support the development of Arizona's workforce, so that all the citizens of the state can participate in and benefit from the New Economy.

Together, these strategies ensure that Arizona will be in a strong position to provide leadership in America's transition to the New Economy and that Arizona's workforce will be ready and able to contribute to that effort.

The Task Force recommends the development of partnerships and the targeting of investments in a series of university research initiatives that directly support the state's existing industry clusters. A parallel effort to enhance the development of small business in the state should also be implemented through community college programs and legislative support.

University

Research and Technology Transfer Initiatives

To provide support for the industry clusters identified by the Governor's Strategic Plan for Economic Development (GSPED), the university research and technology transfer initiatives cover a broad range of fields:

- ✓ **Bio-Science and Technology** (human health, plant sciences, molecular engineering, anti-cancer research, combating infectious diseases, aging, brain research)

- ✓ **Information Science and Technology** (software and hardware development, telecommunications, artificial intelligence, e-learning, Internet applications)

- ✓ **Environmental Engineering** (water reclamation, sustainable energy, advanced materials)

- ✓ **Environmental Science** (research, education, outreach, alternative energy sources, new construction techniques, new waste treatment approaches)

- ✓ **Manufacturing** (semiconductors, aerospace technologies, environmental quality)

- ✓ **Materials** (ultra small and ultra light, high temperature, high pressure)

- ✓ **Optics** (lasers, optical fibers, telescope lenses and mirrors, new glass and polymers)

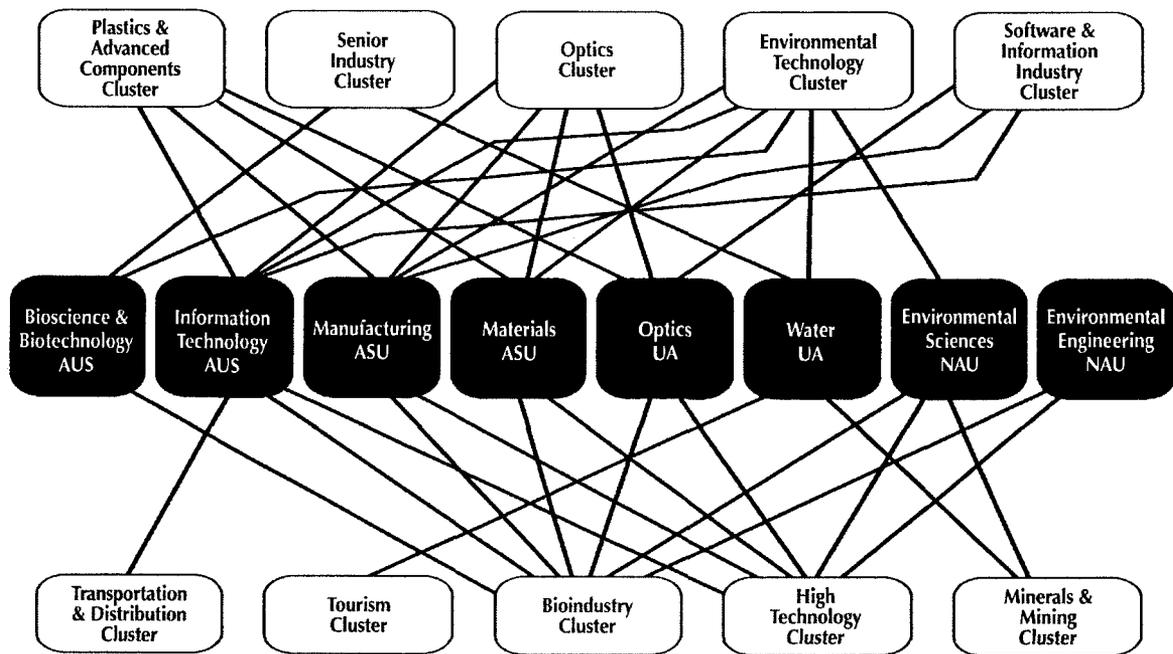
- ✓ **Water Sustainability** (semi-arid issues, water quality, climate impact on resources)

The Task Force recognizes that future economic development is irrevocably tied to the rapidly emerging New Economy; that regional, national, and global competition for benefits is well underway; and that Arizona is already behind. For one thing, Arizona's economy is not sufficiently diversified. In October 1999, the Morrison Institute for Public Policy reported that of the ten areas of cutting edge business and industry that comprise the New Economy, Arizona has relative strengths in only two (*The New Economy: A Guide for Arizona*. Morrison Institute for Public Policy, October 1999, www.asu.edu/copp/morrison)

One way to ensure that Arizona gains solid ground in the race to secure New Economy benefits, and to ensure that the state is quickly positioned to attract New Economy enterprises and jobs, is through significant state investment in

higher education research and technology transfer initiatives. New Economy enterprises, especially those in high-technology, prefer to locate near research institutions, a proximity which contributes to the discovery and sharing of knowledge, as well as to the transfer from theory to application of emerging technologies. New Economy firms are also attracted by the presence of a skilled and educated workforce (Morrison Institute). With timely state investments, Arizona's public universities directly support efforts to attract, retain, and grow New Economy enterprises.

Arizona's public universities have developed initiatives to help Arizona sprint forward. The first two initiatives are system-wide and encompass bio-science/bio-technology and information science/technology. Each university has also designed individual initiatives unique to each campus. To fully support these initiatives, it is estimated that an annual investment of \$50 million by the State of Arizona into the research infrastructure of its public universities will be needed. This investment, leveraged by external funds from foundations, the federal government and industry, will be repaid to Arizona taxpayers many times over and will position the state to attract and enhance New Economy enterprises.



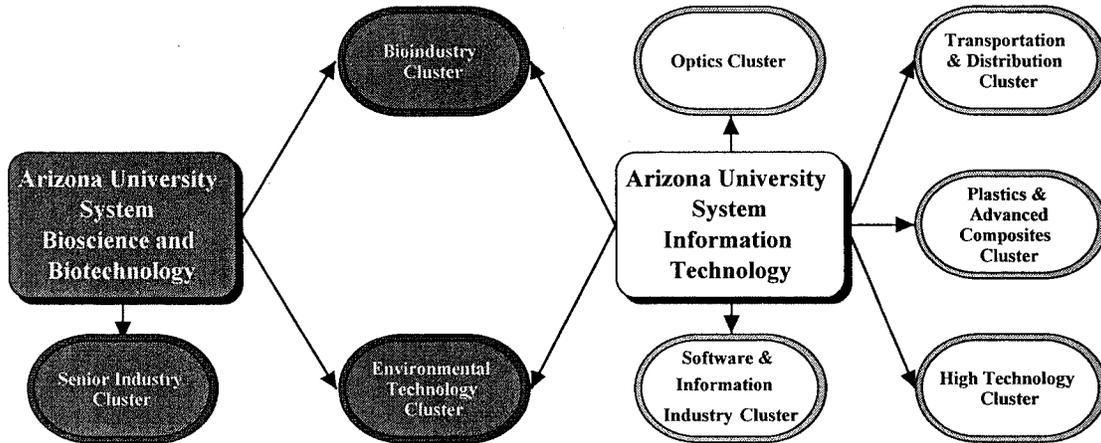
Arizona University System (AUS) Research Support for Arizona Industry

The chart above depicts how Arizona's university research and technology transfer initiatives tie to key sectors of the state's economy.

In 1990, led by the Enterprise Network, public and private funding was secured to launch a process that in October 1992 led to the formation of the Governor's Strategic Partnership for Economic Development (GSPED). The mission of GSPED is to provide leadership in promoting a vital cycle of economic growth that improves the standard of living and quality of life for all Arizona residents. The framework for GSPED was organized around economic clusters and economic foundation groups. Clusters are concentrations of competitive firms in related industries that can create quality jobs and share common economic needs. Ten key clusters identified by GSPED include: BioIndustry, Business Services, Environmental Technology, Food, Fiber and Natural Products, High Technology, Mining and Minerals, Optics, Software, Tourism, and Transportation.

In 1999, the work of GSPED was augmented by the Morrison Institute for Public Policy in a landmark study, *The New Economy: A Guide for Arizona*. Most recently, the Governor's Arizona Partnership for the New Economy (APNE) Task Force has begun a systematic study of Arizona's emerging role in the New Economy. For more information on the work of both the Morrison Institute and the APNE consult the Internet at www.asu.edu/copp/morrison and www.commerce.state.az.us.

UNIVERSITY SYSTEM-WIDE INITIATIVE ON BIOSCIENCE AND BIOTECHNOLOGY



America is undergoing a dramatic transformation as the nation moves to an economy driven by technology industries and the application of technology to traditional industries. Biomedically related biotechnology is rapidly becoming a major economic driver not only in the US but throughout the world. There is broad agreement that we are moving rapidly into the "age of biology" powered by exciting advancements in molecular technologies. These technologies will empower unprecedented advances in our fundamental understanding of biology, especially medicine and agriculture. They can lead to major breakthroughs in the treatment of disease, development of new drugs and medical devices, and the improvement in quality of life. This emerging age of biology will continue to spawn new industries at an unprecedented rate. As a result of the emphasis placed on life science research by the National Institutes of Health and other major funding programs, the nation's universities will play a central role in developing the knowledge base and nurturing these new industries. Many states are positioning themselves to compete in this arena by making major investments in both basic and applied research areas.

If Arizona is to be a player in the New Economy, it must act boldly to attract the kinds of industry that provide high paying employment opportunities. Arizona's three universities represent an important component of the state's intellectual infrastructure. A recent report by the Milken Institute found that of the top thirty high-technology metropolitan areas, twenty-nine were home to, or within close proximity of, a major research university (Milken Institute, 1999).

Arizona can improve the intellectual infrastructure by strengthening the research capacity of its higher education system in this major area of industrial relevance.

The universities have a significant base on which to build and expand Arizona's research infrastructure in biosciences and biotechnology. The initiatives described herein by the individual universities are designed to augment each other and foster collaboration that will leverage the resources provided by the state and enhance the translation of the research into Arizona's industries.

ARIZONA STATE UNIVERSITY INITIATIVE

To enhance ASU's ongoing programs and facilitate interactions with the medical community and biomedical/biotechnology industrial base in the Phoenix area, ASU is creating the Arizona Biomedical, Behavioral and Health Institute. The Institute will initially be comprised of three major research elements: Bioengineering, Stress and Lifespan Development, and Basic Biological Processes including Functional Genomics and Structural Biology. The initiative described herein focuses on two of the three areas that are intimately related to the New Economy.

Bioengineering Thrust: Molecular, Cellular, and Tissue Engineering

Bioengineering uses a "systems engineering" approach to understand complex biomedical processes and develop novel therapeutic devices that create solutions to longstanding physical challenges associated with disease. Examples include the development of critical medical devices such as artificial organs and joint replacements, pacemakers, and a multitude of noninvasive diagnostic monitoring and imaging techniques. Current research increasingly focuses at the nano-level on characterization and manipulation of molecular and cellular systems whereby very elegant approaches are envisioned to replace current 'half-way' medical technologies. The National Science Foundation and the National Institutes of Health have identified the critical role engineering plays in providing new, enabling technologies that demonstrate a high impact on biological research. As such, with the current significant advances in molecular and cellular biology, and in nanoscience and nanotechnology, bioengineering is envisioned to play a pivotal role in advancing both the biological sciences and the emerging field of molecular medicine in the 21st Century.

ASU's bioengineering and biotechnology programs, with significant support from the Whitaker Foundation, are pursuing the following research directions: Imaging and Measurements from Molecule to Function, Functional Genomics from Molecule to Function, Engineered Materials (both synthetic, naturally derived and combinations thereof) for understanding and controlling of biological processes (existing and planned expansion), and Molecular, Cell and Tissue-based Biohybrid Devices for the delivery of molecular and cellular therapies.

Basic Biological Processes, Functional Genomics, and Structural Biology

At ASU, cellular, molecular and nano-level research extends our current understanding of biological and chemical processes that support life. This basic research into the cellular and molecular components of life continues to lead to remarkable discoveries that both combat and prevent disease. The initiative will enhance our capabilities in two specific areas.

- **Functional genomics:** to explore genome sequencing and detection of the encrypted genetic information that results in testable hypotheses concerning gene function. The subsequent identification, regulation, and modification of specific genes hold great promise for treatment of many medical problems.
- **Structural biology:** to develop an understanding of varying biological processes by analyzing the structures of the molecules involved in these processes. Knowledge of molecular structure, obtained by physical methods such as X-ray crystallography, nuclear magnetic resonance (NMR) and microscopy, provides the basis for rational conclusions on the mechanisms of molecular interactions and the development of higher levels of biological organization. In addition, this information is essential in the diagnosis and treatment of disease, both pathogen-caused and molecular diseases caused by genetic defects.

Specific research projects to be undertaken or enhanced include the development of structural information on biomolecular systems as an essential prerequisite for the rational design of drugs, the design of new enzymes with novel catalytic activities and the re-engineering of biomolecules with new properties not found in natural systems. Techniques, such as various types of microscopies, will be utilized to determine structural information of supramolecular and subcellular complexes on a somewhat larger dimensional scale.

THE UNIVERSITY OF ARIZONA INITIATIVE

The University of Arizona has significant research capabilities in basic life sciences, the physical sciences, mathematics, biomedical engineering, and the clinical sciences across the campus. There are also important developing capabilities in the techniques of Genomics, Proteomics, and Bioinformatics in several parts of the campus. The need is to integrate and enhance these core technology programs, to bring these technologies to the clinician-scientists of the College of Medicine, to facilitate specific areas of research and technology, and to develop graduate training programs that stress the interdisciplinary nature of future research in life science.

The Institute for Biomedical Science and Biotechnology. Once implemented, this Institute will bring collaboration between the University of Arizona's physician-scientists and basic life scientists, engineers, chemists,

pharmacologists, physicists, and mathematicians to allow development and application of technologies required to enhance the quality of life of Arizona citizens. The University of Arizona is ranked among the very best universities in the nation in terms of total research funding from the federal government and the proposal will enable the University of Arizona to compete more effectively for the increasing budgets of the National Institutes of Health. Health problems such as cancer, obesity and diabetes and other obesity-related disorders, asthma and other respiratory diseases, and illnesses encountered in the brain during aging and other aging-related diseases are particularly prevalent in Arizona. The University of Arizona is uniquely situated to play a central role in understanding these disease conditions as well as the genetic basis of human diseases in general. This is because of the combination of a core of technical expertise available on campus and the genetically diverse population of southern Arizona. These two facts make southern Arizona a unique laboratory in which to study the genetic basis of a variety of disease states in human populations.

Expertise on campus in genomics research is at or near the best in the world in areas like plant science, medicine, and biochemistry. Genomics technology, wherever developed, can be applied to any question in genomics. Thus, the UA proposal is to interface established genomics expertise with the physician-scientists and the problems of human health that are their area of expertise to solve the great puzzles of human disease and health. Additional areas of opportunity involve creation of food sources that lack substances that cause allergic responses in some individuals, that have enhanced vitamin content, that require less water and pesticide, and that have higher per acre yields. It is interesting to realize that the basic technologies required for the human studies and the plant studies are the same, and that situating agricultural scientists and physicians such that both can access the same technologies will allow both to make advances that neither would likely make in isolation.

This proposal includes the establishment of a Magnetic Resonance Imaging (MRI) Center for Cognition and Neuroimaging that would house a high field-strength (4 Tesla) research-dedicated magnet. The Center would be open to researchers from all disciplines involved in brain research, reflecting the interdisciplinary nature of the research. The Center would provide a common space for key research faculty, visiting scholars, postdoctoral fellows, technical support personnel, analysis workstations, and research equipment as well as meeting and seminar facilities. Because the outlay of money needed for specialized equipment for use in MRI is usually well beyond the capacity of a single laboratory, a key role of the Center will be to provide access for all researchers to state-of-the-art equipment, including computers for data processing and brain image analysis, auditory and visual presentation systems, response systems, eye tracking systems, and physiological monitoring equipment. A high priority is to increase faculty in specific areas of molecular life science and clinical investigation and increase support for Ph.D. and postdoctoral students. Attraction of the best faculty and students will require increased

instrumentation and technical support. Training of students will enhance the workforce that is essential to the development of Arizona's biotechnology industry.

It is generally agreed that biotechnology will be the technology of the 21st century. High technology, including microelectronics, is already well established in centers around the United States; however, biotechnology centers are less well established, and excellent opportunities still exist to stake a claim in this area. The biotechnology industry is typified by high salary levels and employees with well above average education levels, and it is an attractive industry because of its low environmental impact on water and air quality. This industry directly benefits the citizens of the city and state in which it is well established because of increased availability of clinical trial sites, thus, access to new treatments and drugs, as well as high paying jobs. Biotechnology industry also leads to enhanced educational systems, which in turn attract more scientists in an upward spiraling manner. Last, Tucson has a potential for development similar to the opportunity realized by the Reno/Lake Tahoe area. Companies are relocating to the Reno/Lake Tahoe area because of the high cost of living in the San Francisco Bay area. Reno/Lake Tahoe costs are much lower and still provide easy access to the Pacific coast. San Diego and Tucson are in a similar relationship; however, the influx of the biotechnology industry from San Diego into Tucson has yet to occur.

NORTHERN ARIZONA UNIVERSITY INITIATIVE

The proposed Northern Arizona Center for Biotechnology and Human Welfare includes four major interdisciplinary foci that are further supported by a broad array of bioscience research.

Biotechnology, Plants, and Human Health. The explosive development of biotechnology has made it feasible to develop plants with the ability to correct the degradation that has occurred in our environment and food supply over the last 100 years. Using genetic material from plants growing locally on the Colorado plateau, NAU researchers are taking a two-pronged approach to help address some of these problems. By studying how nature works, they have discovered genes in plants that will be used to develop crops with the capacity to cleanup metal polluted soils and waters. NAU researchers are also using these genes to develop food plants with elevated levels of certain anticarcinogenic compounds to help increase the body's inherent ability to resist the potentially toxic effects of certain environmental pollutants.

Emerging Infectious Diseases. The spectrum of infectious disease is changing rapidly in conjunction with dramatic changes in society and environment. Despite historical predictions to the contrary, people today remain vulnerable to a wide array of new and resurgent diseases. Emerging virus diseases represent a major cause of the expanding threat. In the spring and summer of 1999, the West Nile Virus, never seen before in our hemisphere, emerged in New York City and

surrounding areas where it caused 61 infections and 7 deaths. In 1993, in the Four Corners area of the American Southwest, Hantavirus emerged and began killing healthy young adults. NAU researchers are attempting to develop novel therapeutic strategies for these and other emerging virus infections.

Heavy Metals and Cancer. People are turning more and more to alternative and non-conventional medicine and the use of nutritional supplements such as chromium, a heavy metal. In addition, modern living exposes us to heavy metals as environmental pollutants. It is critical to discover how such pollutants and nutritional supplements may cause diseases such as cancer, to identify the genes responsible, and to determine relative humans' genetic sensitivity to damage by such agents. NAU chemists are exploring the pathways of chromium and other metal genotoxicity that will contribute to our understanding of the mechanisms of cancer, will be necessary for evaluating the potential of trace minerals to be systemic carcinogens, and will be useful for assessing a potential risk to humans ingesting bioavailable mineral nutritional supplements.

Biotechnology, Genetic Medicine, and Society. As biomedical technology becomes more and more advanced, it brings with it dilemmas that are as complex as any ever addressed by any civilization. Americans have deep concerns about genetic testing, genetic diagnosis, genetic alterations, cloning, and the use of genetic information. When individuals begin to understand this research, they move beyond a fear of the science fiction possibilities to an understanding of the wonderful potential to change how diseases are understood and treated. Diseases will be redefined by genetic research, because there will be a new understanding of basic mechanisms on a molecular level, with the potential for prevention, very early diagnosis, and effective treatment that can be aimed at new targets, occurring earlier in the disease process. The proposed NAU center will develop forums to inform Arizona citizens about the forthcoming genetic medicine revolution in order to provide an opportunity for input into matters that will affect their lives considerably. A further goal would be to establish a dialogue with Native Americans on how the issues of genetic medicine relate to their cultural and religious heritage.

There is not only an unmet need for highly technologically trained individuals in northern Arizona, but for the small firms that can become the nucleus to draw biotech firms of like nature to the northern part of our state. Through expansion of NAU's interdisciplinary biotechnology facilities the ability to train students and improve the workforce in Arizona will be enhanced. Growth of the biomedical research technology program base will form the nucleus for the transformation of northern Arizona from a service-based economy focused on tourism into a locus of biotech activity.

Implications

The initiatives proposed by the universities will require support for staff scientists who are experts in the technologies required for these advances, support of the

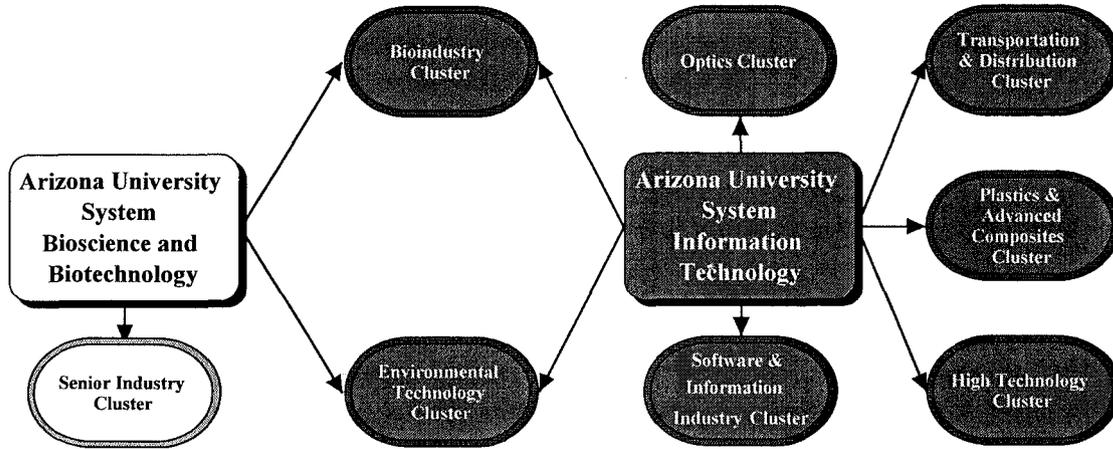
sophisticated instrumentation, salaries for faculty with expertise not currently present on the campuses, and stipends for graduate students and postdoctoral fellows from Arizona and across the country who will fill positions in the new biotechnology industries in the state. Enhanced efforts in the biomedical and biotechnology areas should result in a substantial increase in federal funding primarily from the National Institutes of Health. In addition, the programs described will enhance our competitiveness for funding from foundations and other organizations interested in advancing this critical area. Factoring in the multiplier for funds spent in the local economy and enhanced industrial development, it becomes clear that the proposed investment has the potential to repay the taxpayers of the State of Arizona many times over.

Success in this endeavor will be evidenced through increased activity in the biotechnology industry in the state that will parallel the increase in well-trained students graduating from the Arizona's universities to support the biotechnology programs. These are activities that are readily monitored and evaluated quantitatively. In addition, funding rates and trends from federal sources are easily monitored. The proposed expenditures should, over a period of 5 years, result in an increase in research support of \$70 million to \$100 million per year.

Possible Performance Measures

- Increase in funding from Federal agencies, foundations, and other interested organizations
- Increase in activity in the biotechnology industry in the state

UNIVERSITY SYSTEM-WIDE INITIATIVE ON INFORMATION SCIENCE AND TECHNOLOGY



Information technologies are an integral part of people's lives, businesses, and society. Advances in microprocessors, memories, storage, software, and communication technologies make it possible to build computers and computing devices that are increasingly affordable, as well as to enable the development of increasingly powerful systems at reasonable costs. Transforming the way we deal with information requires significant improvements in data access methods, including high performance information systems and tools to help individuals locate information and present, integrate, and transform the information in meaningful ways. Systems will require interfaces accessible both to experts and novice or infrequent users regardless of physical ability, education, or culture.

Electronic communication is already dramatically changing how commercial transactions between companies are conducted, how digitally based goods and services are distributed, and how retail sales are made. Companies are using information technology to get closer to their customers and suppliers. Technology is also helping to reduce paper work and purchasing costs by streamlining the acquisition process and allowing companies to more efficiently find the best suppliers. High-end computing technologies are needed for concept design, simulation, analysis with interactive control and computation steering, the mining of archived data, and the rendering of data for display and analysis. There is a critical need to link engineering development processes with business processes like planning, purchasing, scheduling, investment, and cost management.

High-speed computers and networks are enabling scientific discovery across a broad spectrum -- from mapping the human brain to modeling climatic change. Research problems are becoming more complex and interdisciplinary in nature. As a result, researchers are finding innovative ways to collaborate with their colleagues across the globe. Key research technologies include high-end computing to allow higher fidelity models of complex physical phenomena, advances in collaborative environments, visualization of complex data sets, data mining techniques, and management of very large data sets and databases.

Arizona's universities play a vital role in positioning the state to successfully compete for information science and technology opportunities in the New Economy. The universities have collaborated to develop system-wide initiatives to address these vital, emerging areas.

ARIZONA STATE UNIVERSITY INITIATIVE

ASU, in partnership with industry, intends to develop a Center for Embedded Systems. Embedded systems are the lifeblood of semi-conductor manufacturers such as Motorola and Intel, in addition to other manufacturers in the state. Embedded systems software is required by almost every product imagined from cell phones to automobiles to refrigerators. For these industries to grow and prosper, it is essential that ASU 1) advances this technology through research and, 2) trains a sufficient cadre of engineers in Arizona capable of meeting the needs of employers.

Software Collaboration. The growing complexity of software and its pervasive use to create systems that can be rapidly modified at low cost while maintaining quality has caused the creation of a new discipline called "software engineering." Without a method for doing systems analysis, design, development, evaluation, and maintenance of large-scale software, nearly all major design projects are doomed to cost overruns and schedule slippage. ASU will work collaboratively with industry to: 1) build a college-wide emphasis on software that will provide an intellectual focus for software research, 2) provide an investment focus in software research and development for Arizona industry and commerce, 3) provide leadership in the development of undergraduate and graduate educational programs in software engineering and closely related disciplines, and 4) provide leadership in the development of continuing educational programs for industry and commerce in the areas of software engineering and software-intensive applications.

Telecommunications Research. Communication systems are involved in many aspects of our everyday lives ranging from the banking, airline, and entertainment industries to the educational, scientific, and military realms. Our nation's security relies on sophisticated radar detection, warning, navigation and communication systems. Telecommunications technology plays a vital role in space exploration, stealth and other defense technologies, wireless communication, and other information technologies. The design of these

systems offers challenging opportunities to telecommunications engineers and scientists.

The trend in telecommunications is toward universal communication systems integrating intelligent, wireless, broadband, miniaturized, and lightwave networks that can be accessed by people anywhere, any time, through any medium. To accomplish this, the architectures and components of these systems need to be researched and developed in order to meet the expectations of advanced home, office, scientific, military communications, information, entertainment, detection, and security systems. Arizona is in an ideal position to dominate this market with major communication and information technology companies and many small entrepreneurial companies operating in the state and an established semiconductor industry already developing the new generation microwave and optical devices. Just like the computer industry before it, however, Arizona's ability to compete in this emerging market place will be limited more by the availability of trained engineering personnel than by any other factor.

THE UNIVERSITY OF ARIZONA INITIATIVE

The UA's initiative focuses on education, research and technology transfer related to foundations and applications of software and information science and technology. The objectives of this initiative are:

- educating university students so that they can contribute to the industry and business needs of Arizona in the software and information technology arena;
- re-educating the place-bound working engineer, scientist and business person in important areas of software and information technology (often through mechanisms of distance);
- performing research on leading edge issues relating to specific information technology issues of interest to businesses in Arizona; and
- providing mechanisms of technology transfer from the university community to the business community in areas of software and information technology.

The strategic intent is to provide a statewide resource where new ideas, talent and software products can be incubated within a collaborative (and non-commercial) setting. Such an environment will promote greater confidence in adopting viable technologies for commercialization. It is also expected that activities through this initiative can play a role in attracting high-tech industry into Arizona

The core functions of this initiative by which the objectives will be met are:

- 1) **Education:** Offer degree, certificate, and continuing education programs presenting students with the knowledge and skills to develop and manage (a) software for a variety of applications, including, engineering, business, earth and life sciences and (b) information technology for distributed work. We will use information technology to create, coordinate and deliver education across the virtual community of the universities and industry.
- 2) **Research and Development:** Investigate foundational elements of software and information technology resources for the virtual workplace through industry and university partnerships.
- 3) **Facilities:** Provide resources including high performance computing and scientific visualization capabilities, digitized learning content, high-speed communication and multimedia facilities and know-how for partners from the private and public sectors for their own research, development, and operational needs.
- 4) **Human Resource Development:** Provide opportunities for multi-disciplinary teamwork, internships and fellowships, particularly to software-educated engineers and managers.
- 5) **Outreach Arid Technology Transfer:** Encourage interactions between multi-disciplinary UA teams and industry, distance-based continuing education, short courses, applications training, intellectual property, and law.

Areas of strength that UA brings to this initiative include expertise in general-purpose software; general-purpose mathematical software; application-specific modeling and simulation software; applications-specific software-enabled technology development; cognitive science and computer human interfacing; bioinformatics; data acquisition and distributed database management; internet web applications; technology of distance course delivery; web-based education; network-centric research; and distributed information systems.

NORTHERN ARIZONA UNIVERSITY INITIATIVE

NAU's e-Learning initiative will use information technology to transform the teaching and learning process for students and professionals alike. By partnering with industry leaders, the Colleges of Business Administration and Engineering and Technology will create learning environments that allow students to experience and function in a networked world. Business and engineering students will practice their professions in a rich virtual environment where they will team up with other students, faculty, and practicing professionals from all over the world to tackle real-world problems using leading-edge

applications and technologies. Another vital component of this initiative is the e-Learning Park, a facility that will foster a rich intellectual and educational exchange among its participants while keeping an eye to issues of private enterprise. The e-Learning Park will be a center of cross-fertilization between academic and private enterprises where students link learning with practice and work side-by-side – both physically and virtually – with practicing professionals.

In Phase One of the e-Learning Initiative, the Colleges of Business Administration and Engineering and Technology are collaborating to integrate leading-edge information technologies into students' educational experiences. The College of Engineering and Technology is advancing its e-Design capabilities to enable distributed product design teams to learn, create, and simulate using electronic design and Web communication tools. The goal is to expand the Design4Practice project-based learning model to incorporate non-local students and distance industrial partners using state-of-the-art groupware and electronic design tools.

The College of Business Administration is integrating e-business and Enterprise Resource Planning (ERP) across its curriculum to provide students with hands-on experience using ERP and e-business software tools in their courses and in the development of marketplace solutions. The goal is to address e-business and Enterprise Resource Planning in courses throughout the business curriculum, to facilitate faculty research on a wide range of e-business and ERP topics, and to give students hands-on training while providing outreach services to businesses seeking assistance with their e-business and ERP needs. The two colleges will also integrate their efforts by forming interdisciplinary teams of engineering and business students who will use e-Commerce and e-Design tools in courses to solve real-world problems.

Business students graduating from this program will understand the concepts and applications of e-business practices and strategies, giving them both the technical and conceptual skills to enhance their value in the marketplace. Engineering graduates knowledgeable in e-Design will be well prepared to make immediate contributions in the marketplace of the New Economy.

Implications

The competitiveness of Arizona industry depends upon new research in computing and communication systems. This research will help sustain the state's economic boom in information technology, address important societal problems such as education and crisis management, and protect us from catastrophic failures of the complex systems that now underpin our transportation, business, finance, and healthcare infrastructures.

In order to promote business growth, Motorola estimates that engineering capability in embedded systems and software must grow by 25 to 50% per year. Almost every product one can imagine from cell phones to refrigerators to

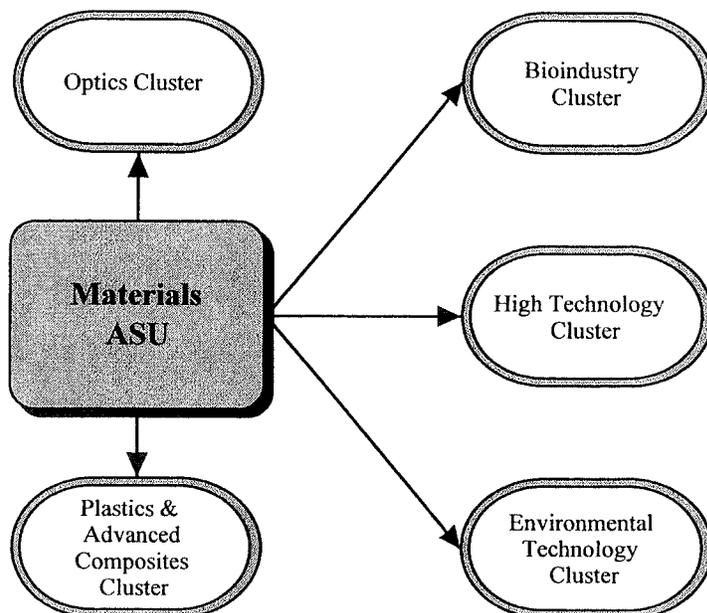
automobiles has computer chips with embedded software as an essential component. It has been stated that "Embedded systems is the lifeblood of Motorola". It is critical that the universities increase their output of research and appropriately trained industry-ready engineers dramatically. The demand for software has grown far faster than our ability to produce it. Furthermore, the Arizona industry needs software that is far more usable, reliable, and powerful than what is being produced today. Industry has become dangerously dependent on large software systems whose behavior is not well understood and which can often fail in unpredicted ways. Therefore, increases in research on software should be given a high priority. Special emphasis will be placed on developing software for managing large amounts of information, for making computers easier to use, for making software easier to create and maintain, and for improving the ways humans interact with computers.

Extremely fast computing systems, with both rapid calculation and rapid data movement, are essential to provide accurate weather and climate forecasting, to support advanced manufacturing design, to design new pharmaceuticals, and to conduct scientific research in a variety of different areas. Although they achieve remarkable performance in some cases, the current scalable, parallel, high-end computing systems are not well suited to many important, strategic applications. Focused high performance systems research is a priority for Arizona.

Possible Performance Measures

- Increase in research in information science, technology, and software
- Increase in activity in the information technology industry in the state

ARIZONA STATE UNIVERSITY INITIATIVE ON MATERIALS SCIENCE



Materials and Manufacturing. Nanotechnology (the production of ever smaller and more condensed materials) is fundamentally changing the way materials and devices will be produced in the future. The ability to synthesize nanoscale building blocks with precisely controlled size and composition and then to assemble them into larger structures with unique properties and functions will revolutionize segments of the materials manufacturing industry. At present we perceive only the tip of the iceberg in terms of the benefits that nanostructuring can bring: lighter, stronger, and programmable materials; reductions in life-cycle costs through lower failure rates; innovative devices based on new principles and architectures; and use of molecular/cluster manufacturing, which takes advantage of assembly at the nanoscale level for a given purpose.

Materials, Medicine, and Health. Living systems are governed by molecular behavior at nanometer scales where the disciplines of chemistry, physics, biology, and computer simulation all now converge. Such multidisciplinary insights will stimulate progress in nanobiotechnology. As a result of the development of new analytical tools capable of probing the world of the nanometer, it is becoming increasingly possible to characterize the chemical and mechanical properties of cells (including processes such as cell division and locomotion) and to measure properties of single molecules. Moreover, biocompatible, high-performance materials will result from controlling their nanostructures. Proteins, nucleic acids, and lipids, or their nonbiological mimics,

are examples of materials that have been shown to possess unique properties as a function of their size, folding, and patterns. Based on these biological principles, bio-inspired nanosystems and materials are currently being formed by self-assembly or other patterning methods. Artificial inorganic and organic nanoscale materials can be introduced into cells to play roles in diagnostics (e.g., quantum dots in visualization), but also potentially as active components.

Materials, Aeronautics, and Space Exploration. The stringent fuel constraints for lifting payloads into earth orbit and beyond, and the desire to send spacecraft away from the sun (diminished solar power) for extended missions, compel continued reduction in size, weight, and power consumption of payloads. Nanostructured materials and devices promise solutions to these challenges. Nanostructuring is also critical to the design and manufacture of lightweight, high-strength, thermally stable materials for planes, rockets, space stations, and planetary/solar exploratory platforms.

Materials, Environment, and Energy. Nanotechnology and nanostructured materials have the potential to significantly impact energy efficiency, storage, and production. Such applications can be used to monitor and remediate environmental problems; curb emissions from a wide range of sources; and develop new, "green" processing technologies that minimize the generation of undesirable by-product effluents. The impact on industrial control, manufacturing, and processing will result in energy savings especially through market driven practices as opposed to regulations. New technologies that utilize the power of nanomaterials illustrate this potential. For example, a long-term research program in the chemical industry into the use of crystalline materials as catalyst supports has yielded catalysts with well-defined pore sizes in the range of 1 nanometer; their use is now the basis of an industry that exceeds \$30 billion/year. Potential future breakthroughs include use of nanorobotics and intelligent systems for environmental management.

Materials and Biotechnology. Biosynthesis and bioprocessing offer fundamentally new ways to manufacture new chemicals and pharmaceutical products. Integration of biological building blocks into synthetic materials and devices will allow researchers to combine biological functions with otherwise desirable materials properties. Imitation of biological systems provides a major area of research in several disciplines.

Initiative: Ultra Small and Ultra Fast

Interdisciplinary research for advanced materials underpins the development of new technologies and creates new business opportunities. The emerging field of nanostructure science and technology is broad and multidisciplinary. Faculty members at Arizona State University have made significant contributions in this general area and already have strong connections with major industrial companies and national laboratories. Additional support, especially for new faculty, could place ASU among the upper echelons of U.S. universities in the

field. Arizona State University proposes to contribute significantly to the state's high technology industrial base by expanding its research and education capabilities in Ultra Small (less than 1 billionth of a meter) materials synthesis and Ultra Fast (1 trillionth of a second) analysis of chemical reactions. Major upgrading of instrumentation for high resolution electron microscopy and laser spectroscopy, as well as nanofabrication, nanolithography, and materials preparation are required.

Through millions of years of evolution, biological systems have developed very sophisticated materials for many different purposes including microscopic and macroscopic structure, sensing, communication, chemical processing, and energy conversion. We can capitalize on this natural "research and development" by using biological materials for new purposes, including hybrids of biological and traditional materials. In addition, the basic science underlying biomaterials may be elucidated and used to prepare artificial biomimetic materials for a variety of purposes in health-related, electronics, sensing, energy conversion, and other areas. In an attempt to seed a "molecular electronics" effort at ASU, researchers are embarking on a multidisciplinary program to investigate the interfacing of light-responsive biomimetic organic molecular species with nanoscale electronic circuits. This program involves researchers from the Center for Solid State Electronics Research and the Center for the Study of Early Events in Photosynthesis. The approach is to use the basic principles of photosynthetic energy conversion and storage in the design of engineered photoresponsive biomimetic devices. These will ultimately act as molecular scale photovoltaics, optoelectronic logic gates, and sensors. Expertise in the synthesis of these types of molecules has been developed during 20 years of research in the Photosynthesis Center at ASU and the increasing scale of these molecules has been met by the decreasing scale of nanofabricated structures in the Center for Solid State Electronics Research.

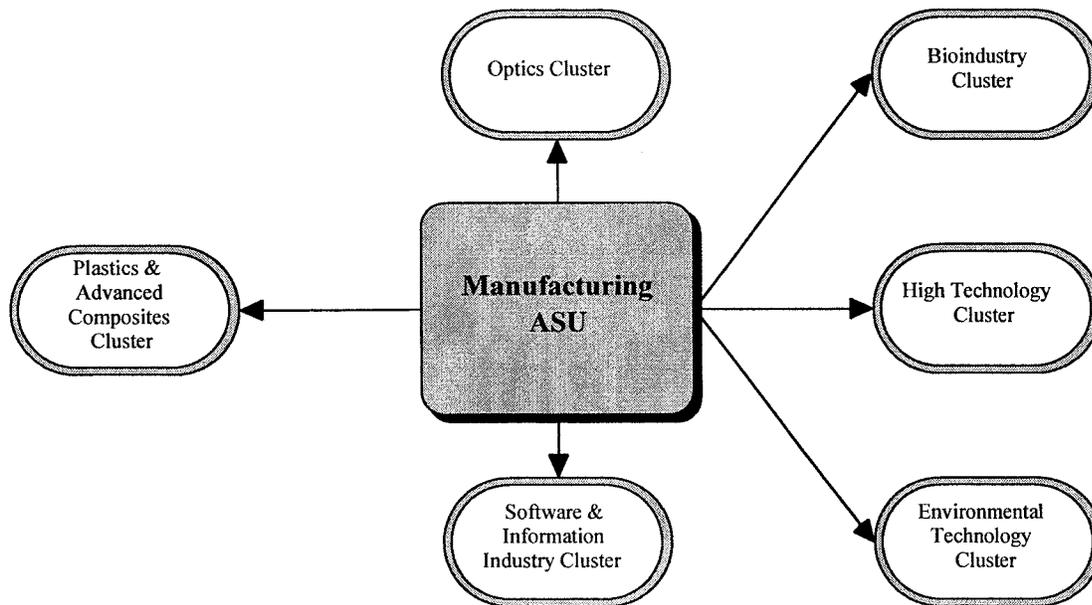
Implications

Advances in materials research has implications in the following areas: 1) manufacturing of nanostructured metals, ceramics and polymers at exact shapes without machining; 2) new standards for measurements at nanoscale; 3) nanofabrication on a chip with high levels of complexity and functionality; 4) new formulations and routes for drug delivery; 5) more durable rejection-resistant artificial tissues and organs; 6) sensor systems that detect emerging disease in the body; 7) low-power, radiation-tolerant, high performance computers; 8) nanoinstrumentation for microspacecraft; 9) thermal barrier and wear-resistant nanostructured coatings; 10) nanoscale chemical and photochemical sensors; 11) extremely sensitive nanoscale photo-detectors; and 12) new types of molecular-semiconductor hybrid "AND" gates.

Possible Performance Measures

- Increase in external funding
- Increase in the number of patents registered

ARIZONA STATE UNIVERSITY INITIATIVE ON MANUFACTURING



Manufacturing industries worldwide are faced with unprecedented global competition and rapid advancements in product, process, and information technologies. These pressures demand new competitive strategies. Increasingly, manufacturing companies are embracing strategies that differentiate them by focusing on globalization, creating products and services faster than ever before, integrating supply networks, developing new manufacturing processes, and having a much better understanding of customer requirements.

To support the manufacturing environment of the future, academic institutions must adopt a definition of manufacturing that dynamically links together the disciplines necessary to develop and delivery products, services, and solutions subject to customer and market requirements. These disciplines include design, production, research and development, supply chain, accounting, marketing and information systems, environmental engineering, data mining, rapid prototyping, and virtual learning. Advances in computer and communication technologies allow for seamless integration of the total manufacturing enterprise with its customers, suppliers, and strategic partners.

In adopting this perspective it becomes obvious that high technology manufacturing in Arizona is driven not only by engineering, but in large measure by advances in science (physics, chemistry, biology, and mathematics).

Discoveries, particularly at the nano scale (1 billionth of a meter), are yielding dramatic new insights into the manufacturing of devices and materials. Innovations such as chemistry labs that function on a computer chip, the visualization of individual atoms using electron microscopy, miniature biocompatible devices that can be implanted to monitor body chemistry or to release medication, and mathematical algorithms designed to drive manufacturing processes are all a part of the New Economy. Science will play the leading role in defining the economy throughout the 21st Century as we move into such areas as "green technologies", knowledge management, and novel methods for treating disease that will create new economic opportunities for the citizens of Arizona.

The Semiconductor Industry Association (SIA) has developed a roadmap for continued improvements in miniaturization, speed, and power reduction in information processing devices—sensors for signal acquisition, logic devices for processing, storage devices for memory, displays for visualization, and transmission devices for communication. The SIA roadmap projects the future to approximately 2010 and to 0.1 micron structures, just short of fully nanostructured devices. The roadmap ends just short of true nanostructure devices because the principles, fabrication methods, and the way to integrate devices into systems are generally unknown. Potential breakthroughs include, among others; 1) nanostructured microprocessor devices with lower energy use and cost per gate, thereby improving the efficacy of computers, 2) communications systems with at least ten times more bandwidth, 3) small mass storage devices with capacities a thousand times better than today, and 4) integrated nanosensor systems capable of collecting, processing, and communicating massive amounts of data with minimal size, weight, and power consumption. All of these breakthrough areas contain significant manufacturing challenges as ramping up from the bench to the factory presents major issues in the fields of industrial engineering, process control, and supply chain management.

Arizona is home to a rapidly growing aerospace, space technologies and space instrumentation business sector anchored by Motorola, Honeywell, Raytheon, Orbital Sciences, and Spectrum Astro. Arizona State University's deep education and research expertise in the areas of developing instrumentation for NASA planetary missions, nanosatellite development, avionics, remote sensing, and aerospace engineering are crucial to nurturing this strategically competitive business cluster.

Environmental sciences tied to technology fields in the areas of sensors, remediation, recycling, source reduction, reverse logistics, and controls are creating new opportunities for movement towards "green manufacturing". Multidisciplinary efforts between biology, chemistry, materials and civil engineering in collaboration with the City of Phoenix and Maricopa County are supporting the green manufacturing effort and creating models for best practices

that are being embraced across the country. Such research and technological breakthroughs hold the best promise for balancing high quality of life with industrial expansion in Arizona.

Initiative: The Manufacturing Institute

In the transformation to the new manufacturing enterprise of the future, universities and industry have abundant opportunities to partner together. Since 1979, ASU has maintained a strong partnership with Arizona's high technology manufacturing industry. The collaboration has elevated the quality of engineering and business education at ASU, and fostered multi-disciplinary research that supports economic development. Building on this foundation, Motorola supported Arizona State University to create the Manufacturing Institute (MI) as a collaborative partnership between industry and the College of Business and the College of Engineering and Applied Sciences. Since its inception the metropolitan industrial community has thrown its support behind the concept by investing in MI scholarships as well as research. It is through the Manufacturing Institute that Arizona State University seeks to create a new form of partnership with Arizona's manufacturing industry, one that advances our mutual goals of creating new knowledge, innovative education, lifelong learning, and advancing global partnerships.

The Manufacturing Institute breaks the traditional paradigm of residing academic programs in specific departments. Rather, as an integrated unit, MI serves as a sponsor and advocate for multi-disciplinary research education and network programs. In this organizational form, MI enhances already-strong department capabilities across disciplines by fusing knowledge bases together in ways that provide a systems perspective to manufacturing. In MI's view, the challenges of the 21st century manufacturing must be addressed through forward-looking research and educational programs involving faculty and students from various departments such as industrial engineering, supply chain management, bioengineering, biology, physics, accounting, computer science, materials, marketing and many other supporting disciplines. By focusing on the manufacturing life-cycle in total, MI is positioned to partner with a diverse set of industries including aerospace, automotive, biotechnology, communications, electronics, software, transportation as well as public sector providers such as the National Aeronautics and Space Administration, the Arizona Department of Transportation, and the Defense Advanced Research Project Agency (DARPA).

ASU proposes to move forward aggressively to solidify and expand its core science and engineering research and education competencies in strategic areas such as semiconductor manufacturing, software, space instrumentation sciences, ultra small satellites, aerospace technologies, biotechnology, and environmental sciences and technologies.

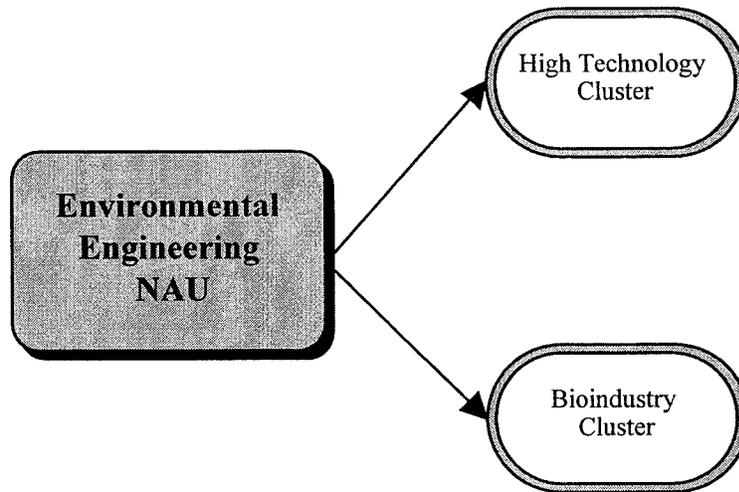
Implications

Enhancing the quality and competitiveness of faculty, facilities, instrumentation, knowledge transfer and graduate education in key New Economy Arizona-based growth industries (semiconductors, electronic devices, aerospace, materials, biotechnology and environmental technology) leverages competitiveness and future opportunities. Additionally, quality-of-life factors (such as green manufacturing) are important to knowledge workers in high-tech industries. In order to attract and retain scientists, engineers, top-level programmers, managers, and other technicians, firms must pay close attention to quality of life. Research focused on quality of life issues is an essential element to Arizona's long term competitiveness.

Possible Performance Measures

- The number of interdisciplinary grant proposals funded in manufacturing
- Increase in the number of student internships with industry

NORTHERN ARIZONA UNIVERSITY INITIATIVE ON ENVIRONMENTAL ENGINEERING



The growing gap between the “haves” and the “have-nots” is no more profound than in rural Arizona. Small firms trying to develop new environmentally related technologies that may better serve rural areas typically do not have access to the current knowledge and technologies, laboratory equipment, and space where they can develop prototypes and test techniques, instruments, and systems of environmental management and engineered products. Statistics illustrate that this lack of adequate testing laboratories with state of the art engineering equipment is often a barrier to innovative prototype development and production.

Rural Arizona needs a resource where technology transfer and technology development support is made available to small businesses. This resource will serve as a site for broad based dissemination of new technologies to the rural communities where these technologies can help to transform small rural communities into self sufficient, knowledgeable consumers and conservers of their environments. Resources will include 1) research to develop new environmental technologies; 2) training and workforce development related to environmental technologies; and 3) laboratory equipment, modeling, and information technology support for small business technical development efforts.

Northern Arizona University (NAU) has a strong research emphasis that marries engineering and the environment with a focus on provision of the latest technologies to rural economies. NAU’s research laboratories, the Water Resources and Reclamation Laboratory, Sustainable Energy Laboratory, and the Advanced Composite Materials Laboratory emphasize three key areas that strongly impact life in rural Arizona: water, energy, and advanced materials. High technology laboratories and faculty expertise in the environmental technologies are well

established at NAU. What is needed is suitable targeted expansion of these facilities to allow enhanced research with direct impact on economic development and enhanced technology transfer to rural Arizona. Specifically, the proposed Arizona Center for Environmental Technology will provide research activities that develop new environmental technologies; training and workforce development related to environmental technologies; and laboratory equipment, modeling, and information technology support for small business' technical development efforts. Small firms have repeatedly requested this type of arrangement over the years but NAU has not been able to accommodate their needs adequately. Additional support and consultation on best business practices will be provided by the NAU College of Business Administration to the firms and community groups participating in the Center activities.

The NAU College of Engineering and Technology is currently involved in a number of federally funded environmental engineering demonstration and training programs that serve as models and could be readily expanded. In engineering technologies, these programs have clearly demonstrated that a combination of e-learning and on-site hands on demonstrations are most effective in technology transfer.

Initiative: Arizona Center for Environmental Technology

The proposed Arizona Center for Environmental Technology would include and be an expansion of the existing laboratories identified above which all integrate with the existing Center for Data Insight (data mining).

The Arizona Center for Environmental Technology would serve as an incubator for small technology development projects for firms of various sizes, partner with small businesses to apply for federally funded Small Business Innovation Research (SBIR) awards, and serve as a resource and training center for rural Arizona. Specific initiatives are described below. Each is based upon the current research capabilities, expanding those capabilities to serve economic development efforts of small technologically-dependent businesses:

- Water Resource and Reclamation Laboratories will provide demonstration and research capabilities in the technologies for wastewater treatment, microbial water and soil reclamation, water desalination, water reservoir rehabilitation, and water resource studies.
- Sustainable Energy Laboratory will provide demonstration solar, wind and hybrid technologies that can be used by small businesses to test newly developed components such as intelligent battery chargers, fuzzy-logic system controls, or hydrogen fuel cells. Computer models will be made available for power system design and computational fluid dynamic studies of wind turbine designs.

- Advanced Composite Materials Laboratory will provide fabrication and test facilities for new materials developed by small firms who lack the necessary test equipment. Advanced materials are often critical to lightweight but strong components, such as wind turbines or bridges, and can offer lower environmental impacts and decreased life-cycle costs.
- Geographical Information Systems Laboratory will provide comprehensive mapping of physical quantities such as energy resources (insolation, wind), natural resources (minerals, forests), water, meteorological data, and environmental quality data. This data is invaluable to economic initiatives relying on the natural resources of rural Arizona.
- *E*-learning at NAU will expand technology transfer capabilities by providing Web-based resource centers for environmental technologies, video-conferencing for consulting and training, on-line tutorials and short courses for workforce development activities.

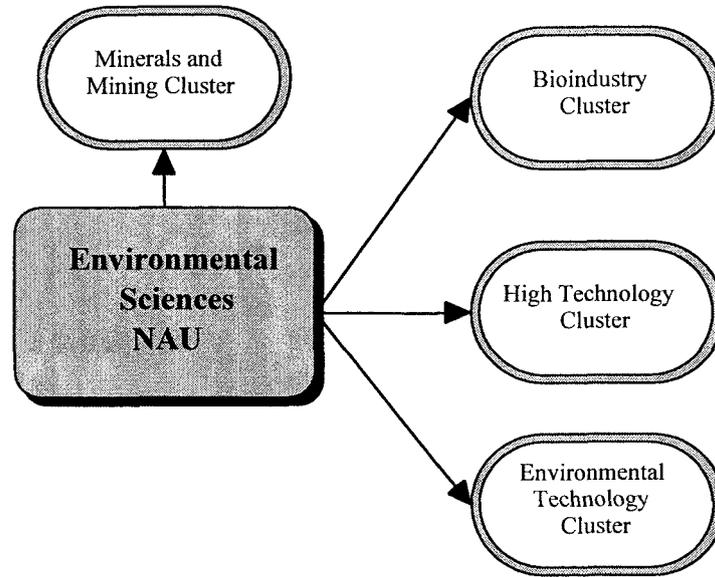
Implications

NAU's initiatives will increase the number and diversity of community and workforce training programs available to citizens in isolated parts of the state. There will be a growth in federal funding for research at NAU in environmental technologies and rural areas of the state will see an increase in understanding of and access to technology-based information.

Possible Performance Measures

- The number of firms that use the Center and bring products to production
- The number of specific workforce development workshops, courses, and training programs completed

NORTHERN ARIZONA UNIVERSITY INITIATIVE ON ENVIRONMENTAL SCIENCES



The scarcity of privately owned land, water issues, and fragile ecosystems that characterize most of our state can be powerful deterrents to conventional development. As environmental issues become increasingly complex, finding creative and effective solutions requires integrated thinking from multiple disciplines. More specifically, there is a need to develop findings, concepts, and patents or other practical applications designed to facilitate economic development within the unique Arizona environment. A related need is a workforce trained in these new applications and techniques in the environmental field. In fact, environmental management is one of the fastest growing components in corporate America.

Northern Arizona University has long been a leader in environmental education, research, and service. Through its Center for Sustainable Environments, NAU is prepared to further leverage its expertise in sustainability and transform the way tomorrow's leaders address environmental issues in the 21st century. The Center for Sustainable Environments offers an innovative, interdisciplinary umbrella structure that brings together scientists, business leaders, governmental agencies, community members, students, educators, and many interested stakeholders to create new and comprehensive ways of addressing environmental issues. NAU has a group of faculty whose interests address the interrelated impacts of changing economics, population growth, natural resource management, and economic development through scientific research, education, and community outreach. NAU has significant resources in place, including programs in forestry, geography, geology, biology, chemistry, environmental sciences, and engineering, as well as expertise in

environmental communication, environmental policy and interdisciplinary interaction, which support a major focus on issues of environmental sustainability.

Initiative: Center for Sustainable Environments

The Center for Sustainable Environments (CSE) will serve as a catalyst to facilitate the broad range of activities related to environmental research, education, and outreach. NAU researchers are seeking and devising alternative paths to economic development including the development of alternative energy sources, new construction techniques, and new waste treatment approaches. The CSE has established a set of goals to attain the highest level of multidisciplinary and environmentally relevant research, education, and stewardship. The timeline for many of these goals is the year 2002 and includes the following:

- Develop collaborative relationships with Indian tribes and other local communities in conducting research on environmental issues;
- Support studies that seek to have a direct effect on environmental policy, from the local to the global;
- Through research, produce prototypes of new materials, i.e., construction materials, that are energy efficient and recyclable;
- Actively seek additional private and federal funding for environmentally related research;
- Assist studies that make connections between international and local/regional environmental issues;
- Maintain a website and develop other means of disseminating information on CSE-supported research and projects for local communities;
- Work with partner agencies and organizations to apply knowledge to the development of effective strategies to restore, sustain, and preserve the environment, and
- Sponsor public meetings/dialogues on issues of importance to communities.

Implications

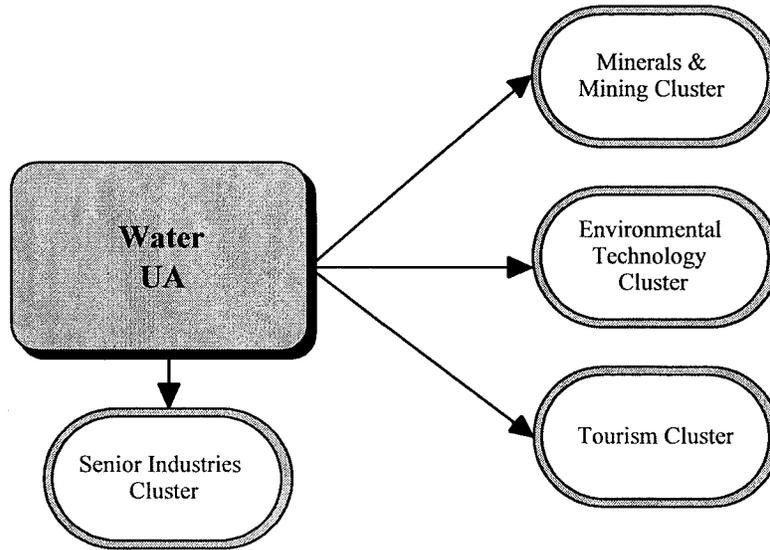
These goals will be accomplished through the efforts of many existing units on the NAU campus. These units include: the Colorado Plateau Cooperative Ecosystem Studies Unit (created by the U.S. Department of the Interior to provide assistance to managers in federal land management, environmental, and research agencies); the Merriam-Powell Center for Environmental Research, the Institute for Ecological Restoration; the Colorado Plateau Field Station (of the U.S. Geographical Survey/Biological Resource Division); and the Institute for Tribal Environmental Professionals.

Accomplishing the above goals will go a long way toward developing awareness, knowledge, technologies, and tools to create an environmentally sustainable future for the State of Arizona.

Possible Performance Measures

- Number of environmental issues addressed
- Number of New Economy businesses attracted to the state because of the environment and innovation in solving environmental challenges

THE UNIVERSITY OF ARIZONA INITIATIVE ON WATER SUSTAINABILITY



Arizona is an arid state, averaging less than 10 inches of precipitation per year. Little of this scant precipitation is available for human use, with 98.5 of every 100 gallons evaporating back into the air. Thus, surface water is scarce. Parts of the state are blessed with large, high-quality groundwater aquifers that filled over millennia, but many are being rapidly depleted. Large areas of rural Arizona lack reliable groundwater supplies. Salinity, pollutants, and pathogens from both natural and human sources impair numerous water sources, and require enormous expenditures on treatment and remediation. Historically, these factors have made providing a sustainable water supply a formidable challenge. Arizona's cotton, copper, and cattle sectors are being complemented by New Economy businesses built on computer chips, climate, and communications, creating new water demands and quality concerns. An unprecedented period of prosperity and growth has increased incomes, home ownership, and demand for environmental and recreational amenities, all resulting in additional demands on Arizona's limited water supplies. These challenges are especially daunting for many rural communities and smaller water providers. Looming over all this is the very real prospect that climate change will impact our water supplies in complex ways.

The need for water resource management and testing tools to address quantity and quality issues in arid and semi-arid regions is large and growing, and represents a global business opportunity as well as a local challenge. Tucson's Environmental Technology Industry Cluster (ETIC) represents one of the fastest-growing sectors in Southern Arizona. ETIC's vision is to become a worldwide

center for products and services dedicated to the solution and prevention of environmental problems, including water modeling, testing, remediating, and water use efficiency.

The UA has a national and international reputation for the quality of its water resources research, teaching, and outreach. Anchored by an internationally-renowned hydrology department, UA is known not only for cutting edge theoretical surface and groundwater hydrology, but also for interdisciplinary research that applies physical, natural, and social sciences to real-world problems. This expertise is reflected in two recent NSF awards, establishing a Center for Sustainability of semi-Arid Hydrology and Riparian Areas (SAHRA) and a Water Quality Center (WQC). SAHRA encompasses nine partner universities, including ASU and NAU, along with six federal agencies; WQC includes ASU and a growing consortium of water-related industries. Both centers link researchers across campus and across the nation. The hydrologic science program also has links with NASA and the National Oceanic and Atmospheric Administration in the area of remote sensing to study climate variability and impacts on water resources. The University's Institute to Study Planet Earth (ISPE) also focuses on climatology - hydrology linkages. The University's Water Resources Research Center, Extension offices, and SAHRA also promote knowledge transfer, public outreach, and hydrologic literacy.

Initiative: Water Sustainability

The goal of this initiative is to maintain and increase the reliability and quality of the state's water supplies. This is necessary to support the state's New Economy while preserving the quality of life that makes Arizona such a desirable place to live, thereby attracting the human capital necessary to drive the economy. The initiative would also generate its own economic activity. It would allow expansion of two critical areas of research and the area of knowledge transfer, as described below:

- 1) Maintaining sustainable supplies of water requires an understanding of the hydrologic cycle--the processes by which precipitation evaporates or becomes runoff; by which surface water is evapo-transpired by vegetation or recharges to become groundwater; and by which dissolved solids and nutrients move through desert and riparian ecosystems. Individual components of this cycle have been studied in detail through the lens of various disciplines. What is needed now is multi-disciplinary research on the basin-scale level. Advances in remote sensing and computer modeling, coupled with approaches for linking the work of social scientists, biologists, hydrologists, and engineers make this type of cross-cutting research both highly promising and sorely needed. This effort will be directed by SAHRA out of the hydrology department.
- 2) The focus of the second area of research is on pathogen detection in potable water, remediation of chemically contaminated groundwater, salinity

control of agricultural irrigation water, and effluent and sewage sludge reuse. Rapid advances in sensor design, bioremediation, and membrane treatments are leading to promising, patentable technologies. The WQC will direct this component from the Department of Soil, Water and Environmental Science.

Research on pressing, real-world hydrologic issues has little value if the results are not effectively communicated to the intended users. Knowledge transfer begins by establishing working relationships with stakeholders who help direct the focus of research and thereby “buy into” the results. It includes technology transfer, such as patenting and marketing new devices and processes, and training decision-makers to use new models. It also includes education and outreach, so that currently available information is made available in useful, understandable ways to decision makers and the general public. This initiative will include:

- a water information center with a library of water-related materials and information staffed by an information specialist;
- courses and research opportunities that will train the state’s next generation of water resource managers;
- a Web-based course in basic hydrology, offered through Extended University and available to anyone, including high school science departments;
- a satellite office in Maricopa County to facilitate interactions with key stakeholder groups; and
- a presence in rural Arizona through the existing network of extension offices. Knowledge transfer will be a joint effort of SAHRA, the University of Arizona’s Water Resources Research Center, Extension offices, and WQC and will serve as the integrating mechanism for the initiative.

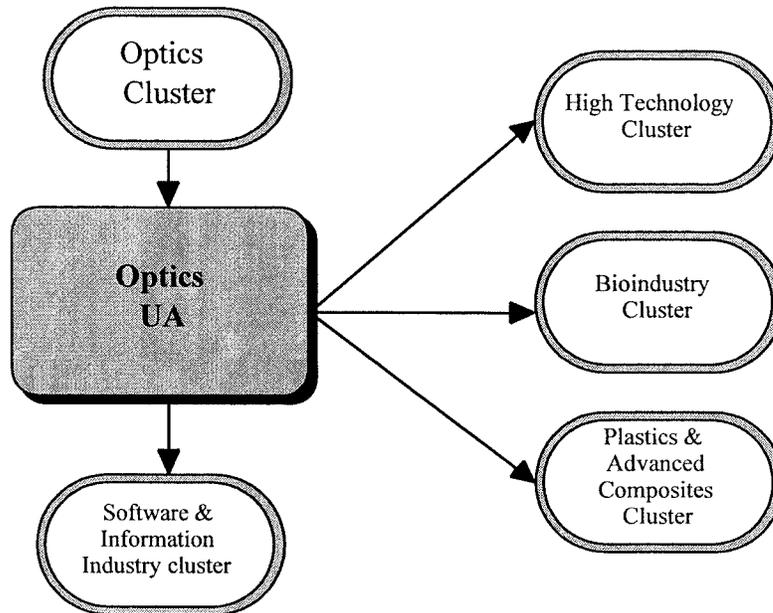
Implications

An initiative of this type is necessary to allow Arizona to confront water resource challenges that could threaten economic development and quality of life. If met squarely, it will create opportunities to market these solutions elsewhere. In order to meet these challenges, the University must have additional resources to not only develop technology and improved understanding, but to transfer knowledge and expertise to metropolitan Phoenix and rural areas of the state and market new technologies globally. This will require additional faculty engaged in teaching and interdisciplinary research, staff positions for enhanced knowledge transfer, a small satellite office in Maricopa County, and programs for rural Arizona run through county extension offices.

Possible Performance Measures

- Number of new water resource management tools developed and adopted
- Growth in Tucson's environmental technology industry cluster in water resources

THE UNIVERSITY OF ARIZONA INITIATIVE ON OPTICS



The field of optics encompasses anything involving the generation, transmission, detection, or modification of light to perform a useful task. We are currently in a new industrial revolution based on optical technology moving out of the laboratory and into critical applications. For example, computer chips are made by optical lithography, and communications is carried out by laser light traveling down optical fibers. Optics is a perfect example of a "New Economy" industry. Typical optics companies are small, flexible, technology-based companies that partner with other companies having complementary technologies and global markets. They are knowledge-based and strongly value research and education. In addition, optics is a major enabling technology for the New Economy. Instant global communication and e-commerce would not exist without the optical communication infrastructure. Without optical displays there would be no television, computer screens or Palm Pilots. Without optical lithography there would be no computer chips. These are all critical components of the New Economy.

The University of Arizona has a unique strength in the area of optics. Its major focal point is the Optical Sciences Center, with an international reputation as the largest and best academic research institute in optics in the world. Strong optics programs are also pervasive throughout the university, including research projects in the College of Medicine, the College of Science, and the College of Engineering. The presence of such a strong optics program at the university has provided an engine for economic growth in optics in southern Arizona. There are

now over 120 optics related industries in Tucson that generate over \$750 million per year. and pay average salaries of more that twice the overall average wage in Tucson. Optics has been identified as one of the GSPED industry cluster groups that are at the core of New Economy business strategy.

The importance of optics to economic competitiveness has been recognized throughout the country, and other states have responded to this by initiating state-supported programs for university-industry collaborations in the development of optical technology. If Arizona does not create a similar initiative our current lead in the field of optics will be surpassed by at least five other states within two years.

Initiative: Optics

The goal of the UA's Optics Initiative is to support the development of the New Economy in the state through providing highly educated graduates for the Arizona optics companies to hire, engaging in world-class research and development in areas of relevance to local optics companies, and implementing an effective outreach program to provide technology transfer and technology support for Arizona optics companies. This initiative will allow the expansion of three critical areas of research and of the university's technology transfer infrastructure:

- The Arizona Center for Photonic Information Technology will be established as a university-community college-industry-federal government partnership with funding from all partners. It will focus on optics in information technology critical to the New Economy including: the development of new lasers and other devices for generating and processing optical information; new optical fibers and waveguides for transporting information in both long haul and local area networks; new techniques for information storage; new technology for information display based on flexible plastic optics; and next-generation concepts for quantum information processing on single atoms. This project will be directed by the Optical Sciences Center. Several companies have already expressed their interest in becoming partners in this center. In addition, Pima Community College will collaborate with this center in establishing a new two year degree program for educating technicians to work in the optoelectronic and optomechanical areas. This is a critical workforce issue that has been recognized at both the national level and in southern Arizona. Pima Community College will provide the classroom curriculum to the students and then they will spend a semester working in University of Arizona laboratories and clean room facilities for practical training.
- The UA is the world leader in developing new technology for astronomy. The new initiative will expand existing capabilities of Steward Observatory, support collaborations of the large optics fabrication facilities on campus, and

support collaborations between the university and local businesses focused on astronomical optics.

- The critical element in any optical system is the optical material. The university has recently hired new faculty members who are world leaders in polymer optical materials and glass materials. The new initiative will be used to establish a coordinated optical materials research effort to provide the local optical industries with the next generation of optical materials they need to remain competitive.
- In order to be more effective in supporting local businesses, the university must significantly expand its technology transfer and industry support capabilities. Currently there is no state funding supporting our technology transfer office and no state support available to allow university facilities to aid local businesses. The new initiative will be used to support the expansion of these efforts to allow us to be competitive with other states that already have this type of program.

Implications

Only through the initiation of this type of initiative will southern Arizona be able to achieve its full potential as “*Optics Valley*.” In order to achieve this goal the University must have additional resources for use in three general areas. The first is for recruiting and retaining key faculty members in areas across campus that directly or indirectly support comprehensive educational and research programs in optics. The second is for providing the infrastructure necessary to have efficient technology transfer and technology support programs. The third is for supporting crosscutting initiatives in new areas of optics research and development.

Possible Performance Measures

- Increase in the number of optics-related research grants
- Increase in the number of optics-related patents

FISCAL IMPLICATIONS FOR UNIVERSITY RESEARCH AND TECHNOLOGY INITIATIVES

It is estimated that an investment of \$50 million annually by the State of Arizona into the research infrastructure of its public universities would repay taxpayers many times over. The investment will leverage external funds from foundations, the federal government, and industry as well as position the state to attract and enhance New Economy enterprises.

Community College Business Development Initiatives

To provide support for Arizona's small business community, the community colleges offer two focused initiatives:

- ✓ **Small Business Development Centers** (technology and knowledge transfer, mentoring, business training, loan counseling)
- ✓ **Tax Credits for Training Costs in Small Business** (expansion of the categories of training eligible for Arizona state tax credits)

The Task Force recognizes that a large part of the New Economy will be driven by Arizona businesses, many of which will be retooling in a competitive environment. Given the speed with which New Economy businesses must adapt, it is appropriate that much of the responsibility for assisting with this task fall to the community colleges.

High-technology enterprises so essential to the New Economy will be attracted to Arizona by a diversified economy that encourages business development and rewards enterprise. New Economy firms are also encouraged by the presence of a skilled and educated workforce, especially when that workforce includes employers and employees engaged in small businesses.

With strong state support, Arizona's public community colleges will contribute to the economic and social climate that supports efforts to attract, retain, and grow New Technology enterprises.

Arizona's public community colleges have designed business development initiatives to help the state's economic growth with an emphasis on the development of small businesses and provisions for training small business employees.

ARIZONA COMMUNITY COLLEGE INITIATIVE: SMALL BUSINESS DEVELOPMENT CENTERS

Established in 1988, the Community College Small Business Development Center Network is now the single largest provider of small business assistance in Arizona. These centers, located in each of the 10 community college districts, help people who either currently own or are planning to open a business learn

the fundamentals of operating a small business. Ninety-eight percent of all businesses in the state have fewer than 100 employees and small businesses represent the majority of jobs in the state. In 1999, community colleges invested \$1.3 million, matched by \$1.1 million in Federal funds, to operate these centers. Arizona is one of only two states that do not provide state funding for this type of center.

During 1999, as a result of these centers, 1,466 jobs were created and 282 jobs retained; 208 clients received over \$35 million in financing; 3,390 clients were counseled; and 3,749 received training. Sales by these clients increased by \$72.3 million. A total of \$5.2 million in state and federal tax revenue resulted from the enhanced activities of these businesses for a \$2.14 return on each dollar invested.

The Small Business Development Center (SBDC) Network is an extremely efficient way to aid businesses statewide. SBDC advice, free and confidential, has helped more than 33,000 Arizona small business owners and prospective owners in the past 10 years, creating jobs in all 15 counties. As productive as these centers are, they fall woefully short of meeting the need for small business support. More than 22,000 Arizona small businesses, not now served, could benefit from immediate SBDC assistance.

Initiative: Expand Small Business Development Centers

It is proposed that the state become a partner in funding the Arizona Small Business Development Center Network by providing \$975,000 annually in increased funding. Over a three year period, the funding will allow the network to assist 2,500 small businesses to create an estimated 5,580 new jobs and contribute more than \$10 million new dollars in state tax revenue.

Implications

Arizona will benefit from a greater number of successful small businesses resulting from the increased availability of the one-on-one confidential counseling and training service provided by the SBDC Network. More jobs will be created throughout the state; the economy will be strengthened; and Arizona will be in a better position to foster a variety of new small businesses that will be needed to support larger employers. An annual appropriation from the state general fund of \$975,000 will be required to fund this initiative.

Possible Performance Measures

- Increase in small businesses served and new jobs created
- Return on investment

ARIZONA COMMUNITY COLLEGE INITIATIVE: TAX CREDITS FOR TRAINING COSTS IN SMALL BUSINESSES

Small businesses in Arizona constitute the major employment opportunity for state residents. The economic health of the state, on the whole, rests on the ability of small businesses to grow and prosper. Since their small size does not allow for redundancy in staffing, small businesses are dependent on obtaining and retaining capable employees. The lack of capable staff can cause a business owner to curtail services to potential customers or to limit production of goods. Despite the need, small businesses generally offer their employees little in the way of formal training due to cost, time constraints, or lack of awareness of opportunities for employee training. Workforce training, targeted to the needs of small business, would enhance the competence and retention of small business staff and improve the overall health of Arizona small business.

Initiative: Expand Tax Credits for Employee Training

Arizona's community colleges are the most accessible and affordable avenues for employee development, with the flexibility to tailor courses and programs to the needs of the employees of small businesses. In 2000, the Arizona Legislature approved a tax credit of 50% of the cost for information technology skills training up to a maximum of \$1,500 per employee. The public community colleges are an approved site to offer such training, as are private postsecondary institutions. Through their Small Business Development Centers, public community colleges can encourage small business employers to make employee training an integral part of their business plans. If this legislation were amended to increase the training topics that qualify for tax credits, the community colleges could serve an expanded number of small businesses and employees. Expanding training will not only improve the profitability of small businesses, but also provide increased services and goods for Arizona consumers.

Under current legislation, an employer may claim a tax credit for a maximum of 20 employees over a five-year period. The legislation works well for small businesses since an employer could work with a community college to map out a year-long training and career development program for each employee. This increases the value of the employee to the business and also increases employee loyalty. To expand the tax credit benefit to serve more small businesses, it is recommended that statute be amended in the 2001 Legislature to cover a wider variety of specialized areas in addition to information technology.

Implications

Extending this program can have very beneficial results not only for improving the profitability of small businesses, but also in providing services and goods for customers in Arizona. For example, health care training for practitioners in nursing care facilities would improve patient care. Training for automotive technicians would provide better service to the automobile owner. An additional

\$2.5 million will be needed annually to support this initiative. The amount is the same as the cap in current statute for information technology training.

Possible Performance Measures

- Increase in utilization of the tax credits by small businesses
- Increase in completion of workforce development training programs offered by Arizona community colleges

**THE PLAN FOR HIGHER EDUCATION:
Recommended Strategies and Initiatives**

STRATEGY III

**INCREASE CAPACITY AND
PRODUCTIVITY**

Enhancement of Human Resources

Management of Capital Assets

Enhancement and Utilization of Information Technology

Enhancement of Human Resources

Arizona must have strong universities and community colleges to develop the targeted research partnerships that are essential for the state's industry clusters to be competitive in the New Economy. Arizona's community colleges and universities also must have the human resources required to develop a highly educated and well-trained workforce and to meet the anticipated increase in demand for higher education over the next 20 years. To fulfill their role in strengthening the economy of the state, each Arizona institution of higher education must have the resources necessary to be competitive in the marketplace for top faculty and staff.

The Task Force recommends that faculty and staff salaries at the universities and community colleges be competitive in each of their respective markets, thereby enabling the institutions of higher education to hire and retain faculty and staff of the highest caliber. The Task Force recommends that initiatives be undertaken and supported in order to provide the resources necessary to achieve competitive salaries.

UNIVERSITY FACULTY SALARY INITIATIVE

A Biennial Plan to Make Faculty Salaries Competitive

The Need for Strong Universities. Arizona must have strong universities to develop the targeted research and partnerships that are essential for Arizona's industry clusters to be competitive in the New Economy. Arizona's universities also must meet the anticipated increase in demand for higher education over the next 15 years in order to develop a highly educated and well-trained labor force. Strong faculties are essential if our universities are to contribute to the research and development infrastructure required by the State of Arizona to succeed in the economic race.

Like the rest of the New Economy, Arizona's state universities operate in a highly competitive national/international marketplace in the recruitment and retention of faculty. Competition for the best faculty is fierce, and the universities' ability to offer competitive salaries to new faculty and to retain the best faculty is being severely compromised. Failure to recruit and retain the best faculty will diminish the Universities' ability to produce competitive graduates and support a competitive economy.

The gap between the average salaries of faculty in Arizona's universities and those of peer institutions is already significant, and despite the reallocation by the universities to faculty and staff salaries of more than \$20 million in the past four years, this gap continues to increase. As this salary gap continues to grow, Arizona's universities are losing increasing numbers of talented faculty to other

institutions offering substantially higher salaries as well as greater resources for research and teaching.

- At the University of Arizona the number of faculty in the College of Business and Public Administration has declined by 28% over a 6 year period.
- At ASU, the student-to-faculty ratio in the College of Business has increased by roughly 20% over the past 4 years. Fewer faculty have been hired because funds from vacant faculty lines have been used to make counter offers to retain current faculty and to enhance recruitment packages for limited numbers of new faculty.
- Recent outside offers made to recruit faculty members at away from the UA, ASU, and NAU averaged approximately 40%, 30%, and 20% respectively above what they earned at their respective institutions.

Competitors for Arizona's faculty, in order, are 1) other, better funded public universities, 2) private universities (where the average premium for a full professor is \$21,700 higher than in the publics), 3) the private sector.

A recent national study on the competitiveness of universities places Arizona among the worst states in maintaining competitive faculty salaries (emphasis added):

"States that rank as the most ineffective for ensuring that their upper tier public sector universities remain nationally competitive in the academic labor market during the last two decades include Arizona, New Mexico, Utah, Oregon, Washington, and Wisconsin..... in the case of Arizona, two of the three public doctoral and research universities are listed as 'non-competitive' while all three institutions have endured substantial declines in the average dollar value against comparable private university full professor salary averages. Incidentally, these states also are among the nation's lowest in per student state expenditure support for higher education. This signifies that the state legislatures particularly in Arizona, New Mexico, Oregon, Washington, and Wisconsin reject the belief that the pursuit of quality academic scholars is not limited to state, region, or national borders. It also indicates that some states do not fully comprehend the economic and social consequences of a faculty 'brain drain' away from their premier public universities to other states and the private sector."

(Alexander King, "National Trends in the Relative Fiscal Capacity of Public Universities to compete in the Academic Labor Market," White Paper, 2000, page 20)

Current Resources and Resulting Unmet Need. The Legislature approved a FY 2001 salary increase of 2% (not to be applied until April). As a result, the average faculty salary will have dropped to as much as 10% below the average for major public universities. (In contrast, UA faculty salaries were 10% above national norms in 1980). In an attempt to stem the growth of the salary gap between salaries at Arizona's universities and the salaries of their peers, ASU

Main, UA and NAU have reallocated to faculty and staff salaries over \$20 million in the past four years alone. Much more has been reallocated during the decade of the 90's. The universities have made their reallocations largely by cannibalizing newly vacated faculty and staff lines and by reducing programs. This has placed a great strain on the existing faculty and staff in many key areas. These drastic reallocations underscore the institutions' commitment to saving their most precious assets: the faculty and staff.

In spite of insufficient resources, the universities' enrollments continue to grow and their missions are becoming more complex in order to serve the diverse needs of the new global, knowledge-based economy. During the past decade resources have been redirected towards building a technology infrastructure in order to support a 21st century curriculum. At ASU the number of computer science majors has grown by 76% in the past 5 years, while the number of faculty has not increased. At UA there has been a turn-over of 30% of the computer science faculty. The university has been forced to replace senior-level distinguished professors lost to industry and other universities with less experienced junior faculty. As the universities have exhausted their ability to shift resources toward salaries without seriously compromising their ability to support the needs of the state for the New Economy, many outstanding faculty have lost hope for their futures in Arizona.

A special salary pool of \$10 million per annum for the next biennium should be established immediately to address special market issues for faculty members that the universities are in jeopardy of losing to industry or other more aggressive institutions (the "brain drain"). If the state is to move into an economic position of national and global prominence, it must aspire to hire and retain faculty who are well *above* average.

Initiative: Raise University Faculty Salaries

For FY 2000 and FY 2001, the legislature provided no funding for market adjustments for the universities (other state agencies received approximately .5%). The 2% merit allocations for all employee groups, including the universities, were deferred until the last quarter of each year. This approach has contributed to the widening salary gap between Arizona's universities and their peers.

- A continuation of small annual salary adjustments by the Arizona Legislature will only contribute to the widening deficit in faculty salaries. Therefore, university salaries should be raised to the 50th percentile of peer institutions over the fiscal years 2002 and 2003.
- It is imperative that this funding be targeted for merit adjustments in order to reward and encourage quality teaching and research.
- These funds must be accompanied with enough flexibility to allow the universities to develop attractive hiring and retention packages for key faculty members that are to be hired and/or retained in the focused

research areas that support the industries that will fuel the New Economy.

- To obtain a salary level that is competitive with peer institutions and to establish a fund to avert a “brain drain” from the State of Arizona will require an investment of approximately \$68.4 million in continuing funds over fiscal years 2002 and 2003.

Justification

Arizona’s universities must have appropriate levels of support from the state if they are to move forward in making salaries competitive. Unfortunately state appropriations to Arizona’s universities stand in stark contrast to many states taking dramatic actions to correct a general downward trend in university funding:

- The Florida and Maryland legislatures approved double-digit percentage increases in general funding.
- Virginia and Texas enacted biennial increases of 15% and 13.5 %, respectively.
- Indiana and Ohio passed increases of 12% and 10%, respectively, for 1999-2001.
- Mississippi allocated 17% for fiscal 2000, with 7.5% earmarked for faculty and staff salaries.

Increased state support to ensure competitive faculty salaries is essential. Along with tuition from students, research dollars, and continued appropriate reallocations from the universities, the state must contribute its proportionate share of support for the salaries of faculty and staff if Arizona is to become a real participant in the New Economy.

The Arizona Board of Regents’ Methodology for University Faculty Salary Comparisons

The methodology used to determine the funding necessary to bring faculty up to the 50th percentile (median) is a two-part process.

The first step determines how far average salaries are now below market. Using the latest American Association of University Professors (AAUP) data for Fall 1999, Regents-approved peer institutions were used to compare average faculty salaries.

The second step calculates the dollars required to raise faculty salaries to market in FY 2001. The salary data was then aged to FY 2003 based on the average salary increase of the comparative group over the past three years. The funding requirement is what is needed to bring faculty salaries to the present market and then maintain competitive salaries through FY 2003. Only the state operating budget cost is presented.

Possible Performance Measures

- Movement of average university faculty salaries toward the 50th percentile of peer institutions
- Increase in externally-funded research dollars brought to the state by university faculty

COMMUNITY COLLEGE FACULTY SALARY INITIATIVE

A Proposal to Increase the Number of Full-Time Faculty And to Make Faculty Salaries Competitive

The New Economy is, without doubt, knowledge driven and based on an educated workforce. Success is no longer a product of muscle power, but rather the result of the ability to manage, organize and work with an increasing knowledge base. The effect of this is that more and more people are seeking access to higher education, even in good economic times. As the largest and most accessible providers of post-secondary education, community colleges are expecting a continuation of the rapid growth they have seen over the past several years.

As the main contact with students, faculty members are the community colleges' most important assets. If community colleges are to continue to provide exceptional services to their communities, it is imperative that they have a faculty pool that is not only highly competent, but also large enough to handle all the students seeking postsecondary education. Full-time faculty not only instruct in their field of expertise but also provide advising and counseling services to students and participate actively in key aspects of the organization and operation of the colleges. They must stay abreast of developing knowledge and participate regularly in college innovation and updating of programs.

Adjunct faculty, who are part-time instructors, form a valuable part of the college operation as well. They are one of the most valuable tools that community colleges have to handle rapid growth in the student population and community needs. A criticism, however, of adjunct faculty is that they operate in the professional field and are removed from the latest academic developments. In addition, meeting recognized accreditation standards of the North Central Association of Colleges and Secondary Schools requires that there be full-time

regular faculty to carry on the important supplementary functions. For example, in the most recent accreditation of Pima County Community College, the evaluation report stated as follows: "The ratio of associate faculty to full-time faculty appears excessive and may be having a negative impact..." This was an itemized "concern" and the college has been working diligently ever since to prepare for the next evaluation by achieving a 50/50 ratio of total student credit hours taught by the two types of faculty. Other community colleges face this same issue.

Initiative: Increase the Number of Full-time Faculty and Make Faculty Salaries More Competitive

Arizona community colleges operate in a highly competitive national/state marketplace in the recruitment and retention of faculty. Competition for the best faculty is fierce (science, technology, math, engineering, etc.), and the community colleges' ability to offer competitive salaries to new faculty and to retain the best faculty is severely strained and at times compromised. Failure to recruit and retain the best faculty will diminish the community colleges' ability to meet and produce a highly-educated and well-trained workforce consisting of life-long learners with the general education competencies necessary to be competitive in the New Economy. In addition, community colleges must continue to address negative trends, such as the alarmingly high rates at which students drop out of the educational pipelines, by working jointly with kindergarten through graduate education systems.

Specifically the initiative addresses two main focus areas:

- In order to maintain a high level of academic integrity in the classroom, resources should be allocated to reduce the ratio of adjunct to full-time instructors in the community college system; and
- Arizona should enact a program to assure that there are available resources to compete for and maintain a faculty pool in the community college system that adequately serves the growing student demand.

In order to bring about these goals, the state should:

- Provide additional funding through expenditure limit adjustments so that community colleges districts can maintain an accreditable ratio of full-time to part-time faculty; and
- Develop funding sources to adequately compete with other institutions for quality faculty and provide an incentive package to encourage districts to increase the number of classes taught by full-time faculty. Proper incentives could include tuition waivers for community college faculty to pursue additional post-graduate education and additional state aid of 33% of the operating costs at each community college district.

Comparison with Peer Institutions: Full-time/Part-Time Ratios and Salaries

A listing of peer institutions for each of the following segments of Arizona community colleges was prepared to address the relative position of the diverse economic and geographic nature of Arizona's community colleges.

- Large Urban Community College District: - Maricopa Community College District with approximately 230,000+ students;
- Medium Urban Community College District – Pima County Community College District 72,000+ students; and
- Rural Community College Districts – Cochise, Coconino, Graham, Mohave, Navajo, Pinal, Yavapai, and Yuma-LaPaz ranging in enrollments from 3,700 to 14,000 students.

Arizona Community College Methodology for Faculty Salary Comparisons and Considerations

Large Urban Community College District Criteria

- The peer institution is a single or multi-campus college district.
- The institution located in a large, urban center and has similar faculty retention rates.
- The number of faculty members is similar.

Medium Urban Community College District Criteria

- Same districts used for at least ten years for benchmarking purposes.
- Large, urban, multi-campus community colleges.

Rural Community College Criteria

- Rural Arizona community college districts.
- Six other rural districts nationwide that have similar numbers of faculty and enrollment.

Part time / full time faculty ratios. The community colleges are striving for a 50/50 split of classes taught by full-time and part-time faculty. This should give students access to residential faculty without hampering the ability of the college to respond to rapidly changing economic situations that demand immediate action.

Based on a full-time student to faculty ratio of 20:1, there is a need to increase the number of full-time faculty in the state community colleges system by 329. The incremental cost to hire a full-time residential faculty member, rather than adjunct instructors for the same number of class sections, is approximately \$40,000.

The first year cost of increasing the ratio of full-time to part-time faculty is \$13.1 million. In future years, this number may fluctuate with the economy and enrollment at community colleges throughout the state.

Issues Among Peer Groups

Large Urban Community College District. The Maricopa Community College District (MCCD) has an average salary that is in the fiftieth percentile of its peer group. They have maintained this position by making difficult decisions in other areas such as program, technology, and plant maintenance along with maintaining a high percentage of part-time faculty members, some of whom could be converted to full-time faculty. In order to maintain or improve its current standing among peer institutions, MCCD may have to sacrifice development of

programs and technology and/or maintenance of its physical plant. It is recommended that \$7,748,000 in funding be made available to keep MCCD competitive within its peer group.

Medium Urban Community College District. The Pima Community College District (PCCD) ranks at the bottom of its peer institutions. Average salaries among Pima's peers fall within a \$10,000 range with the most clustering in the center of the range. An average increase of \$10,000 in annual salary per full-time faculty member would bring PCCD almost in line with the highest mean salary in its peer group. This would cost approximately \$3,360,000 annually for its present full-time faculty.

Rural Community College Districts. Rural districts face faculty recruitment and retention problems due to their lack of a large, professional workforce. Rural districts must continue to offer competitive salaries that will attract quality instructors from other parts of the state and nation. In order to maintain their competitiveness, it is recommended that rural community colleges receive \$4,000,000 annually to keep and improve their ability to compete through the maintenance of a quality faculty pool.

Resources Needed to Improve Community College Faculty
(dollars in millions)

Equity Initiatives	Starting Base	Annual Cost	Annual percent of Base
Rural Salary Equity	\$22.9	\$4.0	17.5%
Medium Urban Salary Equity	\$17.5	\$3.36	18.8%
Large Urban Salary Equity	\$68.6	\$7.748	11.2%
Increasing full-time faculty ratio		\$13.16	100%
		\$28.268	

Possible Performance Measures

- Increase in the ratio of full-time to part-time instructors up to at least 50 percent
- Increase in the statewide percentage of classes taught by full-time instructors

Management of Capital Assets

As part of the New Economy initiatives supporting workforce development and research and technology transfer, several states across the nation have made substantial investments in capital budgets for their colleges and universities. A similar program is needed to ensure that Arizona's community colleges and universities are prepared to support the state in its obligation to provide higher education for its citizens and in its quest to succeed in the New Economy.

The Task Force recommends that the public capital assets of the institutions of higher education be managed over the next ten years in such a manner as to catch up with past needs, maintain existing facilities, and keep up with projected growth. Resources should be identified and secured in order to address these needs in a systematic and on-going manner.

- **The Legislature should be encouraged to appropriate general fund revenues to cover the cost of debt service for university and community college capital projects.**
- **The Legislature should fully fund the universities' existing Building Renewal Formula and/or any future revisions to that formula.**
- **The Legislature should provide greater state support for community college state aid capital funds to improve the repair and maintenance of state-owned community college real property.**
- **The universities and community colleges should more aggressively seek private and federal partnerships to support the construction of facilities and infrastructure.**

The "Subcommittee on Funding: Report and Conclusions" from which these recommendations are derived can be found in the appendix of this supplement. The Subcommittee's report provides an in-depth evaluation of the various funding sources and mechanisms supporting public higher education in Arizona and presents a series of conclusions regarding ways to strengthen the financial foundations of public higher education.

To meet the expanding demands for educational opportunities and workforce development and support the growth and development of the knowledge based industries of the New Economy, a similar program for Arizona colleges and universities is needed.

A systematic approach was taken to examine the critical elements of managing Arizona's higher education capital assets. This resulted in several observations:

The state should improve the management of capital assets by addressing chronically deferred maintenance problems through renewal of buildings and infrastructure, retro-fitting older facilities for information technology, and expanding academic and research facilities at existing sites. This will help to achieve the optimal use of existing facilities, the integration of information technology with campus-based instruction, the education of a growing student population, and the transfer of technology and spin-off of innovation to other sectors of the state.

The state should propel Arizona higher education to the next level by enhancing the formation of investment through new funding approaches, including public/private partnerships, private contributions, mutual leveraging of funds from multiple sources and levels, and new approaches to public funding.

Erosion of Capital Assets

Continued inadequate support for maintenance of community college and university campuses has resulted in a substantial backlog of deferred maintenance and badly needed infrastructure and facility renovation upgrades. For example, during the last decade, the Legislature has funded the universities' Building Renewal at an average of 43 percent of the formula adopted by the Legislature's Joint Committee on Capital Review. In the current biennium, funding is at 23 percent of the formula.

Enrollment Growth and Workforce Development

The Task Force anticipates significant enrollment growth over the next 20 years for Arizona's institutions of higher education. This growth in enrollment will push the universities and community colleges beyond the current capacities of their campuses and create additional capital asset needs for both systems for at least the next decade. Capital needs for the second decade of the 21st Century should be evaluated later to integrate technological advancements in the design of learning facilities.

Enrollment increases will be driven by increases in population, increased access to higher education, and expanded needs on the part of a New Economy workforce for lifelong learning and continuous training. Mindful of the complexity of enrollment projections, the Task Force utilized consultants as well as Arizona higher education researchers to develop an estimate of anticipated enrollment increases. The results of these estimates are provided in "Projected Enrollments in Arizona Higher Education 2000-2020" included in the appendix of this supplement.

Research and Technology Transfer

New and/or improved research facilities are a critical component of positioning Arizona to be successful in the competition to attract and retain the knowledge-based industries of the New Economy.

University Capital Asset Needs

To address the demands of expanding enrollments and increased research and technology transfer for New Economy industries, two categories of capital needs were proposed for consideration by the Governor's Task Force on Higher Education: Building Renewal, and Special Needs Not Addressed by Building Renewal.

The category of the proposal on building renewal has components for Catch-Up and Keep-Up. The proposed Catch-Up element of building renewal would eliminate the unfunded backlog of deferred maintenance by providing 20 percent of the unfunded formula amount (from the last decade) each year over a five year period. This would require appropriations of \$24.4 million per year. The proposed Keep-Up element of building renewal calls for full funding annually of the formula.

The second category of the proposal for special needs not addressed by building renewal includes elements to support enrollment growth/workforce development, research and development and other special needs, all subject to Arizona Board of Regents authorization. To support enrollment growth/workforce development, approximately 1 million square feet of new facilities will be needed in the next ten years. For research and development, the universities plan to maximize the requested state support by matching it in innovative ways with a variety of other fund sources from federal agencies and private partnerships. To cover the debt service/lease purchase payments for the enrollment growth/workforce development and research and development projects would require a 20-year repayment schedule of \$47.9 million annually.

Community College Capital Asset Needs

To meet the challenges of developing a workforce for the New Economy, Arizona's public community colleges must have state assistance for capital development of buildings and infrastructure:

- Enrollment growth will require additional academic facilities on the main and branch campuses; and
- Access needs of Arizona citizens will require support for infrastructure improvements including new facilities and the retrofitting of existing facilities.

Funding for community college capital asset needs would have to begin with a state commitment to increase support for community college buildings which are state-owned real property. This commitment should be matched by state participation in helping local district taxpayers and students in meeting the costs of debt service for capital projects at a 33% share. Also, increased capital state aid formula amounts, with annual inflationary adjustments, should be provided by the Legislature to address deferred maintenance and infrastructure improvements.

Eliminating the 1991-2000 backlog of unfunded capital state aid for community college students and inflationary growth would require additional appropriations of approximately \$1.96 million per year over the next five years. To cover the 33% state share for debt service payments for capital facilities for community colleges, approximately \$22.6 million is needed in FY 2002. State share amounts of 33% beyond FY 2002 would be dependent upon the debt service required for capital projects that are approved for construction at that time.

Possible Performance Measures

- Decrease in the backlog of deferred maintenance
- Increase in federal and private partnership support for capital facilities

Enhancement and Utilization of Information Technology

The Task Force supports plans to increase the technological capacity of the system of higher education in Arizona.

The Task Force recommends that the potential for e-learning through information technology be realized through specific initiatives that provide for electronic course sharing among community colleges, electronic delivery of collaborative programs among the public universities, and useful collaboration between the two sectors.

The Arizona higher education institutions are dedicating significant resources to expanding distance learning and articulating electronically-delivered education. This has been for a number of years the fastest growing area of education. States across the nation are developing virtual universities and colleges, integrative web sites, and telecommunications infrastructures. Most of the commitment in Arizona has been through internal reallocation of resources and when there have been appropriations, they have been in the millions of dollars, not the tens of millions that many other states have provided.

Arizona Learning Systems

There is a demand for increased access to higher education content and training in Arizona. From workers and companies who need training to compete in the New Economy to students in rural areas who do not have access to needed higher education classes, there are needs for higher education that cannot be met by traditional means alone.

Arizona Learning Systems (ALS) was established in 1996 as a consortium of the ten Arizona community colleges to help meet these needs by sharing the resources of its member colleges through statewide distance learning. ALS members will share these courses through the development of a statewide, telecommunications network that has the capability of tying together all educational institutions of the state into a single, cost-effective system. The private-sector contract for the development of this network has the following specifications:

- 1) It can connect all public education sites in the state.
- 2) It has the capability of transmitting not only Internet data, but also instructional-quality voice and video.
- 3) It uses international standards for telecommunications transmission and interactive video to allow "off-network" connections.

- 4) It is priced at a distance-insensitive rate, which means all entities pay the same rate no matter where they are in the state, helping those in rural Arizona get connected.

Currently, ALS is implementing Phase I of this network, which will connect an initial site in each of Arizona's ten community college districts. The contract with the private sector for developing the ALS Network has provisions to expand this network to connect remaining community college sites in Phase II. In Phase III, consistent with statute creating the system, ALS intends to extend its current network to connect all of Arizona public education. The ALS vision includes offering future connection opportunities to all community colleges and other public postsecondary sites, K-12 districts, and charter schools to provide statewide access to ALS courses.

ALS will ensure that all of Arizona's public educational institutions enjoy the technical benefits of using a unified network for distance learning. ALS will also guarantee equitable access to distance learning in all parts of Arizona by leveraging collective buying power.

Initiative: Continue Expansion of ALS

It is proposed that Arizona enable the ALS Network to reach its full potential by funding its expansion for Phase II and ultimately Phase III if initial projections are sustained by experience. This will ensure that Arizona students, no matter where they are geographically, will enjoy the same access to distance learning. Such a statewide network will enhance and grow existing public education cooperative ventures.

Arizona would provide for the provision and installation of the necessary telecommunications and interactive video equipment for Phase II and III sites. This would include:

- 1) Single 10-15 seat video classroom and telecommunications access switch at the site.
- 2) Central equipment to switch data and bridge video signals.
- 3) Sufficient wiring to connect equipment at each site.
- 4) Training of on-site personnel in use of equipment.

This expansion would provide access to statewide distance learning in over 500 sites across the state, creating a local gateway to this resource in every community in the state. Since the ALS Network uses international standards for telecommunications and interactive video, this network could be linked with other government and private sector entities to create a true statewide network for economic development.

Implications

The start-up cost to implement Phase II and the postsecondary portion of Phase III is \$6.3 million. Under current conditions, the cost to add the K-12 districts and charter schools for Phase III is \$40 million. These costs reflect a complete turnkey operation involving all equipment, installation, and engineering costs. The Task Force recommends that, by the end of Phase II and prior to the implementation of Phase III, ALS be evaluated to determine the implications of further expansion.

Possible Performance Measures

- Decrease in telecommunications costs born by Arizona educational institutions for items such as Internet and voice connectivity
- Increase in the number of courses delivered across the network, the different types of courses being delivered, and the number of students taking such courses

University Information Technology Initiatives

The availability of classroom technology to enhance instruction and to extend education to the community via telecommunications and the Internet has become a defining characteristic of higher education today. While existing classrooms meet a variety of needs, the lack of equal access to needed instructional technologies results in serious limitations for most faculty and their students.

The New Economy will demand a better match between workplace requirements and the knowledge and skills of higher education graduates. A program must be developed to advance the breadth and depth of technology literacy that employers expect and need. In order to enhance New Economy workforce development programs, the state's public universities have a strong need to develop their information technology infrastructure, wiring, and equipment.

Initiative

A basic infrastructure platform is needed at each of the universities in order to enhance instruction via electronic technology. Basic needs are estimated to cost \$14.5 million for Arizona State University, \$13.7 million for Northern Arizona University, and \$17.0 million for The University of Arizona. It is proposed that the Legislature provide an annual appropriation of \$3.6 million to cover lease/purchase payments for this infrastructure.

Possible Performance Measures

- Decrease in obsolete technology and equipment
- Increase in student access to new technology

Information Technology Critical Salaries

Many aspects of the New Economy will be driven by information and information is, more and more, supplied via electronic media. Future workers must be trained to use information and use technology. Therefore, information technology (IT) is a critical component of learner-centered programs on today's community college and university campuses.

Properly preparing students for the e-business world requires robust IT infrastructures, state-of-the-art equipment, and quality IT staff to install, operate, and maintain these integrated components. Arizona public higher education must meet the challenge of keeping quality IT staff employed to supply the essential IT environment for students to learn in an efficient and effective manner.

Higher education IT employees are being lured away by more competitive salaries and benefits in other sectors of the economy, leaving vital positions unfilled. Private sector companies offer much higher IT salaries and many other monetary benefits.

Across America, an overabundance of unfilled IT jobs across is driving up salaries for IT staff. Industry analysts estimate that between 350,000 and 500,000 IT jobs are vacant in the U.S. This situation is projected to worsen for a variety of reasons including the booming "dot-com" business marketplace and the decreasing number of college graduates in computer-related fields. These circumstances have prompted some industries to lobby the U.S. Congress to increase the number of work visas for technology workers from other countries. All of these factors have resulted in a rise in the average annual IT salaries at a rate approximately twice the national average for all U.S. jobs.

Competition for IT staff is, to say the least, fierce. The June 2000 *Infoworld* magazine, a journal of the information age, published a Year 2000 Compensation Survey stating that the number one job motivation factor for all IT employees was compensation, including salary and benefits. Companies vying to hire IT professionals are offering enticing packages of salary, bonuses, and incentives to lure workers away from their present jobs. Besides offering notably higher salaries, companies routinely offer substantial annual bonuses and hiring incentives, annual cost-of-living adjustments, stock options, bountiful retirement plans, and generous moving packages such as buying the new employee's present home, and paying for house hunting trips.

Although attempts to reallocate funds have been made in the past, current university budget allocations for overall IT needs are not allowing for salaries to keep pace with industry trends. Additionally, the current benefits offered to university IT staff lag far behind the industry. A small 2% merit pay pool (capped at 4% per individual) provided by the Legislature in FY 2000, plus a few other benefits, do not compare favorably with what many IT employees are being offered by commercial businesses.

The community colleges are experiencing parallel challenges in offering sufficient salaries and benefits to compete for IT professionals with private industry. The fact that many colleges are located in rural areas serves to exacerbate this challenge.

Initiative

The state should take steps to overcome the current lack of sufficient funding to address IT salary and retention issues in higher education:

- Provide the funding necessary to raise IT salaries to the market average (50th percentile) salary for all IT employees. These salary adjustments could be phased over two years. (One gauge for market adjustments is the recent Mercer Study which documents the level of IT compensation in the private sector market.)
- Institute an annual salary adjustment for IT staff, which will help universities and community colleges maintain pace with salaries in the market.

Mercer Study:

Based on a general comparison with the nationally recognized 1999 Mercer Information Technology Compensation Survey of the IT Industry, the three public universities fall below the average industry IT salary figures as follows:

- ASU: \$2,550,000 + \$331,500 for ERE
- NAU: \$2,066,000 + \$269,000 for ERE
- UA: \$2,350,000 + \$305,000 for ERE

ERE based on 13% for salary increase

The overall sum needed to support a phased salary increase for university IT employees is \$7,872,000 plus a yearly 5% increase in each university's IT salary budget to pay for annual market adjustments. The latter will help the universities keep pace with annual increases in the IT job market.

The community colleges would require \$3,195,000 for a phased salary increase plus a 5% increase in each college district's IT salary budget to fund annual market adjustments to keep pace with annual increases in the IT job market.

Implications

More funding for IT staff salaries will make the public universities more competitive with the IT industry compensation structure, which would help in retaining and recruiting high quality IT staff.

Possible Performance Measures

- Increase in retention rates for Information Technology staff
- Decrease in the difference between average Information Technology staff salaries as reported in the Mercer survey and by the Arizona campuses

Arizona Regents University

This initiative will make the Arizona university system more responsive to statewide educational needs, especially those connected with economic development priorities. It will provide access to citizens who are time- and place-bound, life-long learners, or disabled. It will utilize technology-delivered and distance courses and other improvements in access to higher education. It will draw together existing resources from the three public universities and initiate development of new resources, giving preference to new programs that support Arizona's competitive position in the New Economy.

Guiding principles are:

- Student-centered programs
- Flexibility and adaptability
- Innovation
- Accountability
- Responsiveness to market
- Performance/outcome orientation

These principles give preference to new educational programs that support Arizona's competitive position in the New Economy.

Current Resources

Arizona's public universities have a definite, active interest in offering technology-delivered education to the state, and are committed to doing this in close inter-institutional collaboration and in cooperation with the strong statewide community college system.

During 1999-2000 the three public universities developed a website, registered as *AZDistanceLearning.org*, to provide students statewide with access to all distance courses offered within the system. The current inventory includes several hundred courses delivered by Internet or other technology. Students were able to use the website to register for Fall 2000 courses. The web site will also include degree programs that are electronically-delivered off-campus. Many additional courses are or will be available through Arizona community colleges for transfer to university programs.

Initiative: Implement ARU in Three Overlapping Phases

The initiative is proceeding in three overlapping phases, the first of which is already partially accomplished. In Phase Two, new degree programs will be developed as needed. In Phase Three, an appropriate continuing organization, currently called the Arizona Regents University, will be established.

Phase One: Develop the AZDistance Learning Website

Academic Year 1999-2000

- Convene and charge the coordinating group to develop an inventory of potential joint-degree programs
- Develop and post a website with a catalog of current offerings, listed by institution, featuring full degree programs, partial degree programs, and degree-credit courses
- Identify and post degree programs and modes of delivery
- Study implications for registration, financial aid, and other business processes and recommend appropriate policies and procedures

Academic Year 2000-2001

- Market the web site, courses and degree programs; evaluate demand for additional programs
- Develop and set a flexible calendar and schedules
- Identify and select degree management services
- Set criteria for admission, matriculation and degree candidacy
- Establish distance learning advising and other online student services at each campus

Phase Two: Develop New Degree Programs

Academic Year 2000-2001

- Admit distance learning degree students to one of the three universities
- Study existing residency requirements and propose appropriate revisions
- Establish appropriate non-academic support services for distance learning students (call centers, technical assistance, etc.)
- Where appropriate, import online content from other credible sources, add value to that content and make it available to Arizona citizens
- Work proactively to stimulate creation of tri-university programs in high-demand professional areas, starting with creating two bachelor's level and two master's level degree programs
- Devise appropriate business rules for transfer of credit and awarding of degrees
- Evaluate course bank sufficiency; identify issues and develop solutions
- Solicit lower-division courses from community college partners

Academic Year 2001-2002

- Continue development of additional new programs as needed
- Evaluate enrollment impacts and learning outcomes for technology-delivered courses and programs
- Obtain approval from the Board of Regents and other entities when appropriate, to waive regulatory policy and procedural restrictions that may be barriers to the ARU meeting its purpose

Academic Year 2002-2003

- Continue development of additional new programs as needed
- Develop standards and methods for evaluation of proposed ARU programs
- Perform a study of first two years' enrollment and program development to determine the need for "Arizona Regents" degree programs

Phase Three: Devise an Appropriate Continuing Organization

Academic Years 2000-2003

- Evaluate data from Phases One and Two to determine how best to serve students, considering at least the following:
 - an independently accredited Regents University
 - a shared "virtual branch campus" granting degrees from all three universities
 - a system of cooperatively-administered degree programs like the tri-University Masters of Engineering
- Establish appropriate statewide offices to implement selected structures

Implications

Phase One (Year 2000) is already partially accomplished. This phase increases access to individual courses and to a small number of degree programs and begins identifying necessary policy and procedure changes.

Phase Two (Year 2000-2003) creates new courses and programs and makes it easier for students to take full advantage of existing and developing resources by creating more freedom to compose programs of study from courses offered at any or all of the three universities.

Phase Three (Year 2000-2003) optimizes long-run administrative performance by choosing the best-fitting organizational model, based on data to be drawn from first two years of offerings. Although Phase Three concerns the long-term disposition of ARU, it is being examined now, and through out initial phases. The Arizona Board of Regents retained Dr. Sally Johnstone of the Western Cooperative for Educational Telecommunications to advise and facilitate in this continuing activity. Dr. Johnstone conducted an initial study session with the Regents and university presidents in September 2000.

Administrative startup costs including maintenance of Arizona Distance Learning website, are estimated at \$475,000 annually. Program development funds based upon two bachelor's and two master's level programs are estimated at \$1,500,000 initially, then \$750,000 annually thereafter. Total first year budget is \$1,975,000. To implement Phases Two and Three of the Arizona Regents University will require an annual operating budget of at least \$2 million.

Possible Performance Measures

- Increase in hits at the *AZDistanceEducation.org* web site
- Increase in the number of new degree programs created and offered

Cooperation Between the Two Sectors

Arizona's public universities and community colleges are committed to offering technology-delivered education to the state in close inter-institutional collaboration and through cooperation between the Arizona Board of Regents and the State Board of Directors for Community Colleges of Arizona. The eventual form of Arizona Learning Systems and of the Arizona Regents University will be shaped by strong existing transfer and articulation agreements and by thoughtfully negotiated division of effort between the university and community college systems.

**THE PLAN FOR HIGHER EDUCATION:
Recommended Strategies and Initiatives**

**NEED FOR INVESTMENT,
ACCOUNTABILITY,
AND OUTCOMES**

Improved Funding Mechanisms

Collaboration Between Educational Sectors

Accountability and Continued Contribution to the Productivity of the State

Improved Funding Mechanisms

Nationwide, the strongest public universities and community colleges have been built on sustained financial support from multiple revenue streams. In an era in which the competition to attract and develop industries of the New Economy has led to substantial investments by states in the operating and capital resources to support their institutions of higher education, Arizona must act to put in place a competitive funding framework of its own for higher education. Mindful of the importance of funding, and of the Governor's charge to explore this area, the Task Force designated the Subcommittee on Funding. That subcommittee produced a detailed report that is included in the appendix of this supplement. [See also the discussion and recommendations regarding capital needs in the section labeled, Management of Capital Assets.]

University Funding Mechanisms

Over the last ten years, the major source for new state revenue for the universities has been enrollment growth funding. The enrollment growth formula, allowing faculty and staff funding for every student and referred to as "22:1" provides revenue only for marginal costs and does not fund the full cost of growth. Moreover, because the formula does not provide the full cost of education for additional students, it erodes the competitiveness of the universities by diluting the resource base that supports university programs. The Task Force has projected significant new growth in university enrollments which cannot be sustained with a marginal cost formula. Further, the main campuses of Arizona's universities are approaching an optimal size and a funding mechanism that is not based on growth is required to enhance the competitive position of these campuses.

Community College Funding Mechanisms

Operational funding for community colleges, as originally defined by statute, has evolved over forty years. The current formula is based exclusively on the number of full time student equivalency generated, and allows the Legislature to annually fund inflationary increases. Unfortunately, the Legislature has not kept pace with the statutory provisions and has underfunded the formula. The effect of this under-funding has led to an erosion of state support for educational programs and services. As of FY 2001, only 21% of operating costs for Arizona's community colleges was provided by the state.

For the State of Arizona, the Governor's Task Force on Higher Education has identified three major strategies for the state to pursue:

- *Increase participation;*
- *Increase research and business development; and*
- *Increase capacity and productivity.*

Each of these strategies is dependent on availability of sufficient resources for successful implementation. Moreover, the existing funding formulas and incentives must be revised to support accomplishment of the Task Force's major strategies.

The Task Force recommends that Arizona reaffirm and strengthen its current strategy for financing its public universities and community colleges employing multiple revenue streams. The recommendations are, therefore, divided into four categories: state appropriations; other operating revenue sources; tuition; and capital support.

State Appropriations

The Legislature should be encouraged to appropriate a higher level of general fund support, and provide matching funds for grants and contracts, private funds for public/private partnerships, and salaries and faculty start-up costs. In addition, university and community college funding mechanisms should be revised as described below:

Public University Funding Mechanisms

- The Board of Regents should examine and revise the 22:1 formula, as needed, to more fully recognize the real costs of enrollment growth.
- The 22:1 formula, and any subsequent revisions, should be fully funded.
- The Legislature in consultation with the Board of Regents should adopt a funding approach for universities--beyond enrollment growth--that is tied to a market-based analysis utilizing benchmark data from peer institutions. The goal of the funding model should be the average of funding on a per-student basis of each institution's Board of Regents-approved peers. Attainment of this goal should be accomplished through a combination of increases in tuition and state general fund revenues.

Community College Funding Mechanisms

- The Legislature should reinstate the statute establishing the 33 percent share goal and fund it. Funding from the state should occur according to statute from year to year to allow for strategic planning for enrollment growth to meet and comply with the general objectives specified in the community college philosophy and mission.
- The state's general fund support for operations should include growth as well as inflation in the base as called for in statute.
- The Legislature should consider changes in the law to allow Arizona's community college districts to increase their expenditure capacity for New

Economy and local initiatives. Currently, five of the ten community college districts are at or near their expenditure limitation.

The "Report and Conclusions of the Subcommittee on Funding" from which these recommendations are derived can be found in the appendix of this supplement. The Subcommittee's report provides an in-depth evaluation of the various funding sources and mechanisms supporting public higher education in Arizona and presents a series of conclusions regarding ways to strengthen the financial foundations of public higher education.

Other Operating Revenue Sources

Additional revenue sources identified should not be used to supplant current funding. Arizona's public universities and community college should be encouraged to pursue a wide variety of other operating revenue sources, including: private funding, gaming revenues, tobacco settlement funds, enhanced revenue from state trust lands, and tax credits for contributions to higher education.

Public Universities

The public universities should maximize revenues from federal funding, research parks, and commercialization of faculty research; maximize the value of university access; and fully implement the recommendations of the External Review Committee for Public Private Partnerships.

Public Community Colleges

The public community colleges should pursue: public and private grants; private contributions matched with public funds; private funding; partnerships with corporate and public agencies and businesses for funding and training; partnerships with public and private entities for joint facility use and expansion; and incentives to attract increased financial support from the private sector.

Tuition

The Legislature should:

- appropriate additional general funds to improve the match for the Arizona Financial Aid Trust program;
- provide enhancements and tax incentives to programs encouraging family savings for college tuition; and
- match universities' and community colleges' private fund raising.

Public Universities

The Board should:

- consider raising resident tuition to the top of the bottom one-third of the 50 senior public institutions in the U.S. and maintain that relative position over time; and
- consider raising nonresident tuition to the median of the 50 senior public institutions in the U.S. and maintain that relative position over time.

Public Community Colleges

- Tuition should remain affordable to students through a combination of increased state appropriations and private funding; and
- The Legislature should establish an Arizona Financial Aid Trust for community colleges.

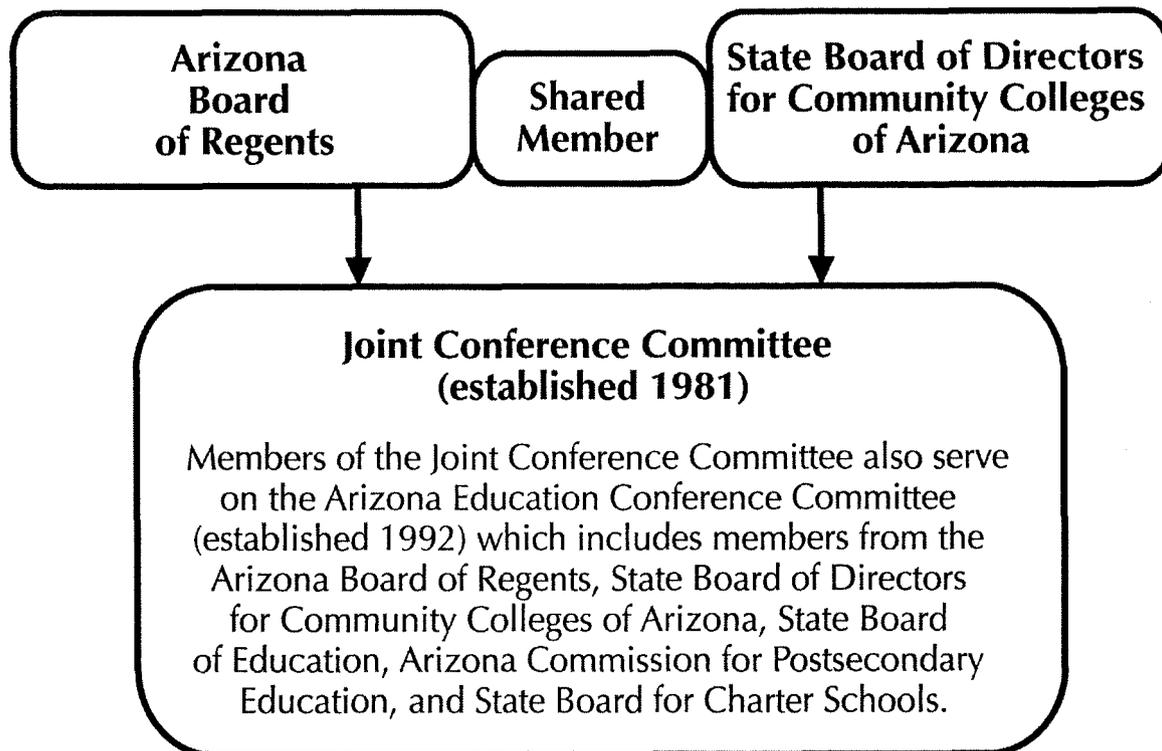
Capital Support

[The recommendations for Capital Support are presented in Strategy III of the report under "Management of Capital Assets".]

Collaboration Between Education Sectors

Arizona's public community colleges and universities are currently governed by separate entities. The three public universities are governed by the Arizona Board of Regents (ABOR). The ten public community college districts are each governed by local county district governing boards with certain key functions coordinated by the State Board of Directors for Community Colleges of Arizona (SBDCCA). The Governor appoints members of the ABOR and the SBDCCA. County voters elect members of local county district governing boards.

A member of the ABOR serves as a voting member of the SBDCCA to ensure communication between the two groups. In addition, representatives of the ABOR and the SBDCCA currently meet two to three times a year as the Joint Conference Committee (JCC), a group that was established in 1981 to allow the two boards to coordinate policy on higher education issues. The JCC has recently taken leadership in improving the transfer of courses and programs from the public community colleges to the public universities. Recently, the two boards have also scheduled joint meetings to discuss topics of mutual concern. The current interaction is depicted in the table below.



In May 2000, the 76th Arizona Town Hall made the following recommendation:

The three-part public governance system (the Arizona State Board of Education, the State Board of Directors for Community Colleges and the Arizona Board of Regents) is adequate, but should be improved. Town Hall strongly recommends that these existing governing bodies, in collaboration with local governing boards, identify a process by which a *well articulated master plan* integrates the delivery and funding for education in Arizona. With one voice, this plan should be presented to the public and the legislature for debate.

In September 2000, a follow-up committee of the Arizona Town Hall recommended that an existing group of statewide boards be asked to consider and recommend a process whereby an articulated master plan could be developed. The follow-up committee identified the Arizona Education Conference Committee (AECC), established in 1992, as such a group. The AECC includes board members from the Arizona State Board of Education, the Arizona Board of Regents, the State Board of Directors for Community Colleges of Arizona, the Arizona Commission for Postsecondary Education, and the State Board for Charter Schools. The Committee meets periodically to discuss issues of mutual concern.

The Governor's Task Force on Higher Education agrees with the recommendation of the Arizona Town Hall and believes that implementation of a process for articulated master planning should be guided by the principle of collaboration. Collaboration can be enhanced by further strengthening the coordination among state education boards and by further facilitating the communication between state and local district boards. The development and implementation of an articulated master plan for higher education will increase collaboration and will, in turn, enhance the coordination of education policy and present unified proposals for support to the Legislature and to the public.

The Task Force agrees with the Arizona Town Hall that an articulated master plan should be developed for all of publicly funded education. The Task Force recommends further that once a master plan is developed, current governance structures should be evaluated to determine if they are adequate to support and guide the future of Arizona postsecondary education as envisioned in that plan. This recommendation should be implemented through a process that includes participation by business and other community representatives in addition to the three state education boards and the local education governing boards. This process should begin with a dialog between the Board of Regents and the State Board of Directors for Community Colleges.

Accountability and Continued Contribution to the Productivity of the State

Many of the Task Force recommendations require additional financial support for full implementation. Those who provide new state, private, or corporate funds to support these initiatives deserve to know that their funds are utilized in an effective and efficient manner. For this reason, implementation of the initiatives recommended by the Task Force should be guided by the principle of accountability.

Accountability in higher education can be strengthened through the process of defining and implementing performance measures for each recommended initiative. Accountability measures should be incorporated into the plan and systematically pursued for each new initiative advanced in higher education.

Each year, Arizona's institutions of higher education provide education and training to thousands of learners who complete certificate and degree programs. These graduates benefit from and contribute to the state's economy. An effective and efficient higher education system that prepares students for success contributes to the productivity of the state. Several Task Force recommendations seek to improve the effectiveness and efficiency of Arizona's system of higher education through policy changes, program enhancements, and coordinated planning. Implementation of these recommendations should be guided by the principle of productivity.

The contribution of higher education to the productivity of the state is enhanced by ensuring the effectiveness and efficiency of academic programs, as well as the coordination of delivery systems between and among individual institutions and sectors. These activities will achieve increased access and effectiveness within the limits of public and private investment, increased utilization of both facilities and information technologies, and increased completion rates for certificate and degree-seeking students.

The Task Force recommends that the State Board of Directors for Community Colleges of Arizona and the Arizona Board of Regents provide additional documentation of the accountability of higher education to the public and the contribution of higher education to the productivity of the state through specific performance measures, such as those described in this document.

Conclusion

Over the course of the last year, the Governor's Task Force has heard presentations, studied reports, and discussed and debated at length a great many issues concerning the future of postsecondary education in this state. From those deliberations, two major conclusions have emerged:

- 1) Arizona is at risk if it does not become a leader in the new, global knowledge-based economy; and
- 2) Arizona's institutions of higher education are the keys to developing the state's workforce and strengthening its economy.

The report, *Arizona At Risk: An Urgent Call for Action*, and this supplemental report provide a strategic framework to position Arizona and its citizens such that they can contribute to, and benefit from, the changes that lie ahead. The Governor's Task Force recommends that the State of Arizona act now to:

- Increase student participation in higher education;
- Increase the research and business development provided by higher education;
- Increase the capacity and productivity of institutions of higher education through improvements in faculty salaries, capital assets and information technology; and
- Enhance funding support from multiple revenue streams for higher education institutions.

Finally, the release of the report and the supplemental report signals the beginning of a crucial stage in creating a prosperous future for Arizona – success hinges on sufficient funding and support to implement these strategies. The passage of Proposition 301 in Fall 2000 provided ample evidence of taxpayers' support for New Economy initiatives. Likewise, the State of Arizona must act promptly to strengthen the financial foundation of higher education, increase access and provide the enhanced capacity it requires. The challenge facing Arizona's leaders and citizens alike is to sustain the momentum provided by the passage of Proposition 301 in building the support required to carry Arizona forward into a successful and prosperous 21st century.

Appendix A

GOVERNOR'S CHARGE TO THE TASK FORCE ON HIGHER EDUCATION

The Honorable Governor Jane Dee Hull

October 20, 1999

A high quality post-secondary educational system is important to the future of Arizona. As Arizona continues to grow, it is important to understand how our system of higher education can be better used to improve our quality of life. Such growth also makes it necessary to plan accordingly. We cannot afford to sit back and presume everything will work out for the best. The public demands, and should expect, policy makers to comprehend (at a minimum) the issues that will affect our state for years to come. It is impossible to forecast every trend that is before us, or that is on the horizon. However, it is possible for learned individuals to begin to examine thoroughly how best to position ourselves for the future. Failure to plan accordingly only will waste limited resources and continue to fuel public mistrust on our leaders ability to meet their needs.

There are numerous questions we must begin to ask (and ultimately answer) in order to plan efficiently. However, at a minimum, Governor Hull believes we must develop clear responses to these issues:

How will we serve the higher education needs of Arizona until 2020?

How will we structure higher education to maximize Arizona's economic development potential?

What kinds of facilities are needed and where?

How will we better use technology?

How will we fund Arizona's higher education needs (operation and capital) until 2020?

In order to start this process - examine what kinds of data and questions policy makers must have in order to make informed decisions - Governor Hull proposes a task force where university and community college leaders, as well as community and business leaders examine current and future trends. This task force will not attempt to answer every question, nor offer a plan that will commit our higher education institutions ad infinitum. It can, however, provide us better information and possible recommendations for current and future policy makers to use.

It is also proposed that staff work for such a task force be overseen jointly by the Governor's Office, Board of Regents and State Board for Community Colleges. For this initiative to succeed, no one individual or organization solely can lead. This must be a true collaborative endeavor that uses the talents of our state's higher education leadership. In order to be timely, however, we should not create a multi-layer bureaucracy with sub-committees, study teams, ad hoc groups, etc. As much as possible this must build on existing efforts looking at similar issues, such as various legislative and business proposals.

Appendix B

SUMMARY OF TASK FORCE RECOMMENDATIONS

The Plan for Higher Education

The Task Force recommends that the State of Arizona choose to compete in the new, knowledge-based economy by adopting a plan of action that recognizes the central role of higher education in the preparation of the workforce and the development of innovation.

Strategy I: Increase Participation

Universal Continuing Access. The Task Force recommends that the state promote early awareness of the benefits and implications of higher education and increase financial assistance for qualified students. This financial assistance should be targeted at needy high school graduates and structured to provide incentives for preparation at high school and for completion of academic programs at the community colleges and at the universities, by both originating freshmen and transfer students.

The state should promote participation in higher education by working adults through financial incentives and training programs focused on preparing the workforce for the new global, knowledge-based economy.

An Excellent System of Higher Education. The Task Force recommends that the Arizona Board of Regents and the State Board of Directors for Community Colleges craft policies for admission that help improve student success.

Workforce Development Through Learner-Centered Academic Programs. The Task Force supports current plans for the community colleges and universities to focus academic programs more thoroughly and systematically on the needs of learners and their prospective employers. The Task Force also recommends that the institutions of higher education develop specific programs to better meet the workforce needs of the state as it transitions into the New Economy.

Strategy II: Increase Research and Business Development

The Task Force recommends the development of partnerships and the targeting of investments in a series of university research initiatives that directly support the state's existing industry clusters. A parallel effort to enhance the development of small business in the state should also be implemented through community college programs and legislative support.

Strategy III: Increase Capacity and Productivity

Enhancement of Human Resources. The Task Force recommends that faculty and staff salaries at the universities and community colleges be competitive in each of their respective markets, thereby enabling the institutions of higher education to hire and retain faculty and staff of the highest caliber. The Task Force recommends that initiatives be undertaken and supported in order to provide the resources necessary to achieve competitive salaries.

Management of Capital Assets. The Task Force recommends that the capital assets of the institutions of higher education be managed over the next ten years in such a manner as to catch up with past needs, maintain existing facilities, and keep up with projected growth. Resources should be identified and secured in order to address these needs in a systematic and on-going manner.

- The Legislature should be encouraged to appropriate general fund revenues to cover the cost of debt service for university and community college capital projects.
- The Legislature should fully fund the universities' existing Building Renewal Formula and/or any future revisions to that formula.
- The Legislature should provide greater state support for community college state aid capital funds to improve the repair and maintenance of state-owned community college real property.
- The universities and community colleges should more aggressively seek private and federal partnerships to support the construction of facilities and infrastructure.

Enhancement and Utilization of Information Technology. The Task Force recommends that the potential for e-learning through information technology be realized through specific initiatives that provide for electronic course sharing among community colleges, electronic delivery of collaborative programs among the public universities, and useful collaboration between the two sectors.

Need for Investment, Accountability and Outcomes

Improved Funding Mechanisms. The Task Force recommends that Arizona reaffirm and strengthen its current strategy for financing its public universities and community colleges employing multiple revenue streams. The recommendations are, therefore, divided into four categories: state appropriations; other operating revenue sources; tuition; and capital support.

Collaboration Between Educational Sectors. The Task Force agrees with the Arizona Town Hall that an articulated master plan should be developed for all of publicly funded education. The Task Force recommends further that once a master plan is developed, current governance structures be evaluated to determine if they are adequate to support and guide the future of Arizona postsecondary education as envisioned in that plan. This recommendation should be implemented through a process that includes participation by business and other community representatives in addition to the three state education boards and the local education governing boards. This process should begin with a dialog between the Board of Regents and the State Board of Directors for Community Colleges.

Accountability and Continued Contribution to the Productivity of the State. The Task Force recommends that the State Board of Directors for Community Colleges of Arizona and the Arizona Board of Regents provide additional documentation of the accountability of higher education to the public and the contribution of higher education to the productivity of the state through specific performance measures, such as those described in this document.

Appendix C

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David Garcia, Arizona Department of Education
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Steve Zylstra, Governor's Strategic Partnership for Economic Development

Consultant on Enrollments

Jim Farmer, Systems Research, Inc.

Resource Persons

Ventana Corporation of Tucson, Arizona, made available to the task force computers, GroupSystems software, two facilitators and a technician for the purpose of identifying desired outcomes and prioritizing issues.

Numerous other individuals from the community colleges, universities, private institutions, and the business community provided assistance in developing the specific initiatives that appear in this report.

Appendix D

***State of Arizona
Governor's Task Force on Higher Education***

***Subcommittee on Funding
Report and Conclusions***

Governor's Task Force on Higher Education Subcommittee on Funding Report and Conclusions

Chair of the Subcommittee: Richard Silverman, Salt River Project. **Members of the Subcommittee:** Nick Balich, State Board of Directors for Community Colleges; Gary Blanchard, formerly of Qwest; Tom Browning, Greater Phoenix Leadership; Kathryn Munro, BridgeWest; John Oppedahl, formerly of *The Arizona Republic*; Gary Stuart, Arizona Board of Regents.

INTRODUCTION

Warren Rustand, Chairman of the Governor's Task Force on Higher Education, appointed Richard Silverman to chair a Funding Subcommittee charged with providing to the Task Force "best practices" in financing public higher education (including viable alternatives for enhancing financial support for higher education) in Arizona.

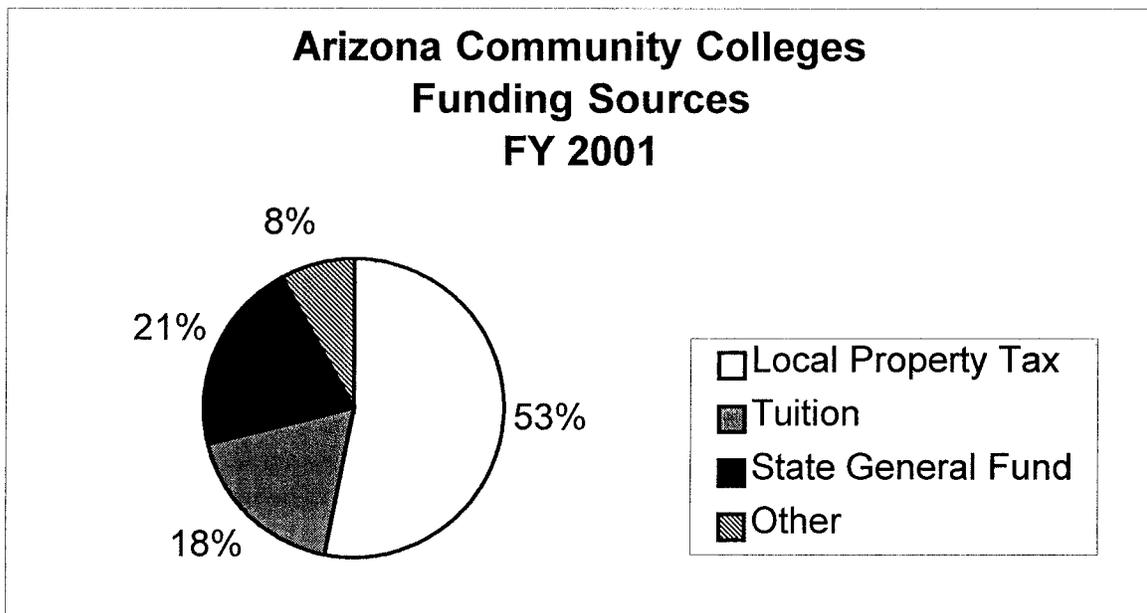
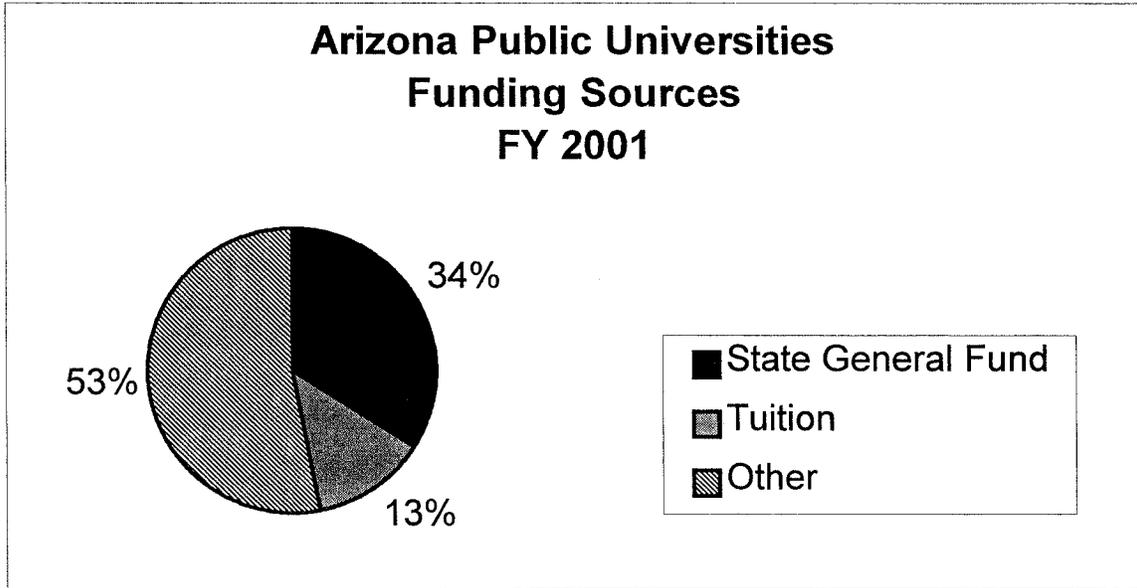
The Subcommittee reviewed current Arizona funding structures for universities and community colleges and considered funding practices in other states.

ARIZONA'S PUBLIC INSTITUTIONS OF HIGHER EDUCATION

Arizona established two levels of public postsecondary institutions to meet the needs of its citizens: 1) the three universities, and 2) the ten community college districts. Their missions, however, are quite different. The universities have multiple missions, serving students from their freshman year through advanced graduate school and continuing education programs. The universities also are responsible for carrying on advanced research missions, undergraduate and graduate general/liberal education and specialized professional education, and extensive public service functions. The community colleges have lower division general education/liberal education responsibilities, specialized developmental education functions, specialized professional and semi-professional occupational responsibilities, and an emphasis on the first two year transfer majors leading to a baccalaureate degree at an Arizona university. Community colleges also provide workforce development and job training programs, recareering education opportunities, continuing education in support of lifelong learning, and diverse professional development offerings.

Funding for the universities and the community colleges also differs. The universities have multiple sources of funds, including state general fund appropriations, research grants and contracts, student tuition and fees, some state capital and building renewal funds, revenue bonds, auxiliary funds, and development funds from gifts and contributions. Most of the community colleges' operating and capital funding derives from county property taxes, along with student tuition and fees, state general fund aid, and a small amount from grants

and contracts. The charts below indicate the proportion of major revenue sources for the universities and community colleges for FY 2001.



FUNDING PRACTICES IN OTHER STATES

Public Universities Comparable to Arizona Universities

The strongest public universities around the country have been built on sustained support from multiple revenue streams. Examples of these states include California, Wisconsin, North Carolina, and Michigan. In each case, these states developed strong financial foundations for their public universities using the major categories of state appropriations, tuition, other operating revenues, and capital support. Moreover, the competition to attract and develop industries of the New Economy has led to substantial investments by states in the operating and capital resources supporting their public universities. The table below summarizes some of the funding approaches which have been utilized by other states.

Summary of Selected States' Funding Initiatives for Public Universities

Source of Financial Support	Initiatives
<ul style="list-style-type: none"> • STATE APPROPRIATIONS 	<ul style="list-style-type: none"> • Hiring new faculty in specific fields, such as microchip technology and bio/life sciences (California, Georgia, Illinois, Wisconsin) • Competitive funding proposals for New Economy research (Michigan, California) • Funding specifically for developing commercialization activities (Georgia, Illinois, Michigan, Washington) • High state appropriations per FTE student (North Carolina, Georgia, California, Wisconsin, Illinois, Michigan)
<ul style="list-style-type: none"> • TUITION 	<ul style="list-style-type: none"> • High tuition revenue per FTE student (Michigan, Washington, Colorado, Wisconsin, California, Illinois) • Increasing low tuition to significantly higher levels (North Carolina—40% increase over next 2 years) • Extensive tuition scholarships (Georgia, California); California's anticipated costs at \$1.2 billion per year
<ul style="list-style-type: none"> • OTHER OPERATING 	<ul style="list-style-type: none"> • Tobacco settlement funds being used (Illinois, Michigan, Nevada) • Private sector partners contribute to operating funds (California, Georgia)
<ul style="list-style-type: none"> • CAPITAL FUNDS 	<ul style="list-style-type: none"> • Building new science facilities (California, Illinois, Texas, Wisconsin) • Combination public/private funding used for new facilities (Wisconsin) • \$2.5 billion capital bond initiative approved by voters in November 2000 (North Carolina)

Community Colleges Comparable to Arizona Community Colleges

Nationwide, the best overall funding strategies rely on multiple sources. The multiple sources for Arizona's community colleges are quite different from the sources in comparable states. Current data show that Arizona community colleges receive only 3.7 percent of the state appropriations allocated to education, and approximately 2 percent of total state general fund appropriations. As a result, Arizona's community colleges receive an unusually small portion of their funding from state appropriations. Nationally, the state average share of community college funding is 38 percent (reported in 1998). Also, the Arizona community colleges receive a greater share of funding from local property taxes than community colleges in most other states. As shown in the chart on page 2, local property tax revenues support over 53 percent of the total general fund budgets of Arizona community colleges. At the same time, state funds are 21 percent of the general fund budgets.

OVERALL SUBCOMMITTEE CONCLUSION

The Subcommittee concludes that Arizona should reaffirm and strengthen its current strategy for its public universities and community colleges that employs multiple revenue streams. This strategy offers the greatest opportunity to optimize financial support for Arizona's public universities and community colleges by leveraging a combination of funds from the major categories of revenue. Overreliance on any single category of support simply will not yield the results Arizona must have if the state and its universities and community colleges are to be competitive in the industries of the New Economy and the future. The strategy for Arizona outlined in this report therefore includes alternatives in each subsection on State Appropriations, Other Operating Revenue Sources, Tuition, and Capital Support.

The multiple conclusions presented in each subsection are not in priority order. In addition, the Subcommittee assumes the Legislature would not use any additional revenue sources identified to supplant current general fund appropriations or discourage higher levels of general fund support.

STATE APPROPRIATIONS

Arizona's Public Universities

General fund appropriations for the Arizona universities' FY 2001 state operating budgets make up approximately 34 percent of all fund sources. State appropriations support the universities' general education operations: instruction, organized research, public service, academic support, student services, and institutional support. Many states have higher levels of state support for general educational operations.

State appropriations can be used to leverage external funding for research and development and academic programs. For example, at one Arizona university, the average annual faculty salaries provided through state appropriations in Engineering and the Physical Sciences are \$79,981 and \$76,279, respectively. These same faculty offer full undergraduate and graduate academic programs and often work with student/faculty ratios that are greater than their peer institutions. Nevertheless, they generated an average of \$147,000 and \$237,000, respectively, per Full Time Equivalent (FTE) faculty during FY 2000 in external funding for research, development, and academic programs through grant-writing activities.

Arizona's Community Colleges

Operational funding for community colleges, as originally defined by statute, has evolved over a period of 40 years. The current formula is based exclusively on the number of full-time student equivalency generated, which is annualized each year. It includes students taking credit courses, adult basic education courses, and courses at skill centers. The count of students taking credit courses also includes students who are participating in dual/concurrent enrollment programs in high school. State aid is provided to the community colleges to continue to cover the partial cost of providing these courses.

A Junior College Survey Committee was appointed by the Arizona Legislature in 1958 and was tasked with making recommendations to establish the Foundation for Arizona's Community College System.¹ The Committee recognized the need for strong state support for community colleges and cited in their final report their intent for the state to fund one-half of the operating costs of community colleges.² This fifty-percent shared responsibility has not occurred.

In 1985 and for a few years thereafter, the Education Code included in A.R.S. 15-1466, Subsection C (3), a phase-in of the state aid share to one-third (33 percent) by FY 1990. However, it was under-funded and repealed by the Arizona Legislature in 1992.³ Arizona's community college districts have maintained that increased state general fund support for operations would provide more full-time faculty to meet required accreditation levels, expand class offerings to meet demand, lessen the need to increase tuition, increase workforce development and training programs to retain and attract businesses to Arizona, and infuse more technology into the classroom to meet the needs of the New Economy.

As of FY 2001, the state's share of support had eroded to less than 21 percent of the revenue stream for operations. Revenues generated by students via tuition and fees were 18 percent of the aggregate. The local district taxpayers assumed the majority of the burden with a contribution of approximately 53 percent, and other revenue sources contributing 8 percent.

¹ Arizona Laws 1958, Chapter 99.

² Report of the Junior College Survey Committee to the Twenty-fourth Legislature; December 1958; Arizona Department of Library and Archives.

³ Arizona Laws 1992, Chapter 345.

Conclusions: General

- Because Arizona's broad access policy is dependent on adequate state support for general educational operations, the Legislature should be encouraged to appropriate a higher level of general fund support for higher education operations. Additional revenues from other revenue sources should not be used to supplant the current level of general fund support or discourage higher levels of general fund support.
- The Legislature should be encouraged to appropriate additional general fund revenues as matching funds for:
 - Grants and contracts
 - Private funds in an effort to increase public/private partnerships
 - Salaries and faculty start-up costs

Conclusions: Public Universities

Enrollment Growth and Peer Funding: Over the last ten years, the major source for new state revenue for the universities has been enrollment growth funding. The enrollment growth formula (22:1) only provides revenue for marginal costs and does not fund the full cost of growth. Moreover, because the formula does not provide the full cost of education for additional students, it erodes the competitiveness of the universities with their peers by diluting the resource base that supports university programs. The Task Force has projected significant new growth in university enrollments, which cannot be sustained with a marginal cost formula. Further, the main campuses of Arizona's universities are approaching an optimal size, and a funding mechanism that is not based on growth is required to enhance the competitive position of these campuses. The Subcommittee on Funding of the Governor's Task Force on Higher Education therefore concludes:

- The Arizona Board of Regents should examine and revise the 22:1 formula, as needed, to more fully recognize the real costs of enrollment growth.
- The 22:1 formula, and any subsequent revisions, should be fully funded.
- The Legislature, in consultation with the Arizona Board of Regents, should adopt a funding approach for universities—beyond enrollment growth—that is tied to a market-based analysis utilizing benchmark data from peer institutions. The goal of the funding model should be the average of funding on a per student basis of each institution's ABOR-approved peers. Attainment of this goal should be accomplished through a combination of increases in tuition and state general fund revenues.

The estimated revenue available from tuition increases derives from the following assumptions used to set tuition:

- Raise *resident* tuition to the top of the bottom third of the 50 senior public institutions in the United States, and
- Raise *nonresident* tuition to the median of the 50 senior public institutions in the United States.

After tuition revenue is projected, the Legislature should assure general fund appropriations to achieve the funding goals. The estimated general fund amount needed to achieve the funding goal reflects the remaining amount required to close the gap after tuition revenue is calculated.

Conclusions: Community Colleges

- The Legislature should reinstate the statute establishing the 33 percent share goal and fund it. Funding from the state should occur according to statute from year to year (be reasonably predictable) to allow for strategic planning for enrollment growth to meet and comply with the general objectives specified in the community college philosophy and mission.
- The state's level of support for operations should fund growth as well as inflation in the base as provided for in statute.
- The Legislature should consider changes in the law to allow Arizona's community college districts to increase their expenditure capacity for New Economy and local initiatives. Currently, five of the ten community college districts are at or near their expenditure limitation.
- Maintain equalization aid for community college districts that meet the prescribed statutory requirements to receive it. Equalization aid supplements inadequate local primary tax levy capacity.
- Dual enrollment for qualified high school students should continue to be funded to afford students the opportunity to move through the higher education system as fast as possible at the lowest possible cost.

OTHER OPERATING REVENUE SOURCES

Other operating revenue is a significant part of the annual budgets of the Arizona universities, while being a useful but far less critical part of the community college annual budgets. This is particularly true for research and development funding. For more than 40 years, states have been taking advantage of their research and development assets to improve their economic future. For example, North Carolina's Research Triangle Park was one of the earliest efforts and was created through a public/private partnership involving business, Duke University,

University of North Carolina, North Carolina State University, and state government. In addition to providing revenue for the universities, the Park has attracted more than 100 research and development facilities that employ more than 37,000 people with combined annual salaries of more than \$1.2 billion.⁴

As Arizona's universities move to secure greater private financial support through fund-raising programs, the impact of public records laws on the willingness of donors to support universities should be carefully considered. Because the information collected by university fund-raising officials is often highly personal, release of this information could seriously jeopardize the success of these programs. A 1996-1997 study conducted by the Washington Attorney General's Office on behalf of the University of Washington concluded that a clear majority of the states—32 out of 50—protect donor information from public disclosure. To effectively pursue the goal of enhanced private financial support, Arizona's public universities need statutory protection to be extended to donor records to ensure their confidentiality.

Arizona's Public Universities

In FY 2001, other operating revenue sources total 53 percent of the expenditure plan. These funds include auxiliary operations, investment income, self-supporting designated funds, gifts, grants, and contracts.

Arizona's Community Colleges

Recently available data for the community colleges show the actual data for the expenditure of general fund income and the source of the funds.⁵ Most of the operational budget comes from property taxes, state aid, and tuition and fees, but a small portion is provided from other sources such as investment income. "Other revenue" represented approximately 8 percent of total community college general fund income.

None of these funds comes from the state's Permanent Fund for educational support derived from the State Trust Lands. Other public education institutions and districts receive funds from the expendable funds in this trust. The community colleges, as a recently developed part of the state educational system, do not participate in this "other" source of revenue at this time.

Conclusions: General

- On November 7, 2000, Arizona voters approved Proposition 301 for a sales tax increase of six-tenths of one percent for education. This Subcommittee on Funding encouraged the Governor's Task Force on Higher Education to support this initiative of the Governor and is pleased to report its passage.

⁴ Bergman and Clark, 2000, publication of the National Governors' Association. "Using Research and Development to Grow State Economies."

⁵ State Board of Directors for Community Colleges of Arizona; Board Agenda Document; June 16, 2000.

- The universities and community colleges should continue to strongly promote and endorse the pursuit of private funding. Recent examples are the \$25 million pledged by Arizona high-technology business leaders to match funds for ASU's high-technology center, and the \$1.2 million provided by the Arizona Dental Association and Delta Dental to build a facility in Central Phoenix for Rio Salado College to train dental personnel. Proposition 301 provides that the Board of Regents shall give preferential allocations of the Technology and Research Initiative Fund created from the universities' share of the increased sales tax revenue to university initiatives developed in conjunction with private industry, private entities, or federal agencies. Proposition 301 also requires that community colleges form partnerships with the private sector to provide for expanded workforce development and job training programs.
- The Governor and Legislature should explore the feasibility of utilizing Indian gaming revenues received by the state for higher education.
- The Governor and Legislature should explore the feasibility of utilizing tobacco settlement funds for health-related education, including biomedical education and research. Arizona voters on November 7, 2000, approved Propositions 200 and 204 relating to these funds.
- The Governor and Legislature should consider adopting statutory provisions which exempt donor information from Arizona Public Records Law.
- State Trust Lands: The Subcommittee notes that the Legislature has identified a portion of the annual trust funds for the universities to be designated for the Eminent Scholars matching program. These dollars are to match the interest income from endowments raised by the universities to attract and retain eminent scholars. The original intention of the legislation was that the Legislature would replace the loss of these revenues from the universities' annual operating budgets. The universities and community colleges should investigate ways to enhance revenue from the State Trust Lands. In addition, the Legislature could consider updating the 1981 Trust Lands statute to include some funding support for the community colleges.
 - The universities, community colleges, and the State Land Commissioner should engage in strategic discussions and formulate a plan to maximize the annual returns from both the Physical Lands and Permanent Funds held for the benefit of the universities and potentially the community colleges.
 - The universities and community colleges should explore opportunities to convert federal lands to State Trust Lands with any sale or lease revenue devoted to higher education.
 - The Legislature should consider replacing the loss of operating funds that are now designated for matching the eminent scholars endowment.

- Tax Credits: The Legislature has established income tax credits for individuals who contribute to K-12/charter schools. A similar program could be established for higher education, consisting of an income or sales tax credit for individual or corporate contributions to higher education. Revenue from the credits could be coupled with private gifts or grants and designated to fund projects that are consistent with the recommendations of the Governor's Task Force on Higher Education.

Conclusions: Public Universities

- The Board of Regents and universities should expand their pursuit of federal funding.
- The Board of Regents and universities should support the continued reinvestment of Research Park revenues into the research enterprise of the universities as an ongoing contribution to Arizona's economy.
- The universities should support the commercialization of faculty research by providing incubation services to faculty in exchange for equity participation in commercial ventures resulting from such commercialization.
- The universities should continue their strategic efforts to maximize the value of assets, such as income from the sale or lease of spectrum rights or cell sites, and reinvest the income as appropriate. At the same time, the institutions must also remain cognizant of the implications of unrelated business income tax and the tax-exempt status of their organizations.
- The Governor's Task Force on Higher Education should endorse the recommendations of the External Review Committee for Public Private Partnerships (ERC/PPP) of the Board of Regents (June 1999). The Committee analyzed the depth and breadth of ongoing privatization and outsourcing activities by Arizona's public universities. The activities reviewed were primarily ancillary to the core mission of the universities – that is, enterprises that do not directly deliver instruction, research, or public service outcomes. The recommendations were adopted by the Board and are being implemented by the universities. Three specific areas of interest to the Subcommittee, derived from the ERC/PPP, are:
 - Tri-University Technology Transfer Management: The universities should consider creating a common system to more efficiently manage the transfer of technology to the private sector, thereby spreading the costs of patents, administration, and marketing over a broader base.
 - New Venture Capital Entity: The universities should explore the creation of a joint venture capital initiative with the private sector to facilitate the raising of capital to support new ventures, start-ups, and innovative enterprises derived from the research efforts of university faculty.

- Information Technology Partnership: The university system should enlist the private sector in creating a tri-university information technology platform, enabling greater access to expertise, capital, operational expertise, and planning sophistication.

Conclusions: Community Colleges

- Community college efforts must be accelerated and aggressive in competing for and obtaining public and private grants.
- Private contributions to community colleges should be matched with public funds from the state.
- Community colleges should continue to expand and strongly promote and endorse the pursuit of private funding.
- Community colleges should continue to engage in partnerships with corporate, public agencies, and business to expand opportunities for funding and training.
- Community colleges should continue to engage in partnerships with public and private entities, including other higher education institutions, for joint facility use and expansion to serve community needs while at the same time leveraging taxpayer dollars.
- Community colleges should provide more incentives to attract increased financial support from the private sector.

TUITION

According to the Arizona Constitution, for "The University and all other State educational institutions... the instruction furnished (to Arizona residents) shall be as nearly free as possible." The Arizona Board of Regents sets tuition and fees in Arizona for the three public universities. The State Board of Directors for Community Colleges, upon the recommendation of the local community college district governing boards, sets tuition and fees in Arizona for the community colleges.

Arizona's Public Universities

About 13% of the Arizona universities' total revenue in FY 2001 is derived from tuition and fees paid by resident and nonresident students.

In response to the constitutional provision mentioned above, Board policy requires that resident tuition and mandatory fees maintain a position within the lower one-third of rates set by all other states for resident tuition, but Arizona's resident tuition currently is near the bottom of the lower one-third. As shown in

Appendix A, Arizona's 1999-2000 rates tie for 49th of the 50 senior public institutions in the United States.

As shown in Appendix B, the 1999-2000 nonresident tuition rates within the Arizona University System are lower than the average of nonresident tuition rates of the 49 senior public universities in the other states. Under current Board practice, nonresidents pay the equivalent of the amount the state spends per student (i.e., the average state operating expenditure per full-time equivalent student).

The Arizona Board of Regents pursues a wide variety of methods to provide financial aid to students. These methods fall into the two broad categories of waivers and scholarships.

The Federal Government provides aid both in the form of grants and loans. Over the last two decades, the federal ratio of grants to loans has reversed itself so that it is now about 25 percent grant to 75 percent loan.

The state supports two programs for financial aid. The first, administered through the Board of Regents, is the Western Interstate Commission for Higher Education (WICHE), which supports qualified Arizona residents who wish to matriculate in an area of study not provided by Arizona's universities (e.g. Dentistry). The program pays the difference between Arizona's resident tuition and the host state's nonresident tuition under a reciprocal agreement. The state of Arizona thereby provides access to a degree program while avoiding the cost of funding such a program itself. The second program is the Arizona Financial Aid Trust. Through this program the state matches, dollar for dollar, student fees equivalent to one percent of the resident tuition rate.

Board of Regents policy also sets aside a portion of tuition revenues for financial aid administered by each university's Financial Aid office. Each university has also aggressively raised endowments dedicated to providing financial aid grants.

Arizona's Community Colleges

The tuition of the ten county community college districts varies among districts. The separate governing boards for each of the districts develop the rate as part of their budget and recommend it to the State Board of Directors. In FY 1998-1999, the tuition rate of Arizona's community college districts averaged \$857, which remained lower than the nationwide average of \$1,328. California averaged \$392, New Mexico averaged \$648, and North Carolina averaged only \$585. Tuition increases have become necessary because state appropriations have not kept up with enrollments and the increased demand for programs and services.

Conclusions: General

- The Legislature should be encouraged to appropriate additional general funds to improve the match for the Arizona Financial Aid Trust.
- The Legislature should be encouraged to provide significant enhancements and tax incentives to programs encouraging family savings for college tuition.
- The Legislature should be encouraged to financially match community colleges' and universities' private fund-raising.

Conclusions: Public Universities

- The Board of Regents should consider raising resident tuition to the top of the bottom one-third of the 50 senior public institutions in the United States (to be phased in over three to five years) and maintaining the relative position over time.
- The Board of Regents should consider raising nonresident tuition to the median of the 50 senior public institutions in the United States and maintaining the relative position over time.

Conclusions: Community Colleges

- Tuition levels at the community colleges should remain affordable to students. In order to effect this goal, a combination of increased state appropriations and private funding should be provided to allow students to retain access to a community college education.
- The Legislature should be encouraged to establish an Arizona Financial Aid Trust, similar to the one provided for the universities, whereby matching funds would be provided for student fees that are collected by the community colleges.

CAPITAL SUPPORT

State provision for capital funding for buildings and facilities varies greatly between Arizona's public universities and community colleges.

Arizona's Public Universities

Presently, university capital improvement projects are financed primarily through academic revenue bonds, auxiliary revenue bonds, certificates of participation, and lease/purchase agreements, with little general fund appropriations. In addition, the Legislature provides annual building renewal funding for deferred maintenance on academic facilities and infrastructure.

In 1996 the Arizona Board of Regents appointed the Committee for External Review of University Capital Assets chaired by Mark DeMichele. After an initial review of internal programs, this Committee recommended that the Board retain an external consultant to evaluate various issues involving deferred maintenance of university facilities. In March of 1997, the Board retained the firm of Harvey I. Kaiser, in association with 3D/International, and Vanderweil Facility Advisors to review the deferred maintenance processes. The consultants worked through the fall of 1997 and reported their findings in December of that year. Overall, the consultant team was impressed with the extent to which the Board and the universities took deferred maintenance seriously on the campuses. The consultants further reported that, "full funding by the Legislature of the building renewal requests is critical in limiting deferred maintenance on the campuses." These recommendations were endorsed by the DeMichele Committee in their final report which stated that, "The Board and the universities should continue to demonstrate a national leadership position with their collective efforts to address deferred maintenance backlog."

Over the last 10 years, the Legislature funded building renewal at an average of 44 percent of the formula adopted by the Legislature's Joint Committee on Capital Review. This level of funding produced a shortfall for the decade of \$122 million.

During the last regular session, the Legislature passed Senate Bill 1079 which established a study committee to review the Building Renewal Formula and process. Initially, the committee was scheduled to complete its findings and recommendations by November 15, 2000; however, the committee has received an extension until December 31, 2000.

Arizona's Community Colleges

Community colleges have two primary funding sources for large-scale capital projects: general obligation bonds and revenue bonds. Community college districts, upon the approval of the State Board of Directors for Community Colleges and their local governing boards, can put before the voters a capital financing plan using general obligation bonds. If voter approved, secondary property taxes are assessed to retire the bond debt. In FY 1999-2000, Arizona's community college districts had \$428.7 million of general obligation bonds outstanding.

Revenue bonds are the purview of the State Board of Directors for Community Colleges and the local governing boards of community college districts. The State Board has statutory authority to issue and sell revenue bonds for the benefit of community colleges, and this debt is retired primarily with student tuition and fees. In FY 1999-2000, there was \$39.8 million of outstanding revenue bonds.

A third funding source, certificates of participation and pledged revenue obligations, plays a minor but important role in funding community colleges'

capital projects. As of FY 1999-2000, \$18.3 million was outstanding, with the debt retirement dependent on tuition and fee revenues.

A fourth funding source for capital support is the state's Statutory Funding Formula for community colleges. The formula allocates state support per Full Time Student Equivalent (FTSE), currently \$160 for urban districts and \$210 for rural districts, and can be adjusted for inflation if the Legislature provides the funding. The last time the Legislature adjusted these amounts was in the mid-1990's. In 1999-2000, approximately 5 percent of the total capital support for community colleges came from the state. These capital support funds are used to fund deferred maintenance and infrastructure improvements for all community college buildings, which are also owned by the state.

Conclusions: General

- The Legislature should be encouraged to appropriate general fund revenues to cover the cost of debt service for capital projects.

Conclusions: Public Universities

- The Legislature should fully fund the existing Building Renewal Formula and/or any future revisions to that formula.
- The universities should more aggressively seek private and federal partnerships for capital to support the construction of facilities and infrastructure.

Conclusions: Community Colleges

- The state's support for capital should be increased to \$315 per Full Time Student Equivalent (FTSE) for rural districts and increased to \$240 per FTSE for urban districts. These amounts should be adjusted by the Legislature annually for inflation. The proposed increases will help adjust for inflationary costs realized since the last increase was provided. These adjustments more closely represent realistic funding levels for capital support. The proposed increases would have raised the state share of total capital support for community colleges from 5 to 7 percent in FY 2000-2001.

SUMMARY

In carrying out its charge from the Governor's Task Force on Higher Education to develop viable alternatives for enhancing financial support for higher education in Arizona, the Subcommittee on Funding has articulated funding methods to meet the entire higher education needs of the state. Both university and community college funding in Arizona would be enhanced under the conclusions presented.

1999-00		
RESIDENT TUITION & REQUIRED FEES		
FIFTY STATE COMPARISON OF SENIOR PUBLIC UNIVERSITIES		
	INSTITUTION	RESIDENT 1999-00
1	University of VERMONT	8,046
2	University of MICHIGAN, Ann Arbor	7,148
3	University of NEW HAMPSHIRE, Durham	6,939
4	PENNSYLVANIA State University, University Park	6,592
5	Rutgers College-The State Univ. of NEW JERSEY	5,852
6	University of CONNECTICUT	5,398
7	University of MASSACHUSETTS, Amherst	5,212
8	University of MISSOURI, St. Louis	5,156
9	University of MARYLAND, College Park	4,939
10	University of RHODE ISLAND	4,928
11	University of DELAWARE	4,852
12	University of MINNESOTA, Twin Cities	4,814
13	University of ILLINOIS, Urbana-Champaign	4,746
14	University of MAINE, Orono	4,656
15	INDIANA University, Bloomington	4,212
16	State University of NEW YORK, Stony Brook	4,141
17	OHIO State University, Columbus	4,137
18	University of VIRGINIA	4,134
19	University of CALIFORNIA, Berkeley	4,047
<i>AVERAGE RESIDENT (EXCLUDING AUS)</i>		3,851
20	University of OREGON	3,810
21	University of SOUTH CAROLINA, Columbia	3,740
22	University of WISCONSIN, Madison	3,650
23	University of WASHINGTON, Seattle	3,638
24	University of ARKANSAS, Little Rock	3,525
25	University of SOUTH DAKOTA	3,460
26	University of NEBRASKA, Lincoln	3,338
27	University of KENTUCKY, Lexington	3,296
28	University of HAWAII, Manoa	3,249
29	University of TEXAS, Austin	3,130
30	University of COLORADO, Boulder	3,120
31	University of TENNESSEE, Knoxville	3,104
32	University of MISSISSIPPI	3,054
33	University of GEORGIA, Athens	3,034
<i>LOWER ONE-THIRD</i>		
34	University of IOWA	2,998
35	University of MONTANA	2,967
36	University of NORTH DAKOTA, Grand Forks	2,956
37	University of ALABAMA	2,872
38	University of ALASKA, Anchorage	2,829
39	University of UTAH	2,790
40	WEST VIRGINIA University, Morgantown	2,748
41	University of OKLAHOMA	2,685
42	University of KANSAS	2,518
43	University of NEW MEXICO	2,430
44	University of WYOMING	2,416
45	LOUISIANA State University	2,380
46	University of IDAHO	2,348
47	University of NORTH CAROLINA, Chapel Hill	2,262
48	ARIZONA UNIVERSITY SYSTEM (AUS)	2,259
49	University of NEVADA, Reno	2,259
50	University of FLORIDA	2,140

Source: Annual tuition and fees survey conducted by ABOR-Central Office.

1999-00		
NONRESIDENT TUITION & REQUIRED FEES		
FIFTY STATE COMPARISON OF SENIOR PUBLIC UNIVERSITIES		
	INSTITUTION	NON-RESIDENT 1999-00
1	University of MICHIGAN, Ann Arbor	21,180
2	University of VERMONT	19,254
3	University of VIRGINIA	16,603
4	University of COLORADO, Boulder	16,046
5	University of NEW HAMPSHIRE, Durham	15,829
6	University of CALIFORNIA, Berkeley	14,221
7	University of CONNECTICUT	13,916
8	PENNSYLVANIA State University, University Park	13,705
9	University of MASSACHUSETTS, Amherst	13,365
10	University of DELAWARE	13,222
11	University of OREGON	13,197
12	University of RHODE ISLAND	13,148
13	University of MISSOURI, St. Louis	13,070
14	University of MINNESOTA, Twin Cities	12,954
15	INDIANA University, Bloomington	12,920
16	University of WISCONSIN, Madison	12,400
17	OHIO State University, Columbus	12,087
18	University of WASHINGTON, Seattle	12,029
19	University of MAINE, Orono	11,946
20	University of ILLINOIS, Urbana-Champaign	11,838
21	University of MARYLAND, College Park	11,827
22	University of NORTH CAROLINA, Chapel Hill	11,418
<i>AVERAGE NONRESIDENT (EXCLUDING AUS)</i>		10,953
23	Rutgers College-The State Univ. of NEW JERSEY	10,782
24	University of IOWA	10,440
25	University of GEORGIA, Athens	10,276
26	University of SOUTH CAROLINA, Columbia	9,814
27	University of HAWAII, Manoa	9,729
28	University of TEXAS, Austin	9,610
29	ARIZONA STATE UNIVERSITY / UNIVERSITY OF ARIZONA	9,411
30	University of KENTUCKY, Lexington	9,216
31	University of NEW MEXICO	9,172
32	University of TENNESSEE, Knoxville	9,172
33	University of FLORIDA	9,130
34	University of KANSAS	9,121
35	State University of NEW YORK, Stony Brook	9,041
36	University of UTAH	8,495
37	University of NEVADA, Reno	8,492
38	NORTHERN ARIZONA University	8,375
39	University of IDAHO	8,348
40	University of ARKANSAS, Little Rock	8,295
41	WEST VIRGINIA University, Morgantown	8,100
42	University of MONTANA	8,076
43	University of NEBRASKA, Lincoln	7,845
44	University of ALABAMA	7,722
45	University of WYOMING	7,684
46	University of ALASKA, Anchorage	7,599
47	University of SOUTH DAKOTA	7,533
48	University of NORTH DAKOTA, Grand Forks	7,098
49	University of OKLAHOMA	7,020
50	LOUISIANA State University	6,540
51	University of MISSISSIPPI	6,156

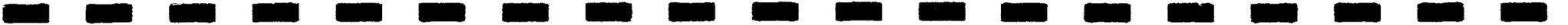
Source: Annual tuition and fees survey conducted by ABOR-Central Office.

**STATE OF ARIZONA
TRUST LANDS FUNDS
TO THE UNIVERSITIES**

	FY 1998-99			
	UA	ASU	NAU	Total
Agricultural & Mechanical Colleges	316,721	152,740	19,308	488,769 1)
Military Institutes	86,772	16,035	26,511	129,318 2)
Normal Schools	56,886	56,886	56,888	170,660 3)
School of Mines	470,580	-	-	470,580 4)
Eminent Scholars	708,122	981,763	398,972	2,088,857 5)
	1,639,081	1,207,424	501,679	3,348,184

	FY 1999-00			
	UA	ASU	NAU	Total
Agricultural & Mechanical Colleges	306,383	150,574	18,793	475,750 1)
Military Institutes	91,898	19,541	30,160	141,599 2)
Normal Schools	64,604	64,604	64,606	193,814 3)
School of Mines		-	-	0 4)
Eminent Scholars	651,080	887,144	365,520	1,903,744 5)
	1,113,965	1,121,863	479,079	2,714,907

- 1) One-half allocated to the University of Arizona; one-half allocated proportionately based on engineering student credit hours.
- 2) Allocated proportionately based on ROTC student credit hours.
- 3) Allocated equally among the three universities.
- 4) Allocated solely to the University of Arizona.
- 5) The University Land Code and the University of Arizona (Act 3-18-1881) lands are combined to fund "Eminent Scholars" and allocated proportionately based on total student credit hours.



**Governor's Task Force on
Higher Education
Subcommittee on Funding**

June 26, 2000

**Comparison of Selected States'
Support for Higher Education**

Ranking of Tuition and State Appropriations Revenues per FTE Student for Selected States

<u>Tuition</u>	<u>State Appropriations</u>	<u>Combined</u>
1 Michigan	1 North Carolina	1 North Carolina
2 Washington	2 Georgia	2 Georgia
3 Colorado	3 California	3 Michigan
4 Wisconsin	4 Wisconsin	4 California
5 California	5 Illinois	5 Wisconsin
6 Illinois	6 Michigan	6 Washington
7 Oregon	7 Washington	7 Illinois
8 Texas	8 Arizona	8 Oregon
9 Arizona	9 Oregon	9 Arizona
10 Georgia	10 Texas	10 Texas
11 North Carolina	11 Colorado	11 Colorado



Current and Future Funding Sources for Higher Education ARIZONA

Current Support		Future Funding (New Investments)
Operating Funds		
<i>Tuition</i>		
• Per FTE Student	• \$4,739	
• Percent of Total	• 24%	
<i>State Appropriations</i>		
• Per FTE Student	• \$8,237	
• Percent of Total	• 41%	
<i>All Other Revenues</i>		
Capital Funds		
<i>Bonds</i>		
• Per FTE student	• \$682	
• Percent of Total Expenditures	• 3.5%	

Current and Future Funding Sources for Higher Education CALIFORNIA

Current Support		Future Funding (New Investments)
Operating Funds <i>Tuition</i> <ul style="list-style-type: none"> • Per FTE Student • Percent of Total 	<ul style="list-style-type: none"> • \$6,257 • 18% 	<p>The legislature has just approved spending \$75 million from the General Fund to establish Institutes for Science and Innovation at three of the U of California campuses. The Institutes will conduct multidisciplinary technical and scientific research primarily in the physical and bio/life sciences. Private sector partners of the three new Institutes would provide at least \$25 million annually for operating costs.</p>
<i>State Appropriations</i> <ul style="list-style-type: none"> • Per FTE Student • Percent of Total 	<ul style="list-style-type: none"> • \$11,234 • 32% 	
<i>All Other Revenues</i>	<p style="text-align: center;">\$2,458,693,000</p>	
Capital Funds <i>Bonds</i> <ul style="list-style-type: none"> • Per FTE student • Percent of Total Expenditures 	<ul style="list-style-type: none"> • \$1,308 • 3.5% 	<p>General Fund expenditures will help build and equip the three new Institutes.</p>

Current and Future Funding Sources for Higher Education COLORADO

Current Support		Future Funding (New Investments)
Operating Funds <i>Tuition</i> <ul style="list-style-type: none"> • Per FTE Student • \$6,349 • Percent of Total • 31% 	<i>State Appropriations</i> <ul style="list-style-type: none"> • Per FTE Student • \$3,997 • Percent of Total • 19% 	<p>In March 2000, Governor Owens announced formation of the Colorado Institute of Technology (CIT), a new research and education institution which seeks to partner the state's technology businesses with the higher education system. Industrial partners have committed \$41 million to the CIT's endowment and operating funds.</p>
<i>All Other Revenues</i> \$463,357,480		
Capital Funds <i>Bonds</i> <ul style="list-style-type: none"> • Per FTE student • \$130 • Percent of Total Expenditures • 0.7% 		

Current and Future Funding Sources for Higher Education GEORGIA

Current Support		Future Funding (New Investments)
Operating Funds <i>Tuition</i> <ul style="list-style-type: none"> • Per FTE Student • Per FTE Student 	<ul style="list-style-type: none"> • \$4,384 • 15% 	<p>In 1999, Governor Barnes signed legislation committing \$100 million over five years to improve the state's competitiveness in microchip technology and high-bandwidth communications. Funds will be used to hire 85 new faculty, establish advanced research facilities, and hire semiconductor designers to implement new findings. The goal is to create 2,000 new high tech jobs in the state.</p> <p>Private firms are expected to contribute operating funds.</p>
<i>State Appropriations</i> <ul style="list-style-type: none"> • Per FTE Student • Per FTE Student 	<ul style="list-style-type: none"> • \$14,104 • 46% 	
<i>All Other Revenues</i>	<p style="text-align: center;">\$465,856,431</p>	
Capital Funds <i>Bonds</i> <ul style="list-style-type: none"> • Per FTE student • Per FTE student 	<ul style="list-style-type: none"> • \$0 • 0.0% 	Expenditures

Current and Future Funding Sources for Higher Education ILLINOIS

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Current Support		Future Funding (New Investments)
Operating Funds <i>Tuition</i> <ul style="list-style-type: none"> • Per FTE Student • Percent of Total 	<ul style="list-style-type: none"> • \$5,112 • 18% 	New legislation will provide \$1.9 billion over five years to advance technology education and training, research and product development in biotechnology, high-energy physics, information technology, manufacturing, medicine, and food processing. Funding from combination of General Fund and tobacco settlement.
<i>State Appropriations</i> <ul style="list-style-type: none"> • Per FTE Student • Percent of Total 	<ul style="list-style-type: none"> • \$9,683 • 34% 	
<i>All Other Revenues</i>	\$768,089,802	
Capital Funds <i>Bonds</i> <ul style="list-style-type: none"> • Per FTE student • Percent of Total Expenditures 	<ul style="list-style-type: none"> • \$214 • 0.8% 	The \$1.9 billion described will fund at least six new buildings at both U of Illinois Research I campuses.

Current and Future Funding Sources for Higher Education MICHIGAN

Current Support		Future Funding (New Investments)
Operating Funds <i>Tuition</i> <ul style="list-style-type: none"> • Per FTE Student • Percent of Total 	<ul style="list-style-type: none"> • \$8,269 • 27% 	Governor Engler signed legislation in 1999 to provide \$1 billion over 20 years from the tobacco settlement to fund a Life Sciences Corridor Initiative involving the U of Michigan, Michigan State U, and Wayne State U to support basic research in biotechnology and the development and commercialization of new discoveries.
<i>State Appropriations</i> <ul style="list-style-type: none"> • Per FTE Student • Percent of Total 	<ul style="list-style-type: none"> • \$9,497 • 31% 	
<i>All Other Revenues</i>	\$1,192,320,584	
Capital Funds <i>Bonds</i> <ul style="list-style-type: none"> • Per FTE student • Percent of Total Expenditures 	<ul style="list-style-type: none"> • \$178 • 0.6% 	

Current and Future Funding Sources for Higher Education NEVADA*

Current Support		Future Funding (New Investments)
Operating Funds		
<i>Tuition</i>		
• Per FTE Student	• \$3,370	
• Percent of Total	• 18%	
<i>State Appropriations</i>		
• Per FTE Student	• \$8,783	
• Percent of Total	• 48%	
<i>All Other Revenues</i>		
		\$136,991,012
Capital Funds		
<i>Bonds</i>		
• Per FTE student	• \$30	
• Percent of Total Expenditures	• 0.2%	

*Current support figures based on IPEDS data for the U of Nevada, Reno and UNLV.

Current and Future Funding Sources for Higher Education NORTH CAROLINA

Current Support		Future Funding (New Investments)
Operating Funds <i>Tuition</i> <ul style="list-style-type: none"> • Per FTE Student • Per FTE Student • Percent of Total 	<ul style="list-style-type: none"> • \$4,148 • 13% 	U of North Carolina trustees agreed this past spring to raise tuition at UNC and UNSU by almost 40 percent over the next two years, largely to improve faculty salaries. Also, student fees were raised 8 percent.
<i>State Appropriations</i> <ul style="list-style-type: none"> • Per FTE Student • Percent of Total 	<ul style="list-style-type: none"> • \$14,933 • 45% 	
<i>All Other Revenues</i>	\$610,390,532	
Capital Funds <i>Bonds</i> <ul style="list-style-type: none"> • Per FTE student • Percent of Total Expenditures	<ul style="list-style-type: none"> • \$104 • 0.3% 	In November 2000, North Carolina voters will decide on a bond proposal that will provide the UNC system with \$2.5 billion for construction and renovation projects.

Current and Future Funding Sources for Higher Education OREGON

Current Support		Future Funding (New Investments)
Operating Funds		
<i>Tuition</i>		
• Per FTE Student	• \$5,097	
• Percent of Total	• 20%	
<i>State Appropriations</i>		
• Per FTE Student	• \$8,010	
• Percent of Total	• 32%	
<i>All Other Revenues</i>		
		\$157,629,066
Capital Funds		
<i>Bonds</i>		
• Per FTE student	• \$25	
• Percent of Total Expenditures	• 0.1%	



Current and Future Funding Sources for Higher Education TEXAS

Current Support		Future Funding (New Investments)
Operating Funds <i>Tuition</i> <ul style="list-style-type: none"> • Per FTE Student • Percent of Total 	<ul style="list-style-type: none"> • \$4,856 • 22% 	
<i>State Appropriations</i> <ul style="list-style-type: none"> • Per FTE Student • Percent of Total 	<ul style="list-style-type: none"> • \$7,587 • 34% 	
<i>All Other Revenues</i>	\$806,544,834	
Capital Funds <i>Bonds</i> <ul style="list-style-type: none"> • Per FTE student • Percent of Total Expenditures 	<ul style="list-style-type: none"> • \$468 • 2.2% 	<p>In February 2000, the U of Texas Regents increased the 2000–2005 CIP by 25%. Projects include a new Biological Science building at Austin and a total of \$729 million in construction at the system’s medical campuses.</p>

Current and Future Funding Sources for Higher Education WASHINGTON

Current Support		Future Funding (New Investments)
Operating Funds <i>Tuition</i> <ul style="list-style-type: none"> • Per FTE Student • Percent of Total 	<ul style="list-style-type: none"> • \$6,660 • 18% 	State has invested \$12 million in next generation Internet capability with an additional \$5 to 6 million on targeted advanced technology research at U Washington.
<i>State Appropriations</i> <ul style="list-style-type: none"> • Per FTE Student • Percent of Total 	<ul style="list-style-type: none"> • \$8,791 • 23% 	
<i>All Other Revenues</i>	\$698,947,000	
Capital Funds <i>Bonds</i> <ul style="list-style-type: none"> • Per FTE student • Percent of Total Expenditures 	<ul style="list-style-type: none"> • \$391 • 1.1% 	

Current and Future Funding Sources for Higher Education WISCONSIN

Current Support		Future Funding (New Investments)
Operating Funds <i>Tuition</i> <ul style="list-style-type: none"> • Per FTE Student • Percent of Total 	<ul style="list-style-type: none"> • \$6,337 • 19% 	
<i>State Appropriations</i> <ul style="list-style-type: none"> • Per FTE Student • Percent of Total 	<ul style="list-style-type: none"> • \$9,942 • 30% 	
<i>All Other Revenues</i>	\$602,411,422	
Capital Funds <i>Bonds</i> <ul style="list-style-type: none"> • Per FTE student • Percent of Total Expenditures 	<ul style="list-style-type: none"> • \$1,034 • 3.2% 	In January 2000, Governor Thompson asked for state appropriations to help build four major new buildings to support biotechnology research and to house 100 new faculty. This initiative follows other public-private funding for eight new buildings in basic sciences, medicine, and engineering for a total of \$909 million.

Summary

- States with strongest universities have been built on multiple revenue streams...
 - California, Michigan, North Carolina, Wisconsin
- Arizona needs to develop a multi-revenue stream strategy to strengthen financial support for public higher education.
- Arizona strategy should include recommendations on:
 - State Appropriations
 - Tuition
 - Other Revenue Sources
 - Capital Support

**Governor's Task Force on Higher Education
Subcommittee on Funding**

September 14, 2000

Review of Funding Mechanism for Universities in Selected States

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Funding Mechanisms Under an Enrollment Cap (or No Enrollment Growth) Scenario

We are gathering information regarding how public universities which have reached their campus enrollment cap (or planned enrollment ceiling) work with their coordinating boards and/or legislatures to secure additional state funding to enhance conditions on the no-growth campus.

What funding mechanisms are in place which provide needed state funds for new programs and improvements to existing programs?

We assume in this discussion that the no-growth campus can justify additional state funds (either general fund appropriations or tuition revenue) through:

- 1) Cost of Living Adjustments (faculty and staff salary increases)
- 2) CPI/HEPI Funding Adjustments for Operations

Are there other formula-driven state funding mechanisms, such as the following:

- A) **Change in Enrollment Mix**—Would you receive additional funds if your campus enrolled, for example, a higher proportion of graduate students (while holding to the campus cap or enrollment ceiling)?
- B) **Technology Improvements or Adjustments**—Do you receive state funds specifically tied to a technology index, possibly for computer infusion?
- C) **Funding Level Among Peers**—Do you receive funds based on any agreement which maintains your position among a set of peer (or conference) institutions?

Are there non-formula-driven mechanisms available for new programs or program enhancements, such as the following:

- D) **New Program Requests**—Can your no-growth campus receive additional funds to support new programs or program re-alignment?
- E) **New Construction**—Under a capped/enrollment ceiling scenario, is your campus eligible for new construction which would expand the square footage on your campus (rather than simply replace existing buildings)?

States and Universities That Provided Responses to Survey:

1. **Illinois**
U of Illinois, Urbana
2. **Maryland**
U of Maryland, College Park
3. **Michigan**
U of Michigan
4. **North Carolina**
U of North Carolina, Chapel Hill
North Carolina State University
5. **Ohio**
Ohio State University
6. **Texas**
U of Texas Austin
7. **Virginia**
U of Virginia
8. **West Virginia**
West Virginia University
9. **Wisconsin**
U of Wisconsin, Madison

University of Illinois – Urbana

Source: Steve Rugg, Associate Vice President, Budget and Planning

The Urbana campus has a self-imposed enrollment cap of 38,000. The Admissions office now uses a wait list to control the size of the incoming freshmen class.

Funding Mechanisms

- For faculty salaries, the Urbana campus has reached agreement with the Board of Higher Education to move average faculty salaries to the median of 21 peer institutions (half of which are private). The University currently ranks 18th among the peer group.
- In the area of new state funding, the university requests and receives funds through a process best described as “research leverage.” Decision packages are presented requesting funds to support the state’s “Illinois Commitment” program, which seeks advancements in economic development, workforce preparedness, technology transfer, among others. The university requests funds for faculty research in these areas of state need. Enrollment growth is not a factor since these are research initiatives.
- The Urbana campus has also proposed funding to rebuild the faculty, documenting the loss of some 200+ tenure/track faculty in recent years to outside competition.

Discussions are also underway to increase tuition in future years at a rate higher than inflation.

University of Maryland – College Park

Source: Tom Vogler, Director, Budget and Fiscal Analysis
Laura Stapleton, Institutional Studies

Maryland – College Park has capped undergraduate enrollment at 24,500. Currently, the university enrolls some 33,000 students.

Funding Mechanism

The Maryland legislature recently passed legislation which sets funding for the College Park campus (expenditures per FTE student) at the average of a set of five public peer universities. The institutions are:

- University of California – Los Angeles
- University of Michigan – Ann Arbor
- University of Illinois – Urbana
- University of California – Berkeley
- University of North Carolina – Chapel Hill

All funding for new programs is derived from increased appropriations realized through maintaining the position among the five peers.

University of Michigan, Ann Arbor
Source: Office of Budget and Planning

Funding Mechanism

Michigan's 15 public universities are organized into tiers, and each university receives a lump sum from the state according to their standing. The university then allocates these funds according to its own needs. Any increase in funding requested by the university for special purposes would be received as part of this general appropriation from the state.

University of North Carolina, Chapel Hill

Source: Sue Clapper, Director of Admissions, and Rogers Patterson, Associate VP for Finance.

No enrollment cap except that no more than 18 percent of new freshmen may be non-resident. No other control on non-resident for older UGs or grad students. For years, a semi-cap on new freshmen, +/- 3,200. Enrollment pressures on all 16 UNC campuses because of population growth. This fall they are 3,400 new freshmen, and next year that probably grow to 3,700. No cap at any state U; all

Funding Mechanisms

- Enrollment growth, as detailed above, will be handled by a complex funding formula that now takes into account headcount, level, discipline, and faculty productivity and numbers. State budget process is biennial, and they are preparing budget now for next biennium, which starts in 2001-02. State budget request has three parts; capital, continuation, and expansion.
- Until 6-7 years ago, an open request system. Last few years, Board of Regents has assumed control of request system. Regents, in consultation with campuses, set up categories within which Us can ask for money: technology, libraries, financial aid, interdisciplinary studies, working with K-12, faculty matching. Just added a new category this year for biotech initiatives. Get more money with central control but lose flexibility for campus to address particular needs.

Have \$300 tuition increase current year. Expect same next year, but it has not been technically approved because just submitting biennial budget. Prior to last year, all tuition set by legislature. This past year, more flexibility for campuses to make individual requests, which two flagships and three others Us did. Legislature looks at total amount to give Us, decides how much through tuition and how much through approps. Still strong legislative sentiment to keep tuition low.

North Carolina State University

Source: Lisa Clough, Budget Director, and George Dixon, Director of Admissions

There is no enrollment cap although enrollments have been stable the last few years. All sixteen of the University of North Carolina campuses are expected to grow substantially to handle the anticipated enrollment growth of 38,000 in the next decade. NC State is now 27,400 headcount students and the central administration wants them at 31,000 in five years, and would even prefer an enrollment of 35,000.

Funding Mechanisms

- Biennial budgets, with virtually automatic increases for salaries. The only question is the percentage increase. A very pro-education state climate helps insure the increases.
- There is a complex funding formula matrix that considers 12 points, including enrollment, level of instruction, and cost of discipline.
- There is a \$3.4B bond issue on the November ballot. N C State would get about \$400M of that and use much of it for building renewal.
- There is some funding for specific initiatives. The state coordinating board or regents will tell Us to prepare funding proposals, such as for agriculture. Funding may not be all requested, and then divided proportionately. She said Us cooperate with each other under board's direction.

Ohio State University, Columbus

Source: Alice Stuart, Office of Institutional Analysis, and Lee Walker, Director of Budget.

No effective campus cap now. Campus at one time about 55,000 and has downsized to 48,000, with 36,000 undergraduates. The campus will experience future decreases in the size of the freshman class for quality purposes. Goal is about 5,800 new freshmen each fall.

Funding Mechanisms

- Biennial budget, with a year-long consultation process among state Us prior year to develop request. Legislature uses an extremely complex subsidy formula for most funding, including cost of education, plant fund needs, level of instruction, cost of discipline, enrollment, etc.
- Outside the subsidy, there are some other ways to get additional resources.
- First, tuition goes up 6 percent every year—maximum limit, but there every year recently. Local trustees for each institution set the amount of tuition.
- They do use peers for benchmarking, but only in third year of this.
- Have a new series of three challenges, aimed at giving Us incentives for performance. The “Success Challenge” has two parts, \$ per headcount student that graduate when in an at-risk category, meaning they qualify for Ohio Instructional Grant. There is a pool of money appropriated, which is spread proportionately among Us. Another aspect of Success is \$ per headcount student that graduate in 4 years + quarter, with consecutive enrollment. Again, a pool of money, spread among Us.
- Second, an “Access Challenge,” but only to community colleges and branch campuses, essentially a subsidy of tuition so students not pay more than 3% increase, even if total tuition increase is 6%.
- There is a Research challenge, a pool of money spread among Us according to amount of grant and contract dollars they bring. Ohio State gets 75-80 percent of this pool.
- Finally, grad students are declining because of the economy. There is agreement in budget legislation that 10.74% of total higher education budget goes to grad programs, regardless of enrollments. Enrollments up in business and education, but down in engineering, computer science, etc.

University of Texas Austin

Source: Marsha Moss, Assistant Vice President and Director of the Office of Institutional Studies.

Although Texas-Austin has no mandated enrollment cap, they are carefully managing enrollment to remain between 48 and 49 thousand headcount students.

Funding Mechanisms

- Texas-Austin has formula-based funding. The formula is based on Course Level (Lower Division, Upper Division, Masters and Doctoral) and Discipline. For example, doctoral level courses are funded higher than lower division courses. Also Engineering, Sciences, and Medical courses are funded higher than other disciplines.
- Texas-Austin has never been fully funded via their formula. They are working to get full funding from the state.
- Texas has a Telecommunications Infrastructure Fund (TIF) which currently funds only K-12. They are working to appropriate some of this funding for Higher Education.
- Internally, students take too few classes during the semester and remain at the university too long. Texas-Austin is encouraging students to take heavier course loads and graduate sooner.
- Texas does not give standard cost of living increases. However, the university does ask for increases through the legislative process.
- Some programs are separately funded, like the observatory and the marine sciences program. Currently, the university is also seeking line-item funding for programs to improve the undergraduate experience and lower student-faculty ratios.
- Texas is currently in the middle of a \$1 Billion fund-raising campaign. Recently a constitutional amendment went into place which changed the endowment income practices. The amendment allowed additional items as income, allowed more aggressive investing, and increased the payout percentage to the universities.
- Tuition and Fees are increased regularly.

University of Virginia

Source: Michael Cline, Budget Manager, Budget Office

Funding Mechanisms

The University of Virginia does not have an enrollment cap, but they strive to keep their undergraduate enrollment at approximately 12,000 students (based on headcount).

- In 1999-00, state appropriations accounted for 14% of the university's operating budget. UV relies heavily on non-state funding such as revenue from the university medical center, sponsored programs, and gifts to the university.
- UV receives no formula-driven state funding. Instead, the university receives nearly all of its state funding in response to specific requests. The university is currently proposing a formula-based system with the help of a consultant. It is hoped that this system will provide the university with a more predictable funding base.
- UV is also proposing 6-year agreements with the state whereby the university would receive a certain level of funding in exchange for meeting certain performance criteria (regarding, for example, graduation rate and length of stay at the medical center, in addition to other more subjective measures).
- UV is attempting to gain the flexibility to set their own tuition rates. The university currently has the ability to increase out-of-state tuition, but the in-state tuition rate has been frozen.

West Virginia University

Source: Rob Lyons, Institutional Research Analyst

Funding Mechanism

The West Virginia legislature recently passed Senate Bill 653 which replaces university funding based on enrollment with a funding mechanism based on the funding levels for a set of peer institutions. This system is very new and currently untested. The peer institutions will likely be a group of universities in the Southeast region of the country. The new system is also likely to be performance-based (retention and graduation rates, etc). Instead of receiving funding for enrolling more students, WVU would gain funding for doing good things with the students they have.

In addition, WVU had goals to get their faculty's salaries at 90% within their region (which is the lowest in the country). However, salary growth would be through reallocation rather than new funding.

University of Wisconsin - Madison

Source: Jim Bolton, Institutional Planner, Office of Financial Policy and Analysis

Funding Mechanism

The University of Wisconsin - Madison has received a temporary increase (See the attached pages for a complete description of the initiative.) in its funding following the approval of a special budget initiative, the Madison Initiative. Under this plan, the state will provide new funds through state appropriations and tuition revenue, and the university is committed to raising matching funds through private support.

**Summary of Survey Results
Re: Funding Mechanisms at selected Research Universities**

University	Faculty Salaries	Research Tech Transfer	Peer Funding	Formula Funding
Illinois	Median of Peers	DP's research leverage	—	
Maryland	peers	--	\$1 Student peer funding	
Michigan	Lump Sum Appropriation	<ul style="list-style-type: none"> • Bio-Tech Corridor • Lump Sum Appropriation 	Lump Sum Appropriation	Lump Sum Appropriation
UNC Chapel Hill	peers	Bio-Tech Initiatives		yes
NC State	peers	Specific Initiatives		yes
Ohio State	peers	Research challenge state dollars based on research dollars earned	Peers for benchmarking	Complex formula
UT Austin	peers			Formula funding
Univ. of Virginia	peers	DP's * No Formulas*	—	proposed
WVU		*New*	Fund based on peers	
Univ. Wisconsin Madison	* Madison Initiative—Public/Private Partnership 4 year program combining state support, student support and private matching			
Total	Virtually all use peers as basis for salary increases	6 universities	3 universities	3 universities proposed

Funding Recommendations

Over the last ten years, the major source for new state revenue for the universities has been enrollment-growth funding. The enrollment growth formula (22:1) only provides revenue for marginal costs and does not fund the full costs of growth. The task force has projected significant new growth in university enrollments which cannot be sustained with a marginal cost formula. Further, the main campuses of our universities are approaching an optimal size and a funding mechanism which is not based on growth is required. The subcommittee on funding of the Governor's Task Force on Higher Education therefore recommends:

- 1) The 22:1 formula be examined and revised as needed to more fully recognize the real costs of enrollment growth.
- 2) That the formula be fully funded.
- 3) That the universities' funding, beyond growth, be tied to a market based analysis utilizing benchmark data from peer institutions. The goal of the funding model should be the average of funding on a per student basis of each institution's ABOR approved peers. This funding should include both tuition and state general fund. The assumption for tuition should include the premise of raising tuition for resident students to the top of the bottom third of senior public institutions in the United States. The general fund number reflects the remaining amount required to close the gap after tuition revenue is calculated. This approach (both tuition and general fund) should be phased in over a 4 year period. (Note: proceeds from proposition 301 would reduce the state appropriations required to reach the goal of 50th percentile of peer funding.)

Capital Funding Sources by State

Compiled by the office of Joseph C. Fisher,
Asst. Vice President for Facilities and Services, West Virginia University

State	State Appropriated	Tuition	Public/Private Partnerships/Gifts	Special Appropriation	General Obligation Bonds	Revenue Bonds	Fees	Debt Service	Lease/Purchase Agreements	Property Tax	Overhead Receipts	Federal Grants	Federal Mineral Royalties	Gambling	Utility Receipts Tax
Arizona															
Instructional	x					x									
Auxiliary			x					x	x						
California															
Instructional						x									
Auxiliary						x	x								
Delaware	x														
Florida															
Instructional					x							x			x
Auxiliary			x			x									
Georgia	x														
Hawaii															
Instructional						x									
Auxiliary							x								
Idaho															
Instructional	x					x	x								
Auxiliary						x	x								
Illinois	x	x	x	x											
Indiana															
Instructional	x		x			x									
Auxiliary							x								
Iowa	x		x			x								x	
Kansas	x		x				x			x					
Kentucky	x														
Louisiana	x														
Maryland	x				x	x									
Missouri	x	x			x	x	x								
Nevada	x	x	x		x	x	x							x	
New Hampshire															
Instructional	x	x									x	x			
Auxiliary							x								
New York	x				x	x									
North Carolina*	60%		x				x				x				
Oklahoma					x	x									
Oregon			x			x	x								
Rhode Island						x									
Tennessee	x						x								
Vermont	x		x				x								
Virginia	16%	2.1%	22.2%				7.4%	43.9%			7.5%				
West Virginia		x					x								
Wyoming	x		x									x	x		

Instructional – classrooms, labs, offices

Auxiliary – residence halls, parking structures, student unions, recreation

* Currently seeking \$7 billion Bond for capital plan

Appendix E

**Projected Enrollments in Arizona Higher Education
2000-2020**

Prepared for the
Governor's Task Force on Higher Education
With the Assistance of
Jim Farmer, Systems Research Inc.
Consultant to the Task Force

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Executive Summary

Enrollment Projection Model

An enrollment projection model has been developed to predict the future number of students who will enroll in an Arizona institution of higher education.¹ The model tells us that by the year 2020, enrollments in higher education may be expected to increase between 120,000 and 162,000 students from the approximately 310,000 students enrolled in the year 2000. Projections based on the “most likely” set of assumptions are shown in Figure 1. Enrollment in private higher education is expected to almost double during this period while community college enrollments would increase 33% and public university enrollments would increase 48%.

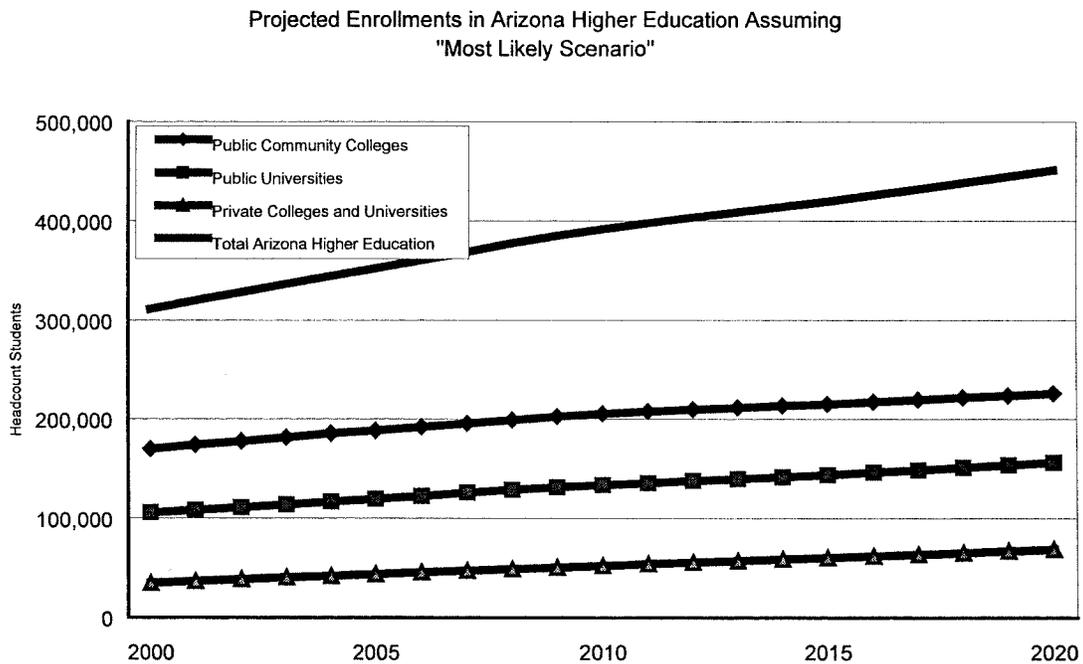


Figure 1 – Projected Enrollments in Higher Education Assuming “Most Likely” Scenario

Validation of Model Based on Population Projections

In order to help validate the results from the Arizona Enrollment Projection Model, these results were first compared to population projections. Then they were compared to enrollment projections based on projected increases in Arizona’s population. To the extent that the population-based enrollment projections are close to those produced by the model, we can more safely conclude that the model (which is more complex and

¹ The assumptions underlying this model are described in Attachment 1.

racial/ethnic composition of the population is expected to change, increasing the proportion of the population with lower participation rates³

A comparison of population-based enrollment projections and the projections from the enrollment model is shown in Figure 3. Since they are based on a different projection methodology, the results of the population-based projections help to validate the model's projections.

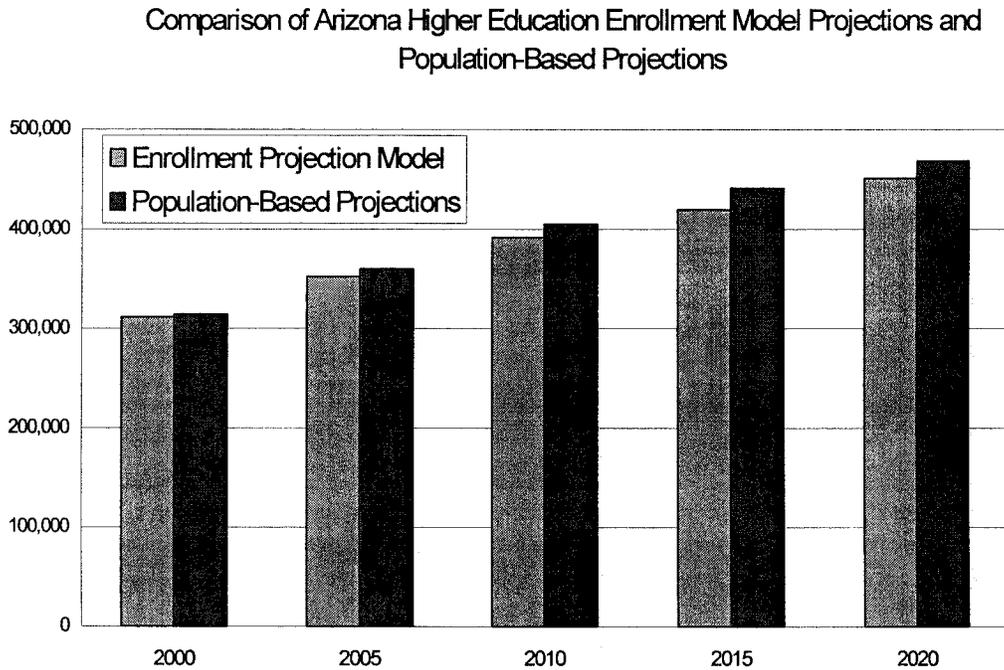


Figure 3 – Comparisons of Enrollment Projection Methodologies

³ A participation rate for a given population group is defined as the percentage of that group that is enrolled in higher education.

Part I: Arizona Enrollment Projection Model

Summary

A model for projecting Arizona's enrollments in higher education that provides a projection of enrollments for the three major sectors of higher education found in Arizona - public universities, public community colleges, and private institutions of higher education – has been developed. The variables that influence the model's projections include future population growth and demographic shifts, patterns of behavior regarding higher education, policies of higher education institutions, and changes in the structure of higher education and the associated behaviors of potential students.

No individual and no model can precisely predict the future. Thus, this model has been used to provide several possible projections of enrollment based on different assumptions about some of the variables that can influence enrollment.

Variables Affecting Enrollment Growth

Changes in a state's population are the major driver of enrollment growth or decline. Beyond that, the total number of students enrolled in higher education is a function of the individual decisions of hundreds of thousands of individuals. Their decisions about whether to enroll in higher education in Arizona are shaped by many factors: their educational backgrounds and levels of preparedness, their need for additional education or additional credentials, and their access to higher education opportunities that meet their needs (in terms of financial access, geographic access, and the constraints on access posed by family and work obligations).

Because these factors are not only different for each individual but because they tend to be different for certain age and ethnic groups, the overall anticipated enrollment of students in higher education will change according to the composition of the population. This enrollment projection model takes into account changes in the composition of the population, both in terms of age and race/ethnicity.^{4,5}

⁴ For the purposes of this analysis, the population is broken into five racial/ethnic categories: African American, Asian American, Latina/Latino, Native American, and Anglo. In addition, projections are made separately for two additional groups: those for whom race/ethnicity is unknown and non-resident aliens (the latter is treated as a unique group by the National Center for Education Statistics, which requires that enrollments be broken out for non-resident aliens but does not require this subgroup to be differentiated on the basis of race/ethnicity).

⁵ The extensive efforts at both the community colleges and public universities to increase access for previously underserved populations provide a clear justification for assuming that college-going rates will increase, since these efforts have as their goal increasing access for this growing portion of the population.

College-Going and Retention Rates

As a result of the initiatives to increase the percentage of K-12 students who graduate and are better prepared for college, and because of the efforts of the colleges and universities to improve student retention, it is very likely that there will be increases in college-going and retention rates. Enrollment projections based on three different scenarios – or sets of assumptions - have been done for both Arizona community colleges and Arizona’s public universities. The first - the “current trends” scenario - assumes that these initiatives will have no impact, and college-going and persistence rates will remain unchanged. The second - the “most likely” scenario - assumes moderate increases in college-going and retention rates. The third scenario assumes that there will be more substantial increases in these rates. Projections based on these three scenarios are presented in Figure 4 for Arizona’s community colleges and in Figure 5 for Arizona’s public universities.

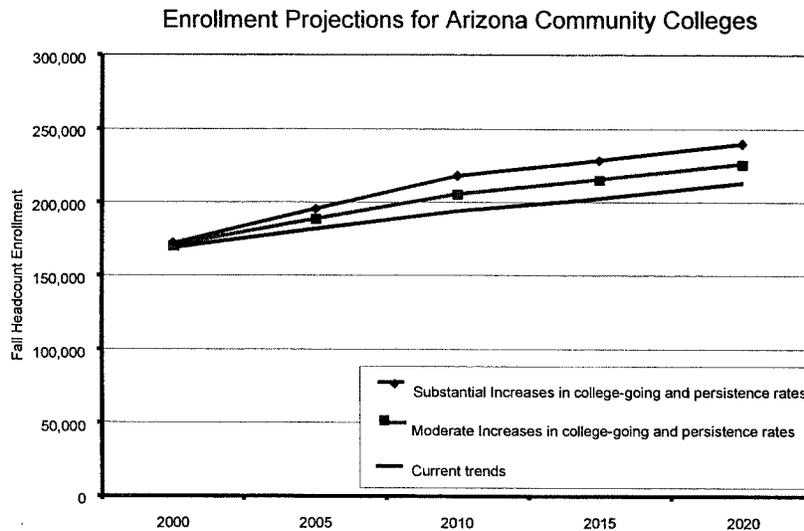


Figure 4 – Projected Enrollments, Arizona Community Colleges

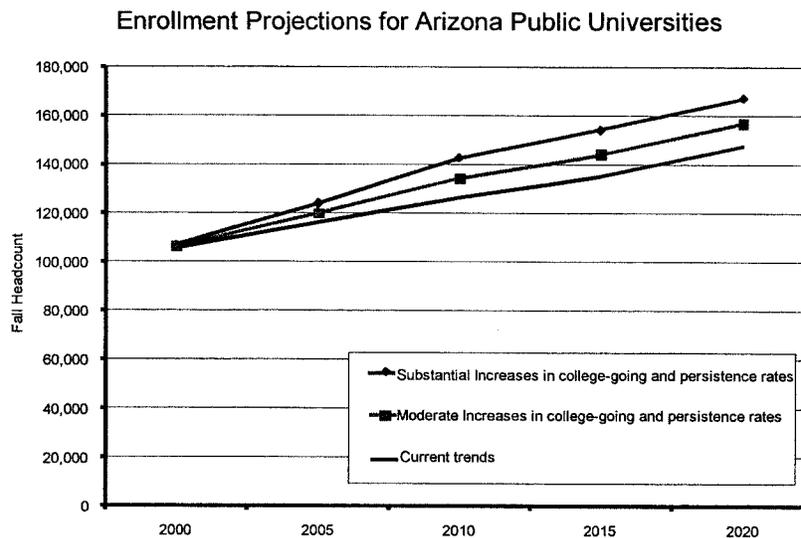


Figure 5 – Projected Enrollments, Arizona Public Universities

Looking at higher education in Arizona as a whole, the model suggests that from the year 2000 to the year 2020, enrollments in higher education may be expected to increase by between 120,000 and 162,000 from approximately 310,000 students in the year 2000 – that is, by 39% to 52% over the next two decades. Both historical enrollments and projections under the “most likely” scenario are presented for all higher education in Arizona in Figure 6.

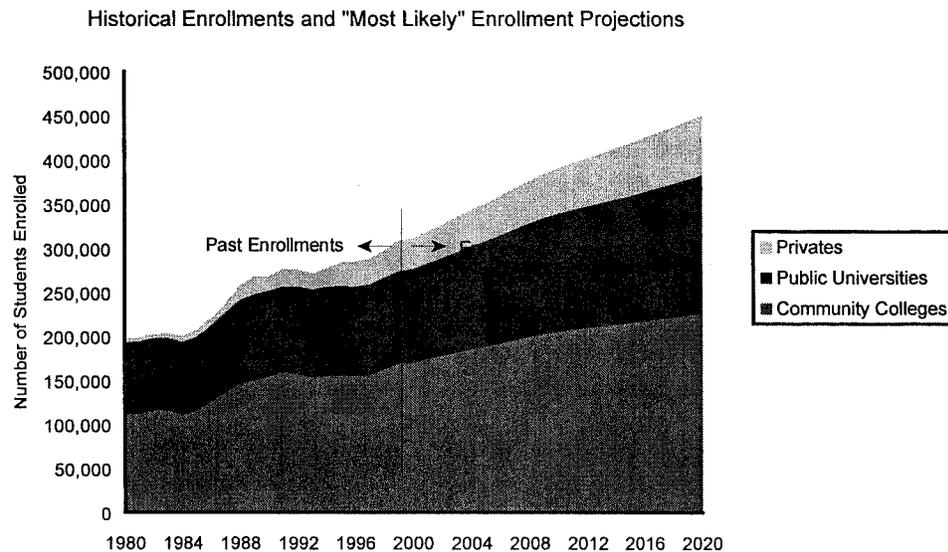


Figure 6 – Historical Enrollments and Enrollment Projections

Additional Variables

The effect of additional variables that can reasonably be expected to influence enrollments may not be adequately reflected in the enrollment projection model. Two such variables are the growth in new modes of instructional delivery and the level of institutional funding.

Growth in New Modes of Instructional Delivery

One factor that may cause greater growth in higher education enrollments than indicated in the any of the three scenarios discussed is the increased growth in the use of new modes of instructional delivery. Arizona colleges and universities have institutions and programs leading the nation in the utilization of these new instructional methodologies. Across the nation, programs with new instructional delivery methods are growing at rates substantially above average higher education growth rates, and this phenomenon is particularly evident in Arizona. While the projection model includes data for programs and institutions using these new methods, these programs do not yet significantly impact total enrollments because of their relatively small size. If the rate of growth in the use of new instructional delivery modes continues to increase, actual enrollments may be substantially above the total enrollments projected by the model for any of the three scenarios.

The Impact of Institutional Funding on Enrollments

The potential of the effect of the funding variable on enrollments can be demonstrated by the effect of changes in funding on community college enrollments during the 90s. In 1992-1993, enrollment in the Arizona community colleges dropped suddenly after having consistently grown along with population growth. Although the population continued to grow, for six years, community college enrollments still remained below the level reached in 1991-92, prior to the drop. The lack of growth during this period may, in part, be attributable to lowered state funding.

Problems in the state budget in the early 90s led to cuts in state funding for the community colleges. To compound the effects of overall lower funding, additional cuts were made during the second half of the 1992-93 and 1993-94 academic years, after financial commitments to regular faculty had already been made. When funding was lowered – particularly when the mid-year cuts were made – the largest expenditure category that could be cut was that for adjunct faculty, and cuts in that category resulted in many classes being dropped. The reduction in classes made the funding problems worse because the reduced number of student enrollments produced a reduced stream of tuition revenue.

College officials believe that the effects of these budgetary problems in the state were compounded for several more years as a result of reduced student confidence that scheduled courses would in fact be offered. Additionally, some of the more costly programs (e.g., engineering technology and physical therapy assistant training) were dropped during this period, so the effects of reduced funding rippled on for several years.

At the same time, in part to cover funding shortfalls, tuition at Arizona community colleges increased significantly (from 1991-92 through 1997-1998, tuition almost doubled). Research indicates that, not surprisingly, increased tuition leads to reduced enrollment, particularly among students of lesser means.

Model Methodology

Community Colleges

The Enrollment Projection Model projects community college enrollments on the basis of historical college-going rates of working adults (defined as 17 to 49 year-olds) along with projected population growth for that age range. Since college-going rates vary dramatically between different racial/ethnic groups, and since the different racial/ethnic groups are anticipated to grow at noticeably differing rates over the next few decades, these projections are calculated using the average historical college-going rate and the projected population for each racial/ethnic group separately.

Possible Limitation of Current Methodology

It can be argued that, particularly given the changing economy and the increase in the number of times a person is likely to change jobs over a lifetime, the population of 50-65 year-olds should be included in with the 17 to 49 year-old population, as the college-going rate of the older group may begin to approach that of the younger group. Given data constraints, it is not currently possible to use the enrollment model to project future enrollments based on the assumption that the college-going rates of 50-65 year-olds will approximate those of younger adults, but it is possible to add such a projection as an additional scenario for the population-based projections. The population-based projections, including a version based on this assumption, are presented in Part II of this report.

Arizona Public Universities

The methodology for projecting enrollments for the Arizona University System is somewhat more complex than that for the other two sectors in that it incorporates a broader range of data. For this portion of the model, students are broken down into one of four categories⁶:

- On-campus undergraduates
- Off-campus undergraduates
- On-campus post-baccalaureate students
- Off-campus post-baccalaureate students

The level of enrollment for these four categories of students appears to be determined by two different sets of dynamics. In particular, enrollment of on-campus post-baccalaureate students and off-campus undergraduate and post-baccalaureate students appears to be a function of program availability. That is, enrollment levels of these three groups of students appear to be more policy-driven than population-driven. As a result, enrollments for these three types of students are projected on the basis of the expected growth of either the number or capacity of programs for such students.

The dynamics behind the enrollment levels of on-campus undergraduates are determined by different, albeit reasonably well-understood, factors. At any point in time, there are three types of on-campus undergraduates: New freshmen, new transfer students, and continuing students. In this model, the number of students is projected as follows:

- The number of new freshmen is projected on the basis of the historical college-going rates of recent high school graduates along with the projected future numbers of high school graduates.

⁶ It should be noted that, although the on-campus/off-campus distinction does not precisely parallel a distinction on the basis of the mode of educational delivery, it may provide some suggestions regarding the provision of instruction to different populations, as it is more likely that those taking their courses off-campus are place-bound or time-bound "non-traditional" students, perhaps working adults, and therefore are taking advantage of newer, less-traditional modes of educational delivery.

- WICHE (The Western Interstate Commission on Higher Education) has provided what have traditionally been the most accurate projections of high school graduates in western states. WICHE currently provides projections of high school graduates through the year 2011-2012. These projections, along with an extrapolation of these projections through 2019-2020, are used as the best available projection of Arizona high school graduates.
- The number of new transfer students is projected on the basis of the historical transfer rates of Arizona community college students along with projected community college enrollments.
- The number of continuing students is projected on the basis of the number of new students who are projected to enter the system and average historical “continuation rates” (the percentage of one year’s freshmen who become next year’s sophomores, for example).

Private Colleges and Universities

The private sector in higher education comprises a wide variety of educational institutions. One important distinction to be made is between more traditional institutions – fairly small traditional liberal arts colleges, for example – which usually grow at relatively slow rates, and new market leaders, which offer non-traditional learning delivery and which have proven to be able to grow rapidly in response to growing demand from working adults for educational opportunities that fit their place- and time-constrained lives.

The projections for the private sector, then, are broken into two components (one for the traditional portion of the sector and the other for the new non-traditional portion). Projections are made on the basis of recent growth rates. Given the lack of a lengthy historical record from this sector, only one projection is provided, as less is known about what variables might lead to higher or lower growth levels.

The details of the projections are presented in Table 1. Those for the community colleges are presented in Figure 7, and those for the public universities are presented in Figure 8.

**Arizona Enrollment Projection Model
Enrollment Projections Under Varying Assumptions**

	2000	2005	2010	2015	2020	2000-2010		2010-2020		2000-2020	
						# Change	% Change	# Change	% Change	# Change	% Change
Scenario 1 – “More Substantial Changes”											
Community Colleges	172,132	195,302	218,052	228,390	239,847	45,920	26.7%	21,795	10.0%	67,714	39.3%
Universities	106,602	123,656	142,621	153,987	167,149	36,019	33.8%	24,528	17.2%	60,547	56.8%
Private Colleges and Universities	34,982	43,882	52,230	60,415	68,656	17,248	49.3%	16,426	31.4%	33,674	96.3%
Total Arizona Higher Education	313,716	362,840	412,903	442,792	475,652	99,187	31.6%	62,748	15.2%	161,935	51.6%
Scenario 2-“Most Likely”											
Community Colleges	170,432	188,634	205,445	215,186	225,980	35,013	20.5%	20,535	10.0%	55,548	32.6%
Universities	106,069	119,748	134,085	144,048	156,754	28,016	26.4%	22,669	16.9%	50,686	47.8%
Private Colleges and Universities	34,982	43,882	52,230	60,415	68,656	17,248	49.3%	16,426	31.4%	33,674	96.3%
Total Arizona Higher Education	311,483	352,264	391,760	419,649	451,390	80,277	25.8%	59,630	15.2%	139,907	44.9%
Scenario 3 – “Continuation of Current Trends”											
Community Colleges	168,741	182,162	193,510	202,684	212,852	24,769	14.7%	19,342	10.0%	44,111	26.1%
Universities	105,538	116,000	126,272	135,107	147,411	20,734	19.6%	21,140	16.7%	41,873	39.7%
Private Colleges and Universities	34,982	43,882	52,230	60,415	68,656	17,248	49.3%	16,426	31.4%	33,674	96.3%
Total Arizona Higher Education	309,260	342,044	372,012	398,207	428,919	62,751	20.3%	56,907	15.3%	119,658	38.7%

Table 1 – Arizona Enrollment Projection Model Projections

Historical Enrollment and Enrollment Projections for Arizona Community Colleges

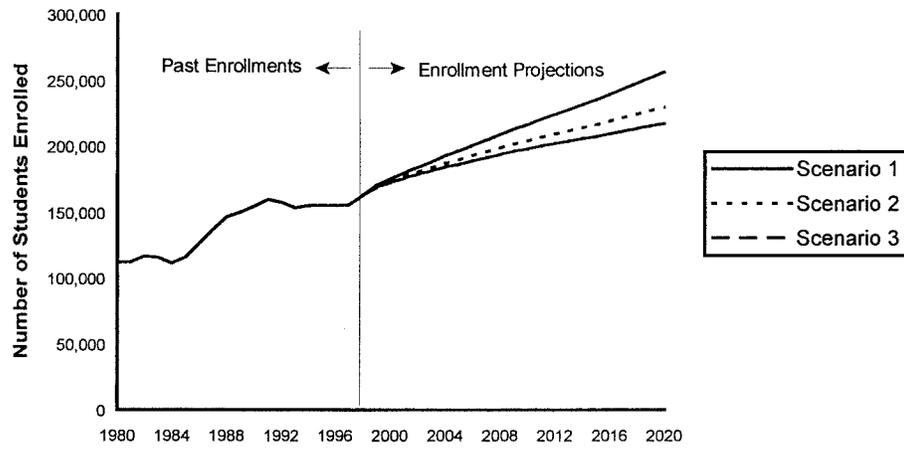


Figure 7 – Historical Enrollments and Enrollment Projections Arizona Community Colleges

Historical Enrollment and Enrollment Projections for Arizona Public Universities

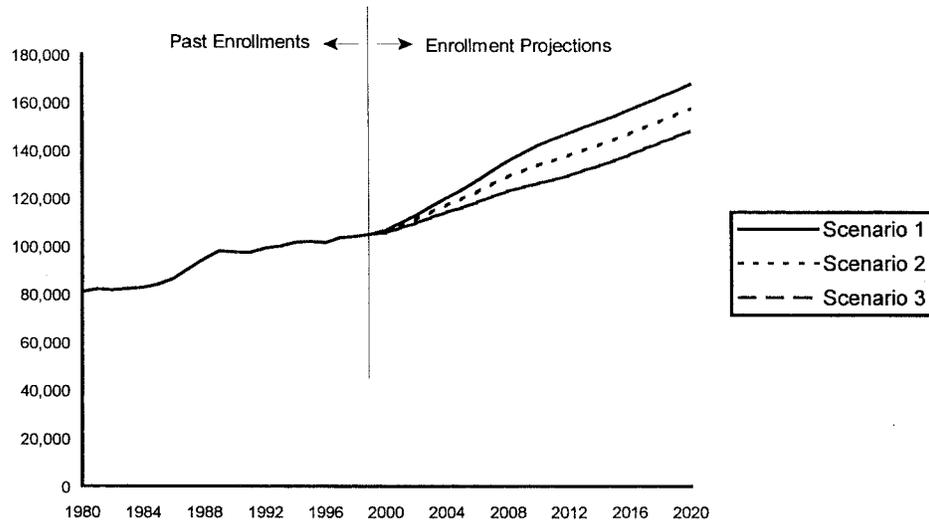


Figure 8 – Historical Enrollments and Enrollment Projections Arizona Public Universities

Part II: Population-Based Enrollment Projections for Arizona Higher Education

Summary

One of the most common methods used to validate an enrollment projection model is to compare results to projections made solely on the basis of projected population changes. Such population-based projections have been used to validate the Arizona Enrollment Projection Model. They are explained in this section.

Population-Based Projections

The projection for each sector of higher education was based on projected changes in the typical population for that sector. The projections made here, as those produced by the enrollment projection model presented in Part I, take into account changes in the composition of the population, both in terms of age and race/ethnicity.

On the basis of projected population changes, the number of students in Arizona higher education is expected to increase from 312,000 in 2000 to 405,000 in 2010 and to 468,000 in 2020. This is an increase of 29% by 2010 and 49% by 2020, compared to a population increase of 24% by 2010 and 48% by 2020. (Depending upon the underlying assumptions, population-based projections could go as high as 415,000 in 2010 and 480,000 in 2020 or as low as 380,000 in 2010 and 430,000 in 2020. Variations in assumptions are discussed below, in the sections on community colleges and public universities.⁷) Historical and projected enrollments derived from this population-based methodology are shown in Figure 10 for the three sectors of Arizona higher education, and the projections are summarized in Table 2.

Historical Enrollments and Population-Based Enrollment Projections for Arizona Postsecondary Education

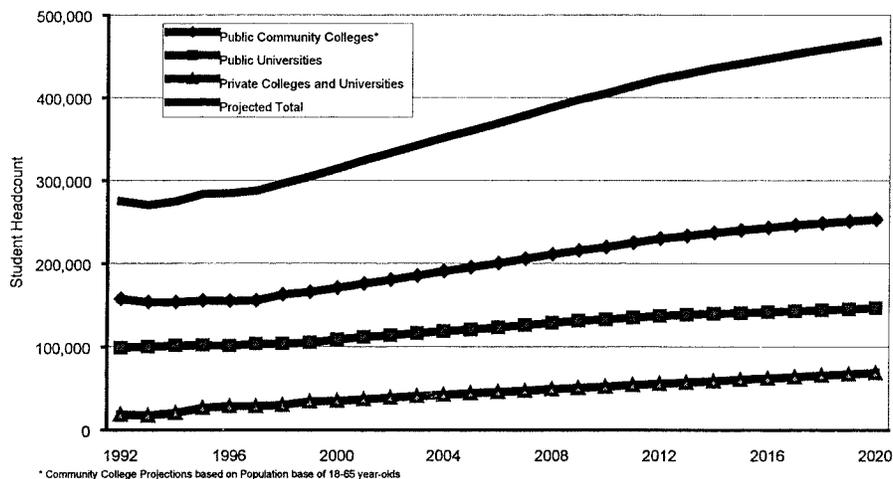


Figure 9– Historical and Projected Enrollments, Arizona Higher Education

⁷ The combination of projecting community college enrollments on the 17-65 year old population base and the assumption of population-driven growth for post-baccalaureate students at the public universities produces the high projections, and the combination of using the 17-49 year-old population base and growth trend derived projections for post-baccalaureate students produces the low projection.

Population-Based Enrollment Projections for Arizona Higher Education

Sector	2000	2005	2010	2015	2020	2000-2010		2010-2020		2000-2020	
						# Change	% Change	# Change	% Change	# Change	% Change
Community Colleges*	170,747	195,287	220,104	240,180	253,222	49,357	28.9%	33,118	15.0%	82,475	48.3%
Universities	108,654	120,815	133,049	140,680	146,612	24,395	22.5%	13,563	10.2%	37,958	34.9%
Private Colleges and Universities	34,982	43,882	52,230	60,415	68,656	17,248	49.3%	16,426	31.4%	33,674	96.3%
Total Arizona Higher Education	314,383	359,984	405,383	441,275	468,490	91,000	28.9%	63,107	15.6%	154,107	49.0%

*Community College projection assumes population base of 18-65

Table 2 – Population-Based Projections, Arizona Higher Education

Arizona Community Colleges

Historically, enrollments of individuals age 50-65 have been lower than those of younger working adults; therefore the Enrollment Projection Model projects community college enrollments on the basis of historical college-going rates of working adults, where working adults are defined as the population between 17 and 49 years of age. Population-based projections are presented here that use this same population base.

With the changing economy, however, and the associated increase in the number of times a person is likely to change jobs over a lifetime, it can be argued that the population of 50-65 year-olds should be included in with the 17 to 49 year-old population, as the college-going rate of the older group will begin to approach that of the younger group. Given data constraints, it is not currently possible to use the enrollment model to project future enrollments based on the assumption that the college-going rates of 50-65 year-olds will approximate those of younger adults, but it is possible to add such a projection as an additional scenario for the population-based projections presented here.

Given the assumption that “working adults” can be defined as those from age 17 to 65, enrollment for the Arizona public community colleges is expected to increase from an estimated 170,000 in 2000 to 220,000 in 2010 and 253,000 in 2020. This is an increase of 29% by 2010 and 48% by 2020, compared to a total population growth of 24% by 2010 and 48% by 2020. The projection using the 17 to 49 population base indicates that enrollments in the Arizona public community colleges will increase from an estimated 168,000 in 2000 to 194,000 in 2010 and 233,000 in 2020. This is an increase of 15% by 2010 and 26% by 2020, compared to a total population growth of 24% by 2010 and 48% by 2020.

Historical enrollments and enrollment projections based on both population bases are shown in Figure 10.

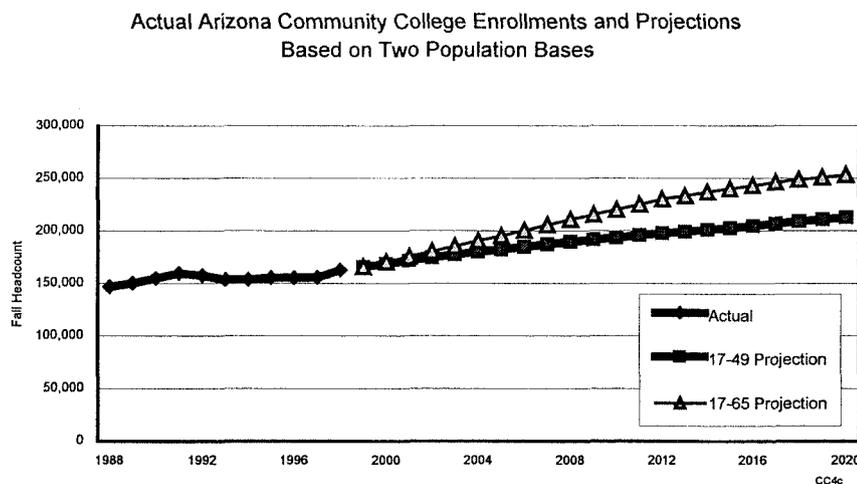


Figure 10 – Historical and Projected Headcount Enrollment, Arizona Public Community Colleges

Arizona Public Universities

Summary

Based on historical enrollment and population growth, headcount enrollment for the three public universities within the Arizona University System is expected to increase from the reported 1999 fall headcount of 104,931 students to 133,000 in 2010 and 147,000 in 2020. This is an increase of 27% by 2010 and 40% by 2020. The college age population (17-24) may increase by 30% through 2010 and by 47% by 2020.

Projections

Projected enrollments are shown in Figure 11 for the Arizona University System. This projection assumes that Arizona University System post-baccalaureate enrollments grow at the same rate as in recent years, regardless of the rate of population growth.

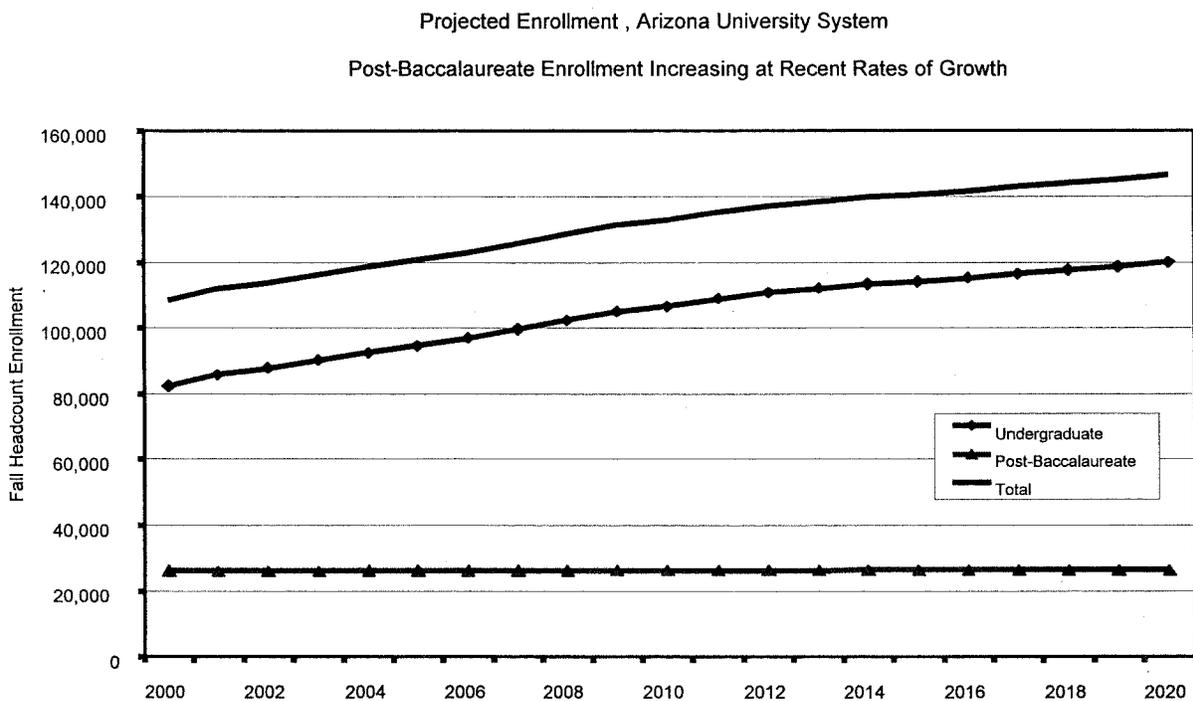


Figure 11 - Projected Enrollment for the Arizona University System with Post-Baccalaureate Enrollment Increasing at Recent Rates of Growth

If post-baccalaureate enrollment were to grow in proportion to population growth rather than following recent rates of growth, the projected enrollment would increase from 104,931 in 1999 to 143,000 in 2010 and 161,000 in 2020. These would be increases of 36% and 55% respectively. The enrollment projection based on population-based post-baccalaureate student projections is shown in Figure 12.

Projected Enrollment Arizona University System
 Rate of Post-Baccalaureate Growth Based on Population Growth

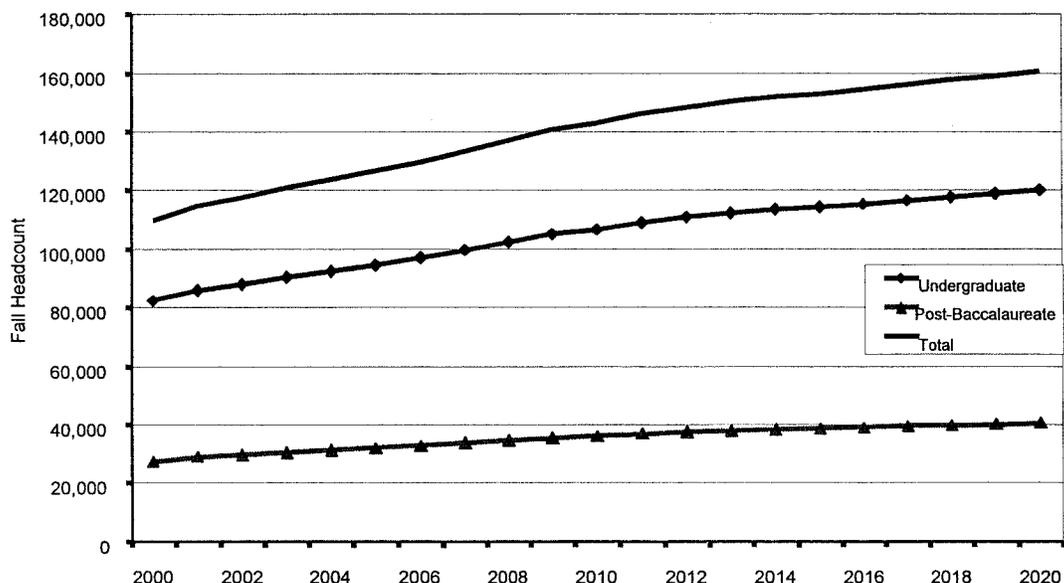


Figure 12 – Projected Enrollment for the Arizona University System
 Post-Baccalaureate Growth Rates Based on Population Growth

The calculation of recent post-baccalaureate enrollment growth was based on a linear projection of enrollment growth from 1992 through 1999. This trend shows post-baccalaureate enrollments increasing from 25,936 in 1999 to 26,325 in 2010 and 26,523 in 2020—growth of about 2% compared to undergraduate growth of 16%. Because post-baccalaureate enrollment is based on the capacity for research rather than market demand, these projections might be argued to better represent current practice. If the demand for post-baccalaureate education increases and the research capacity becomes available, post-baccalaureate enrollments can be expected to increase based on population.

In addition, there is a trend toward post-baccalaureate programs that terminate with a masters degree or a certificate. Enrollment in these programs, such as the MBA for business administration, has sharply increased nationally. These types of programs often do not require research capacity for the educational process. If more terminal post-baccalaureate degrees and certificates are offered and the post-baccalaureate programs expanded, enrollments should increase as those of “emerging markets.”

Arizona Private Colleges and Universities

Growth in private colleges and universities may exceed that in the other sectors due to very rapid growth of a few private institutions (which will be called “market leaders”). From the year 2000, private college and university enrollments may grow a projected 49% by 2010 and may almost double by 2020.

Summary

Based on enrollment information available for Arizona private colleges and universities, the headcount enrollment is expected to increase from the 1999 estimate of 34,250 to 52,230 in 2010 and 68,656 in 2020. During this period traditional private colleges and universities may follow the historic trend adding 4,700 students. Market-leaders, offering non-traditional learning delivery, may increase almost 30,000 students, averaging an 8% per year growth. This is more than four times the projected 2% growth for private colleges offering their traditional method of instructional delivery. Estimated historical and projected enrollments are shown in Figure 13.

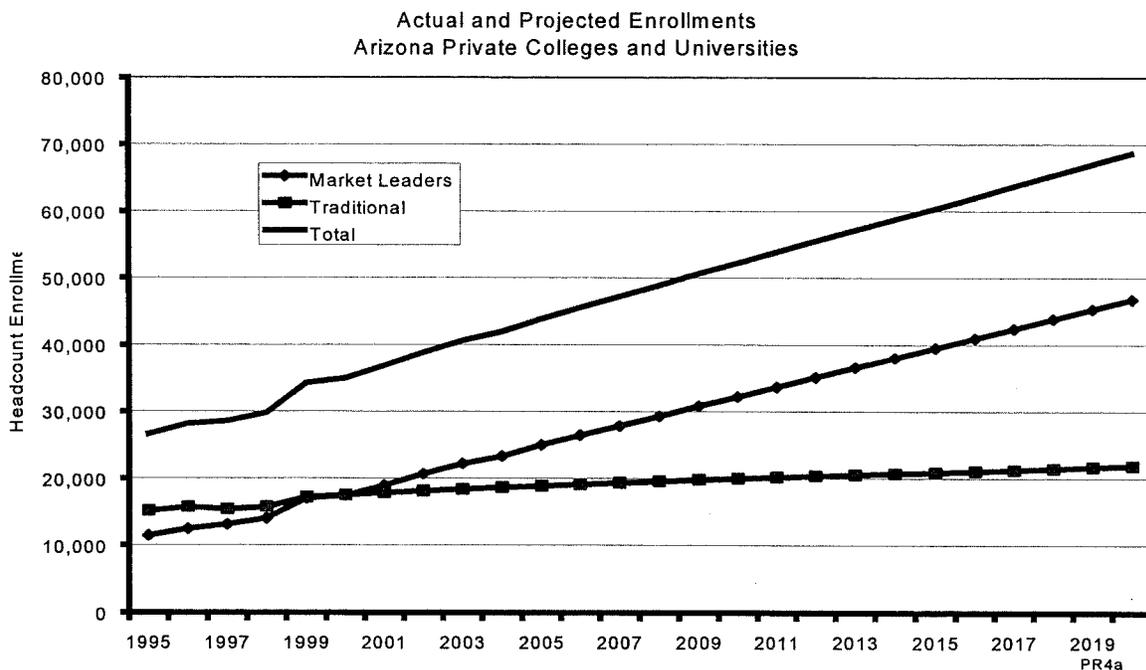


Figure 13 – Actual and Projected Enrollments, Arizona Private Colleges and Universities

Background

The enrollment figures presented here are estimated annual or fall headcount students. Because many of the colleges and universities operate on non-traditional calendars or offer instruction using non-traditional delivery, headcount enrollments are not as precise a measure as they would be for traditional institutions.

The enrollment estimates are based on data provided by the colleges and universities. Some have entered and left the higher education market in Arizona during this time. Enrollment data may be missing from others. However those institutions reporting constitute most of the enrollments in private colleges and universities.

The enrollment data do not include students taking courses—generally distance education—from colleges and universities not located or registered in Arizona. Based on national statistics, this number of students is negligible compared to students taking courses from colleges and universities located or registered in Arizona.

Projection Methodology

For purposes of projecting enrollments, institutions with higher than average enrollment growth were identified. These were classed as market leaders.

Projection of enrollment for the traditional segment was based on participation rates for the total Arizona population from 1992 through 1999. If the participation rates were to continue as they did in 1999, an additional 750 students would be enrolled in 2020. Because the participation rate in the traditional segment was at its highest in 1999, it would seem as if the enrollment of the traditional segment has not been impacted by the sharp growth of the market-leaders.

Projection of enrollment for the “Market Leader” segment of the private sector was based on 1995-1999 data regarding college-going rates in combination with population projections.

PART III Other Measures of Enrollment

Different Measures for Different Purposes

Several different measures of enrollment can be used depending upon the purpose of the measure. In the enrollment model presented in this report and in the population-based projection used to validate the model's results, enrollment has been defined as fall headcount. The fall headcount for an institution is the number of students enrolled on the 21st day of the semester at the public universities and on the 45th day for community colleges. This is the traditional measure of enrollment that has been used to compare institutions. The measure of enrollment which may be most useful to use for planning purposes is influenced both by the type of planning for which projections are being used and by the manner in which an institution delivers education.

Measures Other Than Fall Headcount

Another measure that has traditionally been used to compare institutions is fall full-time equivalent enrollment. Like fall headcount, full-time equivalent provides a "snapshot" of an institution at one point in time. The definition of full-time equivalent is based on the course load—measured in credit hours or clock-hour equivalent—of a student who has traditionally been assumed to be the typical full-time student – one who takes 15 units a semester. For most state purposes, a lower-division full-time equivalent represents 15 credit hours per term or 30 credit hours per academic year. Some use 15 credit hours for upper division, others use 12 credit hours, and some use 8 or 10 credit hours for graduate work; these reflect the more intense advanced coursework. The federal definition of full-time equivalent students is the number of full-time students plus one-third of the number of part-time students. This definition reflects a limitation on data collected by the standard federal survey, in which institutions are only required to report the number of full and part-time students at both the graduate and undergraduate levels. Students are not reported by the discrete number of credit hours taken, so it is not possible to use a credit hour formula to determine FTE.⁸ No consensus has emerged on a better federal definition. Full-time equivalent students has been used for measures of workload and similar purposes that match resources to enrollment. Unduplicated annual headcount is an additional measure of enrollment that has been used by community colleges as a measure of service level, especially for community

⁸ The following are the general federal definitions used to define these data:

Full-Time Student:

Undergraduate: A student enrolled for 12 or more semester or quarter credits, or 24 contact hours a week each term.

Graduate: A student enrolled for 9 or more semester or quarter credits, or students involved in thesis or dissertation preparation that are considered full-time by the institution.

First-Professional: As defined by the institution.

Part-Time Student:

Undergraduate: A student enrolled for either 11 semester or quarter credits or fewer, or less than 24 contact hours a week each term.

Graduate: A student enrolled for either 8 semester or quarter credits or fewer, unless involved in thesis preparation.

Full-time-equivalent (FTE) enrollment: FTE enrollment is estimated by adding one-third of part-time enrollment to full-time enrollment.

service programs. The unduplicated annual headcount is the number of unique students served by an institution during one year.⁹

Relationship between measures of enrollment

The relationship between fall headcount enrollment and annual headcount enrollment and full-time equivalent enrollments for any institution or even similar institutions was relatively stable through the 1960s. Subsequently a larger number of students were part-time, entered college in the spring, and took courses with non-traditional formats such as open entry-open exit, short courses, and intensive courses.

In Arizona the community colleges use 15 credit hours for a semester full-time student equivalent (FTSE) and 30 credit hours for an academic year full-time student equivalent. Courses that are not offered on a traditional term basis are reported separately so the fall and spring full-time student equivalents are a substantial, but not all, of the annual full-time student equivalents.

The Arizona University System uses 15 lower-division credit hours for a semester full-time equivalent and 30 for an annual full-time equivalent. Twelve and twenty four are used for upper division credit hours, ten and twenty for graduate credit hours.

Changes in College Enrollment Patterns Affecting Appropriateness of Enrollment Measure Used

The Arizona community colleges show a higher proportion of students enrolling in the spring semester than in the past, along with more students taking courses with non-traditional formats. For this reason, the fall headcount has not increased as rapidly as the full-time student equivalents, and the latter measure has been used for state funding.

This relationship is shown in Figure 14, where full-time student equivalents per fall headcount enrollment has increased 10.8% in the five years from 1993 to 1998—a growth of about 2% per year. This measure reflects the additional students in the spring term and in non-traditional instructional formats.

⁹ Given this definition, any student enrolled during the year will be counted. If that student takes one course in a summer session, she or he will be counted as one student. If a student is enrolled full-time for both fall and spring semester, that student will be counted as one student.

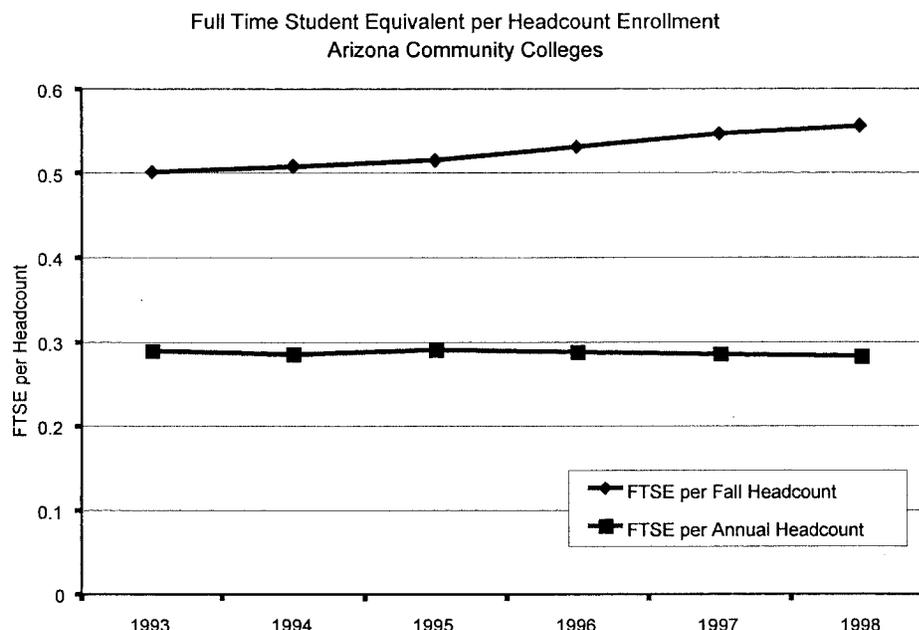


Figure 14 - Relationship between Headcount and Full-Time Student Equivalents,
Arizona Community Colleges

Figure 14 also shows the relationship between the number of full-time student equivalents and annual unduplicated headcount. This shows a small decline—less than one-half of one percent per year—over the five years. This decline reflects that the number of students is increasing more rapidly than the number of credit hours taken; that is, the average number of credit hours taken by each student is declining. These two observations are consistent with changes in the type of students enrolling at the community colleges. Increasingly, those enrolled are individuals who have to adapt education to their schedule and their capacity to take courses and who, as a result, end up taking fewer classes, on average, each semester or year.

If this trend continues, fall headcount enrollment, as projected, would underestimate the amount of resources that would be required on an annual basis to accommodate increased enrollments. If the trend observed from 1993 through 1998 were to continue over the next seven years, then the amount of resources required would increase 28% more (if resources required were calculated on the basis of FTSE as opposed to fall headcount).

If, however, the trend toward increasing the number of courses offered in non-traditional formats continues, the reporting classifications of the State Board would increase the annual full-time student equivalents per fall headcount since the student would not be enrolled for the fall headcount, but would take courses and generate FTSE.

The Universities have a more traditional and stable pattern of enrollment. The relationship between fall headcount and fall full-time equivalent and annual full-time equivalent students shows little change over the five-year period from 1993 through 1998. These relationships are shown in Figure 15.

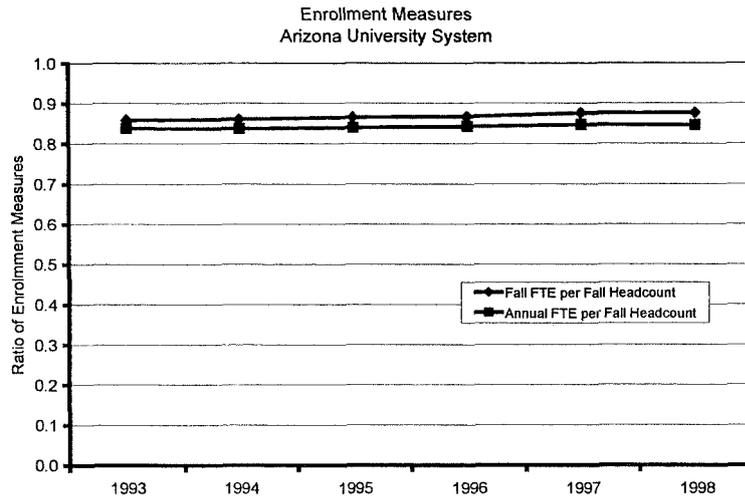


Figure 15 – Relationship between Fall Headcount and Fall and Annual Full-Time Equivalent Enrollments, Arizona University System

The ratio between fall headcount enrollment and Fall FTE changed 2% in the five years as compared to 10.8% for the community colleges, and it changed less than one percent for annual FTE.

The relationship for the Universities is more complex because of the different types of students found at the universities. For example, the ratio between fall and spring FTE enrollments have changed differently for lower-division undergraduates, upper-division undergraduates, and graduate students. This is shown in Figure 16.

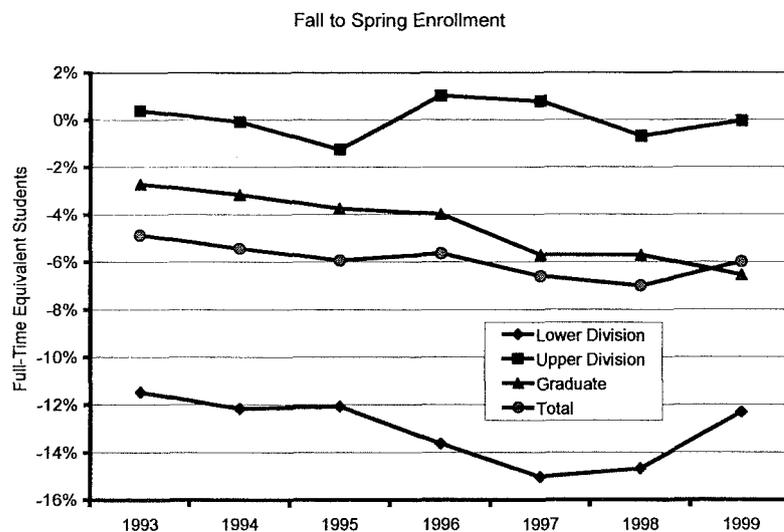


Figure 16 – Relationship between Fall and Spring Enrollment, Arizona University System

Although there have been changes, the average has changed only one percent over the five years, so the composition of the student body has remained relatively constant over this period, as shown in Figure 17.

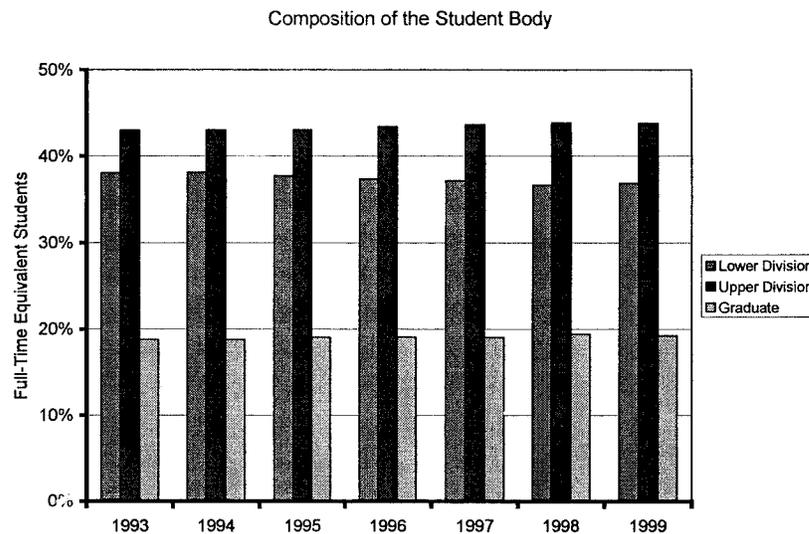


Figure 17 – Composition of the Student Body, Arizona University System

The historical and projected change in the ratio between Fall headcount and full-time equivalent student measures of enrollment are shown in Figure 18. In one sense the change does not affect enrollment-based state funding of the Universities and the community colleges since state funding is determined by full-time equivalency measures. The change does have two effects for the community colleges. First, enrollment-based funding will increase more than the increase in Fall headcount enrollments if present trends continue. Second, since the full-time student equivalent per annual headcount is declining, instructional support and student service costs per full-time student equivalent will increase because it takes more students per FTSE; instructional support and student services costs are more directly related to the number of students than to the number of credit hours taught.

Change in the Ratio Between Annual Full-Time Equivalency and Fall Enrollment
Arizona University System and Arizona Community Colleges

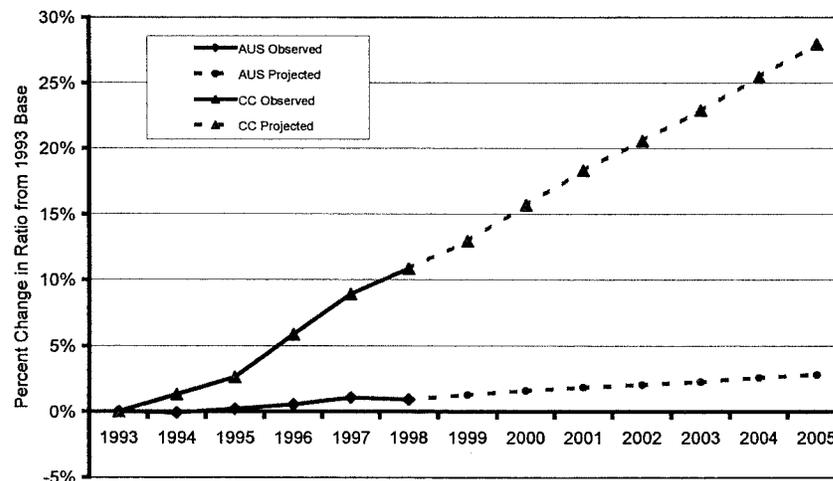


Figure 18 – Historical and Projected Change in Ratios between Fall Headcount and Annual Full-Time Equivalent Student Enrollments

ATTACHMENT 1

Basic Assumptions in the Arizona Enrollment Projection Model

Under the assumption of the continuation of current trends, the projection model is based on the following assumptions and uses the data sources or elements listed below. The variations from these assumptions used to project scenarios 1,2, and 4 are noted in discussed in the body of the report

Higher Education:

- For the purpose of projecting enrollment in Arizona's institutions of higher education, higher education was defined as any postsecondary institution that is accredited by a regional or national accrediting agency and that offers certificate or degree programs. It should be noted that there are many types of postsecondary experiences available outside of such institutions that were not included in these projections.

For all sectors:

- Population projections, derived from DES projections using Census projections to provide breakdown by age, and race/ethnicity

For Arizona Community Colleges:

- Student headcount is projected based on the population aged 17-49. It is assumed that the community-college-going rate for each racial/ethnic group will remain at the level of the three year average for 1996-1998.¹⁰

For Arizona Public Universities:

On-campus undergraduates:

- WICHE high school graduate projections, broken down by race/ethnicity (WICHE provides projections that can be used for the years 1999-2000 to 2011-2012).
- WICHE high school graduate projections are extrapolated to the year 2019-2020 using the assumption that the projected ratio of high school graduates to the population of 17-18 year olds (broken down by race/ethnicity) will remain at the level projected by WICHE for the three year period, 2009-2010 to 2011-2012 (the last three years for which WICHE data are available).
- Yield rate of Arizona University System enrollees from high school graduates, by race/ethnicity, will remain equal to three-year average yield rate from 1996-98
- The yield of transfer students from the community college enrolled population will remain equal to the three-year average yield rate for 1996-98.
- The continuation rate of students, by student level, will remain at the level of the three year average from 1995-96 to 1997-98 for each racial/ethnic group.

Off-campus undergraduates:

- In Fall 1999 the actual number of off-campus undergraduates was approximately 2,500.
- The expected growth rate for off-campus undergraduates is approximately 5% per year.

On-campus post-baccalaureate students:

- In 1999, the actual number of on-campus post-baccalaureate students was 20,500.
- The expected growth rate for on-campus post-baccalaureate students is approximately 0.5% per year.

Off-campus post-baccalaureate students:

- In 1999, the actual number of off-campus post-baccalaureate students was approximately 5,700.
- The expected growth rate for off-campus post-baccalaureate students is approximately 6.5% per year.

¹⁰ For purposes of projecting future enrollments, an average of the last three years was used. If a trend analysis had been used, it would show a continuing decline in participation over 20 years significantly underestimating enrollments. If average rates were used over the past ten years, enrollments would be overestimated if the factors causing the decline in participation rates continue or stabilized. From the trends of the historical data, it appears the participation rates in Arizona have stabilized at a lower rate than they were ten years ago. During this period participation rates for the community colleges in other states, such as New York and California, showed a similar pattern. Arizona private colleges and universities did not show an increased participation rate during this period—the rate actually declined for several years—suggesting that this segment of higher education did not compete for community college enrollments.