VISION 2015

THE WEST VIRGINIA SCIENCE AND TECHNOLOGY STRATEGIC PLAN

WVEPSCOR
scienceresearchinnovation

Foreword

VISION 2015 is a strategic framework of actions and initiatives that position West Virginia to achieve measurable growth in technology-based economic development. The vision, "By 2015, research and innovation will be the number one driver of West Virginia's new, diverse and prosperous economy", is the essential driver of this plan. To achieve this goal and to develop cutting-edge research that will spawn new business growth, the state will invest $250M in both human and physical infrastructure. West Virginia embraces this plan as the state continues to diversify and transform its traditional extractive industrial base to a more high-tech, knowledge-based economy. By doing so, 33,000 jobs and an economic impact in excess of $3.3B will be created over the next decade.

West Virginia will grow the research enterprise by hiring nationally prominent and promising faculty, increasing the production of scientists and engineers, and building research facilities and parks. The Southern Growth Policies Board has recognized this effective strategy in *Innovation U. - New University Roles in a Knowledge Economy*. The highly credible American Academy for the Advancement of Science (AAAS), the National Association of Manufacturers (NAM) and members of the U.S. Congress have also presented recent, alarming data on declining numbers of domestic engineering and science college graduates at a time when the nation is experiencing technological expansion and greater demand for such skills.

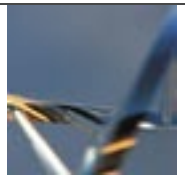
West Virginia is not alone in engaging this strategy. Rather, West Virginia joins the national effort and trend, recognizing that surrounding states (Ohio, Virginia, Kentucky and Pennsylvania) have initiated similar strategic plans—and aggressive state funding—for capitalizing on research growth. West Virginia's universities can no longer be viewed as merely post-secondary academic institutions, but rather as the nucleus of economic strength, entrepreneurship and innovation. While building the state's economy, the results of VISION 2015 will create critical mass in the state scientific community, enhance diversity of the research faculty and suppress the allure of well-financed research initiatives outside the state's borders.

Key components of VISION 2015 are captured on the next page. This approach allows a holistic view of the specific but interrelated actions to be undertaken. Details of each activity are subsequently presented in one- or two-page "Goal-Plans" that serve to outline specific steps and measures to be taken. Sixteen goals in five categories will be coordinated by the West Virginia Higher Education Policy Commission, the West Virginia Experimental Program to Stimulate Competitive Research (WVEPSCoR) Advisory Council and the West Virginia Development Office, in conjunction with the business community and higher education institutions. West Virginia University (WVU) and Marshall University (MU) are major participants in VISION 2015 and have shared extensively in its development. Milestones in the achievement of these goals will be reported on an annual basis.

Visit www.wvepscor.org for the most current version of VISION 2015.

WEST VIRGINIA SCIENCE AND TECHNOLOGY

STRATEGIC PLAN

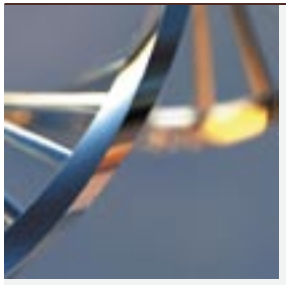


By 2015, research and innovation will be the number one driver of West Virginia's new, diverse and prosperous economy.

vision

HUMAN AND PHYSICAL INFRASTRUCTURE

- Increase the number of critical science, technology, engineering and mathematics (STEM) researchers at WVU and MU by 20% by 2008
- Build at least one new science and engineering facility at MU and WVU of up to 100,000 net assignable square feet each by 2010, and develop a long-term plan to continue creation of new research facilities
- Create four nationally competitive research thrusts/clusters by 2010
- Provide one-time $1M each to WVU and MU libraries to increase electronic journal subscriptions in critical STEM fields by 2007 and $0.5M each on a continuing basis



POLICY

- Develop policies and strategies to improve management of intellectual property (IP) on a statewide basis by June 1, 2006
- Each institution (WVU and MU) will revise promotion, tenure and workload policies to be more research and entrepreneurial friendly by June 30, 2008
- By 2007, increase Research Challenge Fund (RCF) proportion of racetrack video lottery proceeds to 1%—thereafter, increase the proportion until at least 5% is achieved by 2015

EDUCATION AND OUTREACH

- Align with or create a regional alliance including research universities, the private sector and government agencies by 2007
- Increase by 5% per year the retention and completion rates of STEM students (with emphasis on broadening participation)
- Increase by 10% per year the number of doctorates awarded in STEM fields through 2015
- Create a joint university-community and technical college (CTC)-business curriculum to train STEM technicians

RESEARCH AND INNOVATION

- Develop at least four new in-state emerging technologies businesses by 2010
- Double competitive funding from federal agencies every five years

ECONOMIC DEVELOPMENT

- Create a Technology-Based Economic Development (TBED) Office within the Department of Commerce by March 2007
- Create an early-stage, proof-of-concept gap fund of $2.5M for technology development and commercialization by July 1, 2007
- Increase by 10% per year the number of STEM job opportunities in the state of West Virginia for graduates with bachelor's/master's degrees

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VISION 2015
STRATEGIC PLAN OVERVIEW

GOAL ONE

INCREASE THE NUMBER OF CRITICAL SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM) RESEARCHERS AT WVU AND MU BY 20% BY 2008

ACCOUNTABILITY:
West Virginia University and Marshall University Provosts

RATIONALE/BRIEF BACKGROUND:
Today's economy is fundamentally different from the previous decade. It is more global, more knowledge-driven, more entrepreneurial and more dynamic. The impetus for growth in the new economy comes from increasing the knowledge base of the economy, including research, education and skills, and fostering technological innovation.

All these elements are best achieved at research institutions; particularly, research universities. The very foundation for the new economy is knowledge creation, research and innovation emanating from research universities. The most critical need at this time is new high-tech business development in West Virginia. Without these new businesses, our highly trained graduates will continue to seek jobs elsewhere.

Many studies clearly show the direct link between economic development and university-based research. Neighboring states recognize this link and are actively recruiting scientists and engineers in state-supported initiatives such as Kentucky's $350M "Bucks for Brains" campaign, Ohio's 10-year, $1.1B Third Frontier Program, Pennsylvania's $130M Life Sciences Greenhouse Program and Virginia's $328M investment in Centers for Innovative Technology. West Virginia must follow suit and increase the number and quality of STEM researchers at the state's major research institutions.

MEASUREMENT:
Increase critical STEM researchers at WVU and MU by 20% by 2008:

- 2005 Baseline: 444 (130 at MU and 314 at WVU)
- 2010 Goal: 533 (156 at MU and 377 at WVU)

The economic benefit of new STEM research faculty can be measured by an increase in: (1) the number of new competitive grants and contracts awarded; (2) tech transfer activity, including patents and licenses issued and startup companies created; and (3) the number of STEM graduates entering the workforce. A reasonable estimate of the impact of these new researchers by 2015 is a 35% increase in research grants and contracts, number of patents issued, licenses issued and startup companies founded by MU and a 70% increase in these indicators by WVU.

IMPLEMENTATION PLAN:
(1) Increase faculty numbers by at least 20% in WVU's and MU's areas of strength and emerging new interdisciplinary initiatives to better stimulate business development:

- At WVU: nanobiosciences, energy, environment, biometrics, cyberinfrastructure and technology, materials sciences and engineering, and other emerging technologies
- At MU: life sciences (biomedical and biotechnology), environmental science and engineering, forensic science and transportation

(2) Increase faculty numbers by at least 20% with faculty members who have entrepreneurial interests
(3) Obtain a total of $50M by July 1, 2010, to fund new faculty positions:

- 63 researchers at WVU will require an initial investment of $6.4M for salaries and an estimated $28M one-time investment in startup costs. An increase in the base budget for the university will be required beginning in 2008 for the recurring salaries of these positions adjusted for potential salary increases
- 26 researchers at MU will require an initial investment of $2.48M for salaries and an estimated $11.6M one-time investment in startup costs. An increase in the base budget for the university will be required beginning in 2008 for the recurring salaries of these positions adjusted for potential salary increases

GOAL TWO

BUILD AT LEAST ONE NEW SCIENCE AND TECHNOLOGY FACILITY AT MU AND WVU OF UP TO 100,000 NET ASSIGNABLE SQUARE FEET EACH BY 2010, AND DEVELOP A LONG-TERM PLAN TO CONTINUE CREATION OF NEW RESEARCH FACILITIES

ACCOUNTABILITY:
West Virginia University and Marshall University Presidents

RATIONALE/BRIEF BACKGROUND:
West Virginia must increase investment in university-based research in science, technology, engineering and mathematics (STEM) fields. This investment includes attracting top-notch researchers but also aggressively building new research facilities to attract and retain the best and the brightest. STEM research offers the best opportunities for both new business creation and competitive upgrades of existing industries in the state.

Surrounding states continue to boost space for research, innovation and technology transfer at a much faster pace than West Virginia, and most of that space is located at doctorate-granting institutions. While West Virginia recently invested $46M at WVU and $12.5M at MU in science and technology construction, enrollment growth and aging facilities are significantly limiting the growth of the research enterprise required to impact economic development in the state. Both universities have leveraged these investments with federal and private funds and have master planning studies under way to determine future and anticipated research needs. Each institution will need at least an additional 100,000 net assignable square feet by 2010 to help reach our vision.

MEASUREMENT:
(1) $1.8M in funding for program development and schematic design by December 31, 2006
(2) Up to $120M in funding obtained to build two new facilities with 100,000 net assignable square feet by December 31, 2007
(3) Two new facilities built by 2010, with researchers moving in by December 31, 2010

The economic benefit of new research facilities can be measured by more revenue generated from an increase in: (1) federally financed research and development; (2) patent applications; (3) license agreements and (4) new business startups from these two research universities. For example, of the 892 permanent faculty at WVU in 2004, approximately 25% of them were awarded research grants and contracts totaling approximately $110M in 2005. MU's 2004 total grant and contract activity reached almost $40M. WVU and MU research efforts generated 10 patents issued, seven licenses and two new startups in 2004-05. Since the Office of Technology Transfer was established in 1998 at WVU, 53 U.S. and 29 international patents, respectively, have been issued, 31 licenses have been established and 10 new startups have emerged. The pace of these activities is accelerating and is expected to continue at a much higher rate in the next 10 years.

IMPLEMENTATION PLAN:
(1) Obtain $1.8M in funding by July 31, 2006, for programming for two facilities
(2) Develop plans for two facilities, including location, architectural drawings and funding requirements by July 31, 2007
(3) Obtain $120M by December 31, 2007, to fund two facilities
(4) Build two new facilities by 2010 with faculty and other researchers moving in by December 31, 2010
(5) Develop long-term plan to continue creation of new research facilities by December 31, 2006, with representatives from MU, WVU and other state research or planning agencies as needed

GOAL THREE

CREATE FOUR NATIONALLY COMPETITIVE RESEARCH THRUSTS/CLUSTERS BY 2010

ACCOUNTABILITY:
West Virginia University and Marshall University Vice Presidents for Research in coordination with the WVEPSCoR Advisory Council

RATIONALE/BRIEF BACKGROUND:
Given the interdisciplinary nature of today's science, national competitiveness resides in the formation of multidisciplinary teams. To be successful in driving West Virginia's new economy, we must recruit and support competitive teams of investigators in research thrusts or clusters, where broad-based communities of basic and applied researchers and entrepreneurs work together on the same technology or project.

WVU currently has the following nationally competitive centers:

- National Research Center for Coal and Energy funded by state and federal sources
- Sensory Neurosciences Research Center funded by the Howard Hughes Medical Institute and the National Institutes for Health (NIH)
- Center for Identification Technologies funded by the National Science Foundation and industry members
- Virtual Medical Center funded by the Department of Justice and the Department of Health and Human Services

In addition, WVU has a number of emerging research centers currently being supported by the WVU Research Corporation and external funding in the areas of advanced power and electricity, the environment, nanobiosciences and systems biology.

MU's Joan C. Edwards Cancer Center is supported by the NIH. Currently, MU is designing an Institute for Interdisciplinary Research as a nationally competitive research center. MU plans to hire nine endowed professors focused on basic and applied research on cell differentiation and development. Environmental science and engineering and forensic science researchers will round out this interdisciplinary research institute.

MEASUREMENT:
(1) Selection of research thrusts/clusters with funding, space, personnel and other requirements identified by February 2007
(2) Funded research clusters awarded at least one federal grant by May 2008

IMPLEMENTATION PLAN:
(1) Select four to six thrusts/clusters by identifying emerging research areas within the state's research universities with the greatest potential for allowing researchers to obtain competitive funding and enhance economic development in West Virginia by March 2006
(2) Identify and obtain funding, space, personnel and other requirements for the first four thrusts/clusters by February 2007
(3) Develop and implement an evaluation plan to ensure that each newly established center meets milestones and goals for competitiveness and economic development within 12 months of its funding

GOAL FOUR

PROVIDE ONE-TIME $1M EACH TO WVU AND MU LIBRARIES TO INCREASE ELECTRONIC JOURNAL SUBSCRIPTIONS IN CRITICAL SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM) FIELDS BY 2007 AND $0.5M EACH ON A CONTINUING BASIS

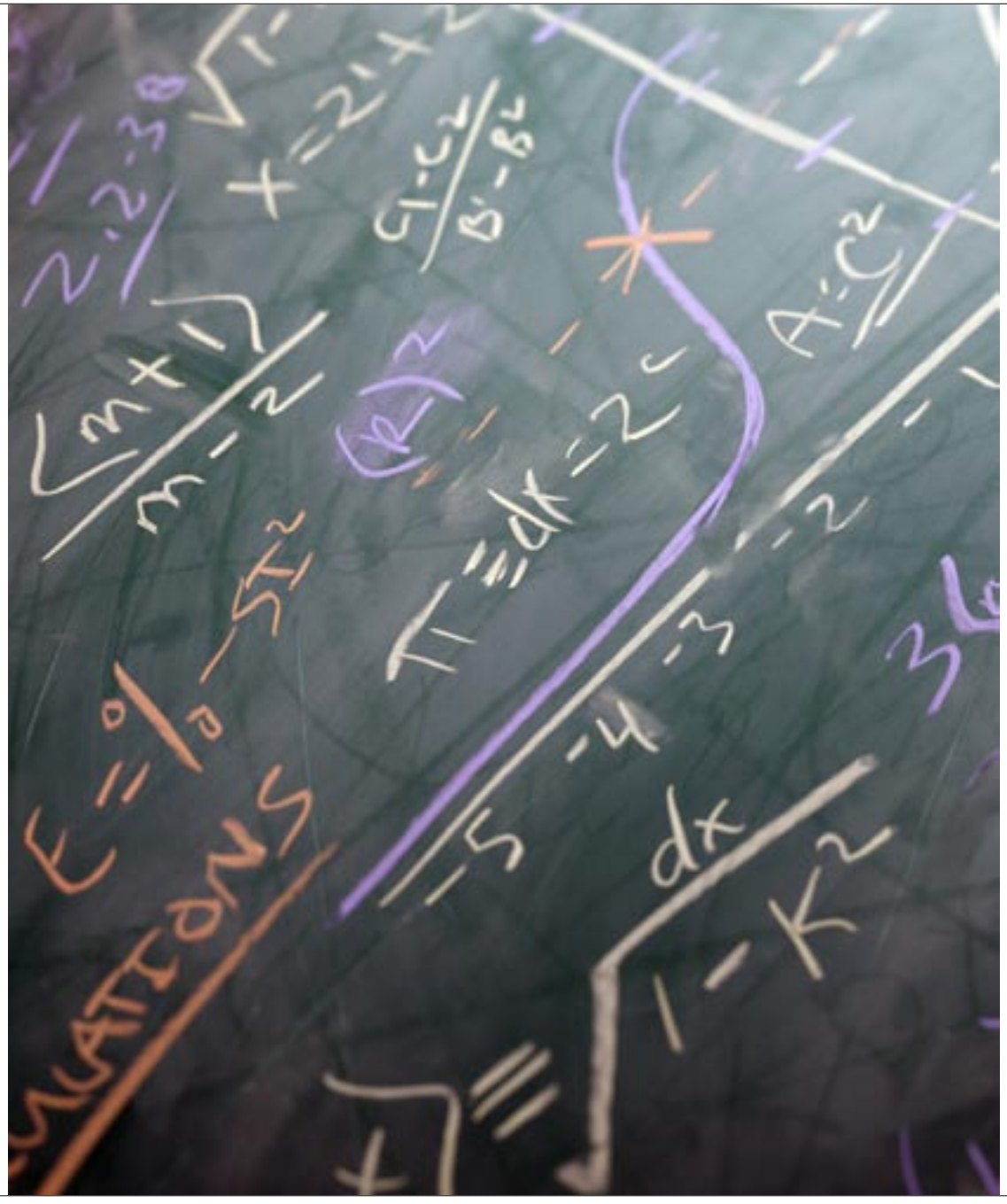
ACCOUNTABILITY:
West Virginia University and Marshall University Provosts

RATIONALE/BRIEF BACKGROUND:
Access to scholarly resources, especially journals in STEM fields, is an essential infrastructure component for any state's research and economic development efforts. Existing journal collections in West Virginia must be maintained to ensure competitiveness while strengthening journal collections in new interdisciplinary fields. Nationally, the price of the average STEM journal increased 241% between 1986 and 2004, and librarians estimate costs will go up 9-10% each year over the next five years. MU and WVU libraries have addressed this inflation by cutting journal subscriptions and making other reductions. MU libraries underwent a $200,000 journal cancellation project in 2004. Since 1997, WVU libraries have canceled $320,000 worth of journal subscriptions. These two libraries are the main sources of journal literature for all West Virginia colleges and universities and would be the main sources for a growing high-technology industry. Therefore, the ability to conduct research all over West Virginia will be compromised if our main research libraries are not upgraded.

Both MU and WVU libraries have fallen behind their peers in the acquisition of scholarly information sources. Sufficient budget flexibility is needed to allow both libraries to participate in state, regional and national negotiations for reduced prices, to acquire new products at "charter subscriber" prices, and to partner with vendors and publishers on new product development when appropriate.

MEASUREMENT:
(1) One-time funding of $1M each awarded to WVU and MU libraries to increase electronic journal subscriptions in critical STEM fields by July 1, 2007
(2) Annual funding of $0.5M each awarded to WVU and MU libraries to increase electronic journal subscriptions in critical STEM fields starting in 2008

IMPLEMENTATION PLAN:
(1) Obtain $1M in one-time funding at the beginning of Fiscal Year 2007 for both the MU and WVU libraries
(2) Create "Library Users Group" of STEM researchers at each university to determine use of funds, including purchasing subscriptions for new journal literature, access to electronic archives of selected STEM journals and creating a STEM journal endowment fund to guarantee continued access
(3) Obtain $0.5M in ongoing funding at the beginning of Fiscal Year 2008 for both the MU and WVU libraries to keep up with the explosive growth of STEM literature
(4) Evaluate the impact of additional funding through journal use statistics and researcher surveys, and use of journals in the published work of university researchers



Access to scholarly resources, especially journals in STEM fields, is an essential infrastructure component for any state's research and economic development efforts. The ability to conduct research all over West Virginia will be compromised if our main research libraries are not upgraded.

GOAL FIVE

DEVELOP AT LEAST FOUR NEW IN-STATE EMERGING TECHNOLOGIES BUSINESSES BY 2010

goal five

ACCOUNTABILITY:
West Virginia Development Office Director, West Virginia University and Marshall University Technology Transfer Offices

RATIONALE/BRIEF BACKGROUND:
To achieve the vision of growing the state's economy with research and innovation, current major research initiatives must be turned into new businesses. Biotechnology and nanotechnology represent two of the leading multidisciplinary research efforts currently under way at MU and WVU. These areas also are growing nationally and globally. Thus, research and innovation in biotechnology and nanotechnology are ripe for new business development, and must be considered high-potential technology areas.

MEASUREMENT:
Creation of four new and easily identified companies from the intellectual activities of the West Virginia academic research community in biotechnology, nanotechnology or other emerging technologies by 2010

IMPLEMENTATION PLAN:
(1) Develop partnerships with key in-state and out-of-state businesses to foster business development guidance and future opportunities by July 31, 2007
(2) Organize "West Virginia New Business Development Conference for Nano and Biotechnology" by May 31, 2007
(3) Identify four to eight potential spin-off technologies or businesses from in-state research initiatives by July 31, 2007
(4) Identify five to 10 potential business partners for the technologies by July 31, 2007

GOAL SIX

DOUBLE COMPETITIVE FUNDING FROM FEDERAL AGENCIES EVERY FIVE YEARS

ACCOUNTABILITY:
West Virginia University and Marshall University Vice Presidents for Research

RATIONALE/BRIEF BACKGROUND:
To achieve the vision for research and innovation in West Virginia, we must dramatically increase the amount of federal funding at our state's colleges and universities. National Science Foundation funding rates for the state of West Virginia, WVU and MU for the five-year period 2000-04 have remained below the national average. This must be reversed.

Since many studies indicate that one federal dollar will generate more than seven local dollars, it is appropriate to measure success by the increase in the number of competitively obtained research dollars brought into West Virginia. It is expected that this goal will be even more successful in demonstrating the fact that the research universities are economic development engines for our state.

MEASUREMENT:
West Virginia's competitive funding will increase from $60.1M to more than twice that figure in each of the next five years:

- 2005 Baseline: $7.4M at MU, $52.7M at WVU, $60.1M in state
- 2010 Goal: $14.8M at MU, $105.4M at WVU, $120.2M in state
- 2015 Goal: $29.6M at MU, $210.8M at WVU, $240.4M in state

IMPLEMENTATION PLAN:
(1) Obtain EPSCoR RII Award for $9M by early 2006 to increase the competitiveness of state faculty
(2) Obtain funding to hire 11 new faculty members at WVU and MU by the end of 2006
(3) Hire 11 experienced science, technology, engineering and mathematics (STEM) faculty at MU and WVU, who bring with them at least $1M each in external funding by the end of 2007
(4) Obtain $5M in university, federal or state funding to provide startup money for new and young faculty (or experienced faculty in new research areas) by the end of 2006
(5) Obtain two large, multidisciplinary awards with multiple researchers from WVU, MU, or both, with each award totaling at least $3M for three or more years by 2009

GOAL SEVEN

DEVELOP POLICIES AND STRATEGIES TO IMPROVE MANAGEMENT OF INTELLECTUAL PROPERTY (IP) ON A STATEWIDE BASIS BY JUNE 1, 2006

ACCOUNTABILITY:
Secretary of Education and the Arts, Higher Education Policy Commission Chancellor

RATIONALE/BRIEF BACKGROUND:
West Virginia currently lacks a comprehensive and effective approach to managing the intellectual property generated by state researchers. In fact, new business development based on our universities' research has been hindered because of the lack of effective technology transfer processes and strategies. An intellectual property management policy that stimulates researchers' creativity and entrepreneurialism, while maximizing the state's return on its investment in research, is essential to economic development and achieving the vision of this strategic plan.

MEASUREMENT:
(1) Number of licenses issued
(2) Number of Small Business Innovation Research Program/Small Business Technology Transfer Program awards issued
(3) Number of research-based startup companies
(4) Number of technologies licensed to existing or new businesses for commercialization

IMPLEMENTATION PLAN:
Create an Intellectual Property Policy Committee (IPPC) consisting of researchers, research administrators, attorneys, business representatives and government officials. This committee may include external experts, and will be responsible for promoting best practices in IP policy to apply to public higher education institutions by October 31, 2006.

GOAL EIGHT

EACH INSTITUTION (WVU AND MU) WILL REVISE PROMOTION, TENURE AND WORKLOAD POLICIES TO BE MORE RESEARCH AND ENTREPRENEURIAL FRIENDLY BY JUNE 30, 2008

ACCOUNTABILITY:
West Virginia University and Marshall University Provosts

RATIONALE/BRIEF BACKGROUND:
Faculty and researchers at the state's two research universities are primarily responsible for West Virginia's growth in research capacity and output. Swift and dramatic changes in the ways scientific research is organized, conducted and funded have left many academic institutions struggling to keep pace. Faculty members face ever-increasing workloads for teaching and service (department, school, university, professional committees) and thus struggle to find time to operate nationally competitive research programs. Similarly, institutional promotion and tenure policies do not generally reward faculty for entrepreneurial activities. The institutions' personnel and workload policies must be revised to reflect these changes so faculty are encouraged and rewarded for 21st century research and entrepreneurial activity.

MEASUREMENT:
More research-friendly tenure and promotion policies in place by June 30, 2008

IMPLEMENTATION PLAN:
(1) Review leading national examples of research/entrepreneurial-friendly personnel policies and identify most-effective institutional case studies by September 1, 2006
(2) Plan and conduct site visits (EPSCoR Advisory Council members, WVU and MU provosts) to case study institutions by December 31, 2006
(3) Prepare a draft report of recommendations for changes in personnel policies based on case study site visits and share with WVU and MU faculty and academic administrators by May 31, 2007
(4) Follow institutional procedures for personnel policy changes for review and approval of the university governing boards by January 15, 2008
(5) Adopt revised personnel policies at WVU and MU by June 30, 2008

policy

goal eight

GOAL NINE

BY 2007, INCREASE RESEARCH CHALLENGE FUND (RCF) PROPORTION OF RACETRACK VIDEO LOTTERY PROCEEDS TO 1%—THEREAFTER, INCREASE THE PROPORTION UNTIL AT LEAST 5% IS ACHIEVED BY 2015

ACCOUNTABILITY:
WVEPSCoR Director, Higher Education Policy Commission Chancellor

RATIONALE/BRIEF BACKGROUND:
In 2003, legislation was passed for the state's Research Challenge Fund (RCF) to be given 0.5% of racetrack video lottery proceeds. This fund now generates about $4M annually for the West Virginia research community. The initial request to the legislature, however, was for 3% of the video lottery proceeds, or approximately $24M per year. Increasing the proportion incrementally from 0.5% to 5%, $40M annually by 2015, will provide significant new and recurring RCFs. These funds can be used to advance research and innovation to full commercialization, and to develop the skilled workforce required for the high-technology businesses relocating to West Virginia and for other businesses being established in the state from new university startups.

MEASUREMENT:
Amount of racetrack video lottery proceeds dedicated to RCF:
- 2005 Baseline: 0.5% of video lottery proceeds dedicated to RCF
- 2007 Goal: 1% of video lottery proceeds dedicated to RCF
- 2010 Goal: 3% of video lottery proceeds dedicated to RCF
- 2015 Goal: 5% of video lottery proceeds dedicated to RCF

IMPLEMENTATION PLAN:
Obtain sponsorship of a bill to increase the lottery proceeds dedicated to RCF funding by January 31, 2006

GOAL TEN

ALIGN WITH OR CREATE A REGIONAL ALLIANCE INCLUDING RESEARCH UNIVERSITIES, THE PRIVATE SECTOR AND GOVERNMENT AGENCIES BY 2007

ACCOUNTABILITY:
West Virginia University and Marshall University Vice Presidents for Research and West Virginia Development Office Director

RATIONALE/BRIEF BACKGROUND:
Pennsylvania, Delaware and other states have successfully linked their universities' research and technology development to the economic development of their states. A key to that success has been the establishment of alliances between research universities and the private sector and government agencies. Likewise, research institutions in West Virginia must establish strong links with business and other key partners within the state and region to: (1) increase competitive science, technology, engineering and mathematics (STEM) research funding within the state; (2) increase funding for technology-based startups and other businesses within the state and (3) increase utilization and commercialization of innovative research and technology developed in West Virginia. This alliance can also be a vital element for workforce development in emerging high-technology industries in West Virginia. The alliance would function as a statewide/regional advisory and advocacy body. Private sector and government agency members can provide needs-based guidance in curriculum development, internships, sponsored and collaborative research agreements, and other activities that will promote development of a highly trained and skilled workforce for new or relocating high-technology businesses and industries. The alliance will also promote research, innovation and entrepreneuralism, leading to greater economic development in the state and region.

MEASUREMENT:
(1) Alignment with or creation of a regional alliance that includes both WVU and MU by December 31, 2007
(2) Annual increases in number of new business, government or other partners joining the alliance with WVU and MU
(3) Annual increases in new or relocating high-technology businesses and industries in West Virginia

IMPLEMENTATION PLAN:
(1) Develop strategic plan for aligning with or creating a university-business alliance by June 30, 2006, including appropriate businesses and other partners within West Virginia and surrounding areas
(2) Begin implementation of university-business alliance strategic plan by September 30, 2006

goal ten

GOAL ELEVEN

INCREASE BY 5% PER YEAR THE RETENTION AND COMPLETION RATES OF SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM) STUDENTS (WITH EMPHASIS ON BROADENING PARTICIPATION)

ACCOUNTABILITY:
Higher Education Policy Commission
Chancellor

RATIONALE/BRIEF BACKGROUND:
The vision — "research and innovation will be the number one driver of West Virginia's economy" — requires an increase in the number of scientists and engineers completing degrees and working in the state. Increasing the number of STEM graduates is an essential component of workforce development for supporting new, technology-focused businesses. Since reports from the National Academy of Sciences and elsewhere have repeatedly demonstrated that women and ethnic and racial minorities are under-represented in STEM disciplines, West Virginia will emphasize broadening participation of these populations. This goal also dovetails with national needs to increase the number of American-born students completing degrees in STEM fields, as many reports suggest the United States is in danger of losing its superiority in science and technology without a significant, sustained investment in educating the next generation of scientists and engineers.

MEASUREMENT:
(1) Number of students majoring in STEM disciplines in West Virginia institutions:

- 2004 Baseline: 7,730
- 2010 Goal: 5% increase compounded annually
- 2015 Goal: 5% increase compounded annually

(2) Number of students completing baccalaureate degrees in STEM disciplines in West Virginia institutions:

- 2005 Baseline: 1,177
- 2010 Goal: 5% increase compounded annually
- 2015 Goal: 5% increase compounded annually

(3) Number of under-represented minority students majoring in STEM disciplines in West Virginia institutions:

- 2004 Baseline: 499
- 2010 Goal: 5% increase compounded annually
- 2015 Goal: 5% increase compounded annually

(4) Number of under-represented minority students completing baccalaureate degrees in STEM disciplines in West Virginia institutions:

- 2004 Baseline: 55
- 2010 Goal: 5% increase compounded annually
- 2015 Goal: 5% increase compounded annually

IMPLEMENTATION PLAN:
(1) Develop detailed plan for increasing retention and graduation of STEM majors and for broadening participation in STEM disciplines by December 31, 2006
(2) Begin implementation of plan at each college or university campus by July 1, 2007
(3) At each institution, conduct annual evaluation of retention and graduation numbers for STEM disciplines to measure success and make strategic corrections if needed
(4) Three years after implementation, assess effectiveness and identify strengths to build upon, barriers to overcome, and opportunities to increase effectiveness and re-energize commitment

GOAL TWELVE

INCREASE BY 10% PER YEAR THE NUMBER OF DOCTORATES AWARDED IN SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM) FIELDS THROUGH 2015

ACCOUNTABILITY:
West Virginia University and Marshall University Provosts

RATIONALE/BRIEF BACKGROUND:
The West Virginia vision requires an increase in the number of STEM doctoral students completing degrees and working in the state. Doctoral students, working closely with their research mentors, are the primary source of innovation. If given the opportunity, these new entrepreneurs will opt to create businesses near their alma mater, where they know they have access to expertise and technologies. Most economic developers will tell you it is easier to "grow your own" high-tech enterprise than to recruit one. West Virginia cannot create or attract new technology-based businesses without building a talented pool of young research scientists and engineers. Thus, this goal is a key component for bringing in and starting up new technology-focused businesses. This goal also dovetails with national needs to increase the number of American-born doctoral students completing degrees in STEM fields, as many reports suggest the United States is in danger of losing its superiority in science and technology without a significant, sustained investment in science education.

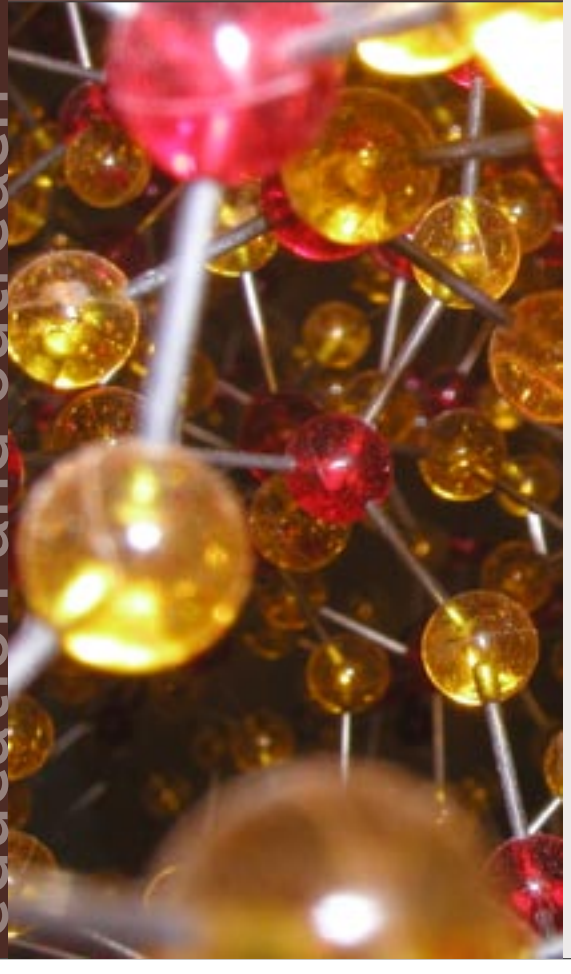
MEASUREMENT:
Number of doctoral degrees awarded in STEM fields:

- 2005 Baseline: 68
- 2010 Goal: 111
- 2015 Goal: 178

IMPLEMENTATION PLAN:
(1) Develop strategic plan for increasing recruitment, retention and graduation of STEM doctoral students, including broadening participation in STEM disciplines, by December 31, 2006
(2) Begin implementation of strategic plan at each university by July 1, 2007
(3) At each West Virginia institution, conduct annual evaluation of retention and graduation numbers for STEM disciplines to measure success and make strategic corrections if needed, beginning as outlined in strategic plan
(4) Three years after implementation, assess effectiveness of strategic plan and identify strengths to build upon, barriers to overcome, and new opportunities to increase effectiveness and re-energize commitment

GOAL THIRTEEN

CREATE A JOINT UNIVERSITY-COMMUNITY AND TECHNICAL COLLEGE (CTC)-BUSINESS CURRICULUM TO TRAIN SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM) TECHNICIANS



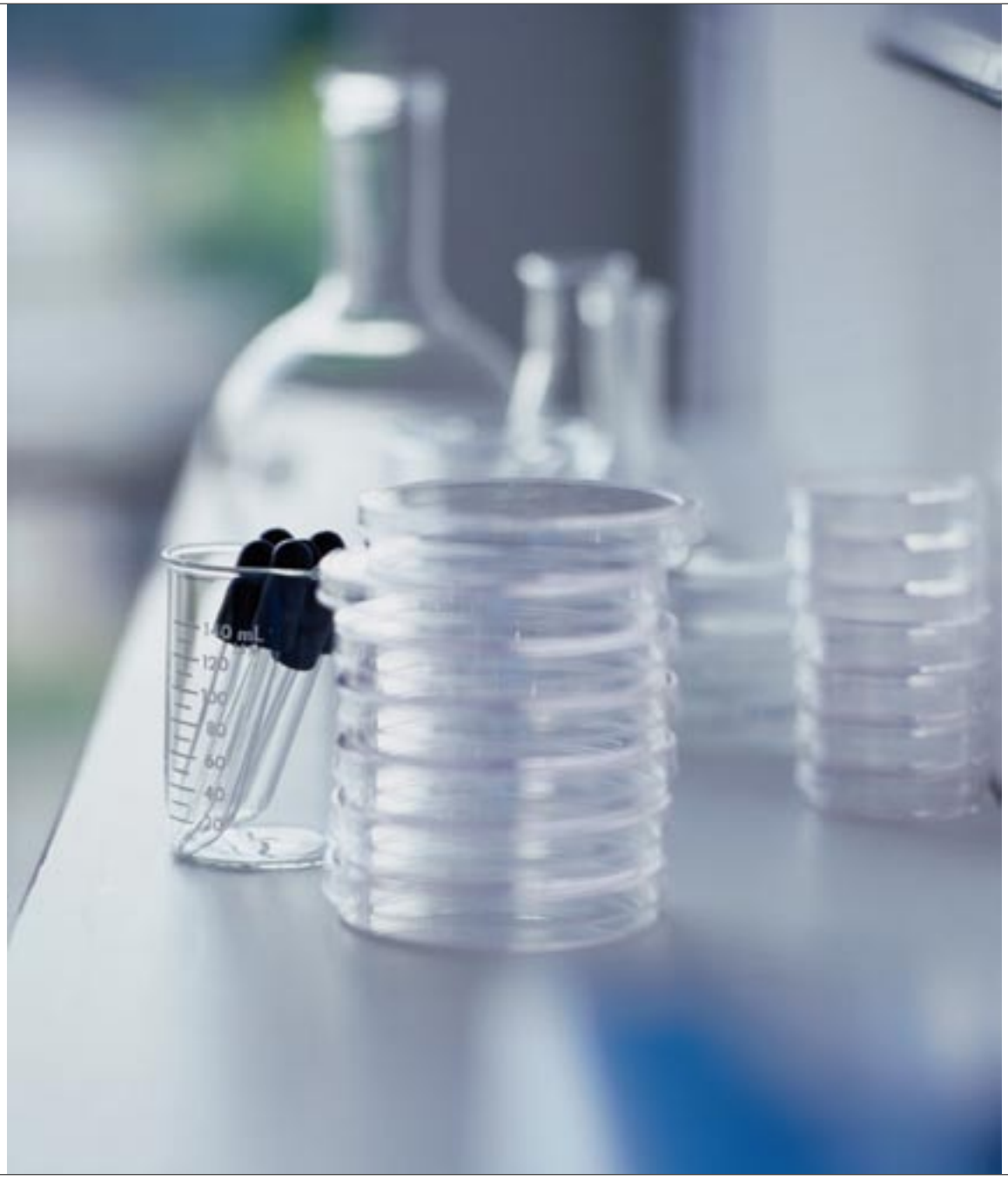
ACCOUNTABILITY:
Higher Education Policy Commission Chancellor and Community and Technical Colleges

RATIONALE/BRIEF BACKGROUND:
VISION 2015 requires an increase in the number of STEM technicians completing degrees and working in the state. We cannot increase university research, spinout new businesses from our universities or attract new, technology-based businesses without increasing the technical workforce. Graduates from STEM disciplines are required at all skill and education levels to meet the needs of new technology-based businesses.

As Pennsylvania and other states have done, West Virginia needs to develop more-effective STEM curricula and training for students in the state's CTCs. Unfortunately, the cost of developing the necessary infrastructure is beyond the reach of most CTCs. To help ensure the success of this program, state businesses will need to provide internship and employment opportunities for graduates.

MEASUREMENT:
(1) Creation of pilot program at two state CTCs by July 1, 2007
(2) Creation of capstone semester experience at MU (biotechnology) and WVU (nanotechnology) by July 1, 2007
(3) Enrollment of first CTC students during 2007-08 academic year

IMPLEMENTATION PLAN:
(1) Identify appropriate pilot CTCs by June 30, 2006
(2) Develop strategic plan for the development of the entire program, including CTC and university capstone curricula, agreements between CTCs and two universities, estimates of costs and funding sources, etc., by December 31, 2006
(3) Finalize implementation of the program and capstone experience in time to begin enrollment by fall 2007



VISION 2015 requires an increase in the number of STEM technicians completing degrees and working in the state. Graduates from STEM disciplines are required at all skill and education levels to meet the needs of new technology-based businesses.

GOAL FOURTEEN

CREATE A TECHNOLOGY-BASED ECONOMIC DEVELOPMENT (TBED) OFFICE WITHIN THE DEPARTMENT OF COMMERCE BY MARCH 2007

ACCOUNTABILITY:
West Virginia Development Office Director

RATIONALE/BRIEF BACKGROUND:
In order to compete in a global economy, West Virginia must have an economic base composed of firms that constantly innovate and maximize the use of technology. TBED is the approach used to help create a climate where that new economic base can thrive. The creation of a statewide approach to TBED requires a well-focused, well-coordinated effort to build: (1) intellectual infrastructure at universities and public or private research laboratories that generates new knowledge and discoveries; (2) mechanisms for transferring knowledge, intellectual property and innovation from the laboratory to a company; (3) physical infrastructure to include global connectivity; (4) a highly skilled technical workforce and (5) risk capital. To achieve these goals, this office will identify gaps in West Virginia TBED processes and develop strategies, policies and procedures to remove these barriers. It will intentionally monitor the ever-changing global high-tech marketplace and work with other government agencies, industry and academia to capitalize on these opportunities.

MEASUREMENT:
(1) Number of technology-based industries (TBI) in West Virginia in 2005
(2) Number of new TBIs assisted by the TBED Office annually thereafter
(3) Number of TBIs gained in West Virginia from 2005 to 2015
(4) Number of TBIs lost in West Virginia annually from 2005 to 2015

IMPLEMENTATION PLAN:
(1) Create a TBED Advisory Board to guide the TBED Office by May 31, 2006 (The executive director of the TBED reports to the board and the board provides annual reports to the Secretary of Commerce. Members of this board will include three representatives from the Council on Commercialization and Economic Development, three members of the WVEPSCoR Advisory Council and three leaders of major out-of-state TBIs.)
(2) Establish operational goals, objectives, budget and staffing requirements for the office by December 31, 2006
(3) Secure the operational budget for the TBED Office by redistribution of existing funds in the Department of Commerce by May 31, 2006
(4) Begin full operation of the TBED Office by March 2007

GOAL FIFTEEN

CREATE AN EARLY-STAGE, PROOF-OF-CONCEPT GAP FUND OF $2.5M FOR TECHNOLOGY DEVELOPMENT AND COMMERCIALIZATION BY JULY 1, 2007

ACCOUNTABILITY:
West Virginia Development Office Director

RATIONALE/BRIEF BACKGROUND:
Early-stage, proof-of-concept funding is critical to support successful development of innovations resulting from basic research completed in university research laboratories, but that have not yet reached the proof-of-concept stage, and thus are not ready to be supported by commercial funds. Gap funding must be used in lieu of federal funds, which generally are restricted to basic research. Applied research, frequently referred to as the translational research phase, requires gap funding to spur development of innovations through the proof-of-concept phase so innovations become attractive to commercial funds from investors or licensing contracts. Gap funding can provide the bridge to success for research innovations to reach the full commercialization required to boost economic development.

MEASUREMENT:
$2.5M available for proof-of-concept funding by July 1, 2007

IMPLEMENTATION PLAN:
Obtain sponsorship in both Houses of bills to create a proof-of-concept gap fund of $2.5M in the West Virginia Development Office budget by July 1, 2006

GOAL SIXTEEN

INCREASE BY 10% PER YEAR THE NUMBER OF SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM) JOB OPPORTUNITIES IN THE STATE OF WEST VIRGINIA FOR GRADUATES WITH BACHELOR'S/ MASTER'S DEGREES

ACCOUNTABILITY:
West Virginia Development Office Director in coordination with the Higher Education Policy Commission Chancellor, and West Virginia University and Marshall University Provosts

RATIONALE/BRIEF BACKGROUND:
West Virginia cannot attract new, technology-based businesses without a talented pool of STEM students, and cannot sustain those technology-based businesses without keeping students after graduation. Secondly, many West Virginia STEM graduates must be prepared to work in an interdisciplinary environment where knowledge and skills from several STEM disciplines will be essential for them to be competitive in high-technology industries, businesses, and university and federal laboratories.

MU's Integrated Science and Technology (IS&T) Program is one example of an interdisciplinary bachelor of science program addressing industry needs. It brings together engineering, chemistry, physics, biological sciences, computer and information science, mathematics, English, communication studies and management to prepare graduates for a wide range of careers that call for a solid scientific and technological background, excellent communication skills, the ability to work effectively in teams and the flexibility to adapt to changing work conditions. Just eight years old, the IS&T Program is the fastest-growing program in the university's College of Science. In this hands-on, lab-intensive program, student demands currently outstrip faculty supply. The Forensics Program at WVU is another applied sciences program demonstrating extremely rapid enrollment growth and excellent job opportunities for its graduates, mostly outside the state.

To meet the growing enrollments in these programs and to create a flexible, highly skilled, high-tech workforce required by knowledge-based industries currently located West Virginia or new businesses relocating to the state, it will be necessary to add additional faculty to teach in these programs to meet anticipated demand for these graduates. The state must work aggressively to create STEM job opportunities within the state for graduates from these programs.

MEASUREMENT:
(1) Number of STEM job opportunities in the state of West Virginia:

- 2005 Baseline: To be developed (See Implementation #1 below)
- 2015 Goal: 10% increase in technology-based jobs, compounded annually

(2) Employment of bachelor's/master's degree students upon graduation from these interdisciplinary science programs
(3) Number of graduates increases by 5% annually
(4) The percent of graduates employed in interdisciplinary positions increases by 10% annually
(5) The percent of graduates retained in West Virginia increases by 10% annually and employee salaries are at least 30% higher than West Virginia median salaries

IMPLEMENTATION PLAN:
(1) Survey existing high-tech industries in the state to identify projected workforce needs by September 2006
(2) Develop strategic plan for increasing the number of technology-based STEM jobs in West Virginia by December 31, 2006
(3) Select new high-tech business targets that complement and diversify the economy by March 31, 2007
(4) Develop faculty hiring plans at WVU and MU designed to fill critical gaps in existing interdisciplinary bachelor's/master's degree programs to strengthen existing industry and build new opportunities by December 31, 2007
(5) Implement hiring plan by March 31, 2008
(6) Complete hiring process by May 31, 2010

VISION2015summary

What VISION 2015 Will Do:

- Attract $1.4B in federal-external funding
- Create 33,000 jobs
- Have total economic impact of $3.3B

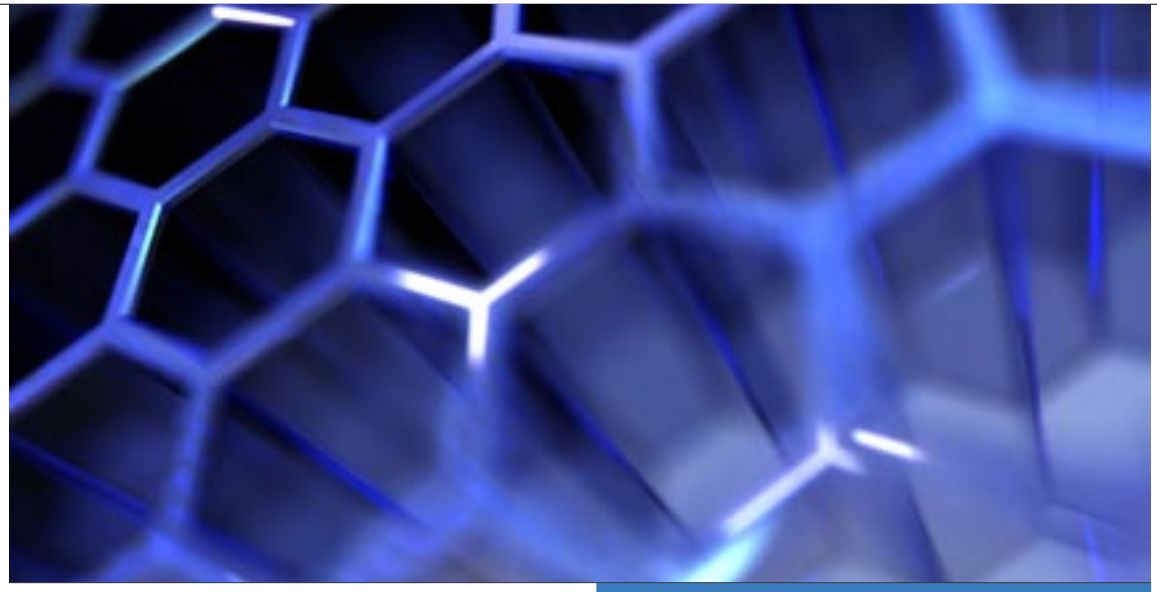
What VISION 2015 Requires:

- Investment of $250M in new research
- Active support of state leaders

Major Components:

- Invest $250M
- Recruit 89 new scientists and engineers
- Construct two state-of-the-art science and engineering facilities
- Increase the production of West Virginia scientists and engineers with advanced degrees
- Develop new tech-based businesses

Neighboring State Investments in Research



research

A Good Investment for West Virginia

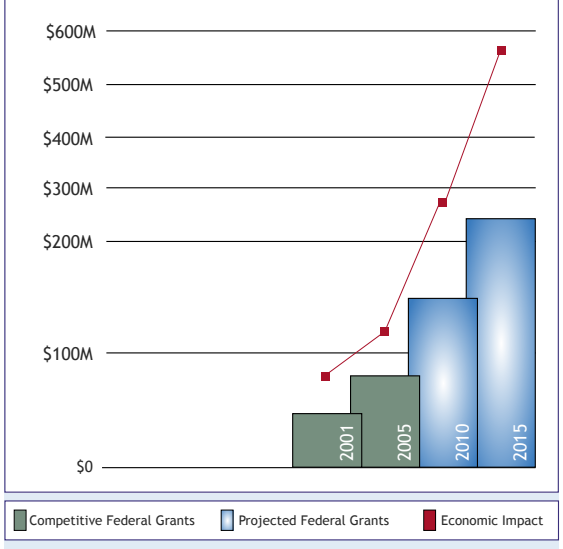
CURRENT SUCCESS:

- Since 2001, competitive federal research in West Virginia has risen from $35.8M to $60.1M.
- Since 2001, West Virginia researchers have received nearly $252M in federal research grants.
- In 2005 alone, research created more than $147M in economic activity and supported 4,423 jobs.

PROJECTED SUCCESS:

- Federal grants will exceed $240M annually by 2015, totaling $1.4B over the next 10 years.
- Investment in VISION 2015 will create a cumulative economic impact through 2015 of $3.3B and 33,000 jobs.

Economic Impact of Research in West Virginia



Sources:

- F. Larry Lesitritz, Ph.D., 2000
- Arles and Scolar, 1998
- US House of Representatives Summit on Competitiveness, 2005
- Association of University Technology Managers, 2005
- WVURC; MURC, 2005
- Non-stock photos provided by West Virginia University Photographic Services

2015

WVEPSCoR ADVISORY COUNCIL

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West Virginia University Research Corporation

Dr. Fred Butcher, Senior Associate Vice President for Health Sciences
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National Center for Technology Commercialization

VISION2015

THE WEST VIRGINIA SCIENCE AND TECHNOLOGY STRATEGIC PLAN
Prepared by the West Virginia EPSCoR Advisory Council, December 2005