

Building Opportunity. Getting Results.

NGA STEM Center Grant Proposal



A PROPOSAL FOR

Science, Technology, Engineering and
Math (STEM) Center Grant Program

SUBMITTED BY

State of Ohio
Ted Strickland, Governor

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CONTENTS:

| | |
|---|-----|
| Governor’s Letter of Support | 1 |
| Building Opportunity. Getting Results. | |
| Introduction | 4 |
| Gap Analysis | 5 |
| Developing a Comprehensive STEM Agenda | 6 |
| Final Comments | |
| ATTACHMENT A: | 15 |
| Gap Analysis of the State’s Policy Landscape for K-12 STEM Redesign that Supports the State Economy’s Innovation Capacity | |
| ATTACHMENT B: | 110 |
| Project Budget | |
| ATTACHMENT C: | 112 |
| Letters of Interest and Commitment | |





TED STRICKLAND
GOVERNOR
STATE OF OHIO

May 11, 2007

Governor Janet Napolitano, Chair
National Governors Association
444 North Capitol Street, Suite 267
Washington, DC 20001-1512

Dear Governor Napolitano:

I am pleased to submit the state of Ohio's proposal for funding under the Science, Technology, Engineering and Math (STEM) Center Grant Program. Along with the other members of Ohio's STEM Leadership Team, I welcome the National Governors Association's support and assistance as we work to expand Ohioans' interest and achievement in STEM, and to strengthen the technological expertise that will shape our state's success in the 21st century economy.

Earlier this year, the Science and Mathematics Education Policy Advisory Council (SAMEPAC) conveyed to me and other state education policy leaders that Ohio has many segmented, individual programs, each trying to improve some aspect of the mathematics and science pipeline, but they are only loosely connected to long-term strategic planning for the state. Council members advised: "This approach has worked well enough for Ohio in the past, but the state needs to invest in an infrastructure that can provide effective intermediate capacity focused on aligning Ohio's P-12 education system, institutions of higher education and industry and business."

Ohio's NGA STEM Center grant proposal confirms our commitment to meet this challenge – to develop a comprehensive agenda that

- Helps all Ohio students become STEM literate and empowers them to become innovators and inventors, self-reliant and logical thinkers and technologically proficient problem-solvers.
- Encourages all Ohio students to achieve greater creativity and to develop the ability to apply their knowledge and skills in multiple settings, and to build the capacity to make sense of the world rather than simply learn the bits and pieces of any particular discipline or subject area.
- Gives state education policy leaders, educators and other stakeholders an opportunity to rethink the design of our system of schools, ensure that all students are outfitted with appropriate technology and create culturally relevant learning experiences both in and outside traditional classroom settings.
- Builds a seamless P-16 education system that closes the leaks in Ohio's education pipeline and prepares all students for a lifetime of learning.
- Nurtures partnerships that allow educators and the business sector to join in collaborative efforts to improve students' STEM-career opportunities, and to improve the education community's ability to meet the talent needs of Ohio's technology- and innovation-driven businesses.

Page Two

May 11, 2007

Governor Janet Napolitano

The state of Ohio's proposal outlines a strategy for systemically supporting the development of a globally competitive citizenry capable of applying STEM principles and attributes across disciplines, and for harnessing the power of scientific and technological expertise to support and stimulate regionally-focused, technology-based economic activity and growth.

Our State Leadership Team has the bipartisan executive leadership needed to (a) guide productive connections between economic strategy in key emerging clusters and STEM policy development; (b) introduce and drive appropriate and enabling state policy; and (c) engage school districts, colleges and universities to implement a P-16 policy agenda that infuses STEM throughout the entire educational system.

Our goals are clear, achievable and measurable. We will work to improve public understanding of and support for K-12 STEM education redesign and its link to improving opportunity for Ohio students and enhancing the state's innovation capacity. And we will work to increase high school graduates' readiness for college-level work in STEM areas in targeted pilot regions, as measured by numbers of students taking upper-level math and science courses and data on student participation and achievement on college-readiness assessments.

We will work to achieve these goals by establishing a statewide network of regional STEM Centers, beginning with the development of a "proof-of-concept" integrated STEM Center in the Dayton metropolitan area (southwest Ohio) that will enhance the research, economical development and employment prospects within two carefully defined economic clusters.

As our proposal demonstrates, the state of Ohio is ready for transformational change and committed to innovative STEM policies. In partnership with the National Governors Association, we are ready to act – to make tough choices based on well-reasoned strategies. We are determined to take bold actions that bring all of Ohio's schools out of the 20th century – to close the gap that too often separates the world inside the schoolhouse from the world beyond its walls. We are committed to driving STEM literacy for all students as they prepare for college and work.

Finally, we believe that when these awards are granted, Ohio will be in good standing with NGA dues and ask that you consider this application with that in mind.

Sincerely,

A handwritten signature in black ink that reads "Ted Strickland". The signature is written in a cursive, flowing style.

Ted Strickland
Governor, State of Ohio

Building Opportunity. Getting Results.

NGA STEM Center Grant Proposal



Introduction

The keys to Ohio’s future economic prosperity are clear. First, **innovation** – the capacity to generate and apply new ideas to the creation and upgrading of products, processes and services – is a major ingredient of long-term economic growth. And second, **talent** – the development of technology-savvy workers with a strong work ethic and advanced synthesizing, reasoning, collaboration, communication and problem-solving skills – is a core driver of competitiveness in the 21st century economy.

The assertion that economic success depends on innovation and the cultivation and retention of skilled “knowledge workers” is supported by substantial research, including a recent analysis of 75 years of state income growth commissioned by the Federal Reserve Bank of Cleveland. Education policy makers, as well as business and education leaders across Ohio, increasingly acknowledge that innovation and talent are the two distinguishing characteristics of the scientific and technological leadership we must develop to prosper as a state in a global knowledge economy. They also recognize the need to change the relationship between teachers and students, improve prevailing learning practices in the classroom and get better results.

Ohio’s Vision of STEM Education

Ohio’s NGA STEM Center grant proposal has been shaped by all of these considerations. It reflects a clear vision that ***the state of Ohio will be a leader in the innovation-based global economy, and that Ohio citizens will have the high-level knowledge (particularly in science and mathematics), as well as problem solving, creative thinking and technology skills, coupled with tolerance and cultural sensitivity, they will need for success in the classroom, careers and citizenship.***

Making this vision a reality for all Ohio students will **not** be easy. Yet, Ohio is not intimidated by the difficulty of the task – no more than the settlers who populated the Ohio Valley more than 200 years ago, the immigrants who flooded this area in the 19th century, the great 20th century industrialists and innovators who built Ohio on the nation’s frontier, and the working Ohioans whose hard work made progress possible, were threatened in centuries past. With the virtues of self-reliance, ingenuity, hard work and foresight, earlier generations of Ohioans prevailed in the face of serious challenges. Ohioans are ready to meet this challenge once again.

Ohio’s leaders understand that our economy is in transition – that we must build a new knowledge-based economy alongside the agricultural and manufacturing economies that have dominated our state for the past 200 years. They recognize that we are not producing enough workers educated in the STEM disciplines and that our supply of qualified workers is not keeping pace with the demands of an innovation- and technology-driven economy. They also reject the notion that it is all right to educate a relatively small percentage of students very well, while a much larger population receives an education that is, simply stated, “good enough.”

Therefore, Ohio’s vision of STEM education – and the driving force behind its efforts to develop a comprehensive STEM agenda – has five elements:

1. Every Ohio student will be **STEM literate**, having acquired the attributes of a STEM-educated learner – an innovator and inventor, a self-reliant and logical thinker, and a technologically proficient problem-solver.
2. Every Ohio student will be challenged to achieve greater **creativity and develop the ability to apply his or her knowledge and skills in multiple settings** – and all students will be supported in their efforts to make sense of the world rather than simply learn the bits and pieces of any particular discipline or subject area.
3. Building on documented advances and achievements of the past decade, STEM education will give state education policy leaders, educators and other stakeholders an opportunity to **rethink the design of our system of schools, ensure that all students are outfitted with appropriate technology, and create culturally relevant learning experiences (both in and outside traditional classroom settings)** that allow students to tinker with ideas and materials that prepare them to meet the requirements of a knowledge-based economy.
4. To close the leaks in Ohio’s education pipeline, and to meet the needs of the “whole child” as students are prepared for the 21st century workforce and a lifetime of learning, **a seamless P-16 education system** – sufficiently agile to adapt to changing state and local conditions and to support the state’s workforce and economic development goals – will be developed under the leadership of the Partnership for Continued Learning, which is the state’s P-16 Council.
5. **Partnerships** that allow educators and the business sector to join in collaborative efforts to improve students’ STEM-career opportunities, and to improve the education community’s ability to meet the talent needs of Ohio’s technology- and innovation-driven businesses, will be built and sustained over time.

Conventional wisdom tells us that if Ohio wants to remain competitive in the global economy, it needs to do a better job of preparing a select number of students to participate in STEM careers, which would lead to the production of more scientists, mathematicians, engineers and technologists. Often, this leads states to limit participation to a few students and to focus on discrete disciplines.

Ohio has chosen to follow a different path – to make STEM education accessible to all students, not just the economically well off or the geographically providential. And on this path, we will pursue cross-discipline, true STEM, which educates the “whole child.”

Ohio will leverage its emerging P-16 system, as well as the state’s significant resources in research and technology commercialization (i.e., Third Frontier Project), with all elements of its education system to develop a technically competent workforce to support two key critical economic clusters: (1) **ICE and AM** – instruments, controls, sensors, electronics and engineering components, and advanced manufacturing; and (2) **Power and Propulsion** – including fuel cells; hybrid powertrain technology; and clean coal, and renewable and advanced technologies.

Propelled by the vision articulated above, **the state of Ohio embraces the required elements of the NGA STEM Center grant program**, including (1) tracking high school graduation measures through the **NGA Graduation Rate Compact**; (2) participating actively in the **National Education Partnership**; and (3) developing and implementing a **comprehensive communications plan** to build and sustain public awareness, understanding and support for STEM education. We also agree to **publicly report** the objectives of Ohio’s NGA grant proposal and its progress **against 10-year goals**.

Gap Analysis (RFP SECTION A)

Ohio has completed a gap analysis of the state’s current policy and landscape for K-12 redesign to support the state’s competitiveness and the success of its students in the 21st century economy. The results of that analysis are reported in **Attachment A**. Here, it is worth noting that the gap analysis reveals a multitude of programs, initiatives and partnerships that are working to improve STEM education across the state, **although it confirms that these activities have not been fully and effectively coordinated**. It also points to other findings that are less encouraging and that have guided the development of Ohio’s grant proposal. For example:

- **Ohio has a serious shortage of highly-qualified mathematics and science teachers.** As the Science and Mathematics Education Policy Advisory Council (SAMEPAC) reported earlier this year, Ohio simply does not retain enough highly effective mathematics and science teachers, and its professional development offerings for those who do stay are far from adequate.

- ***There is an urgent need for the identification, dissemination and scaling-up of best practice models for STEM education.*** More effort needs to be directed at evaluating and supporting the expansion of successful models into long-term efforts.
- While a statewide infrastructure designed to help school districts look at their own data regarding students' academic performance and transitions between P-12 education and postsecondary institutions is being developed ***substantial work is needed to develop a comprehensive P-16 data system that connects disparate databases at the state and local levels.***

Each of these findings points to one of Ohio's greatest needs: a means of coordinating multiple efforts into an integrated longitudinal plan and a linked infrastructure to support implementation, expansion and innovation. As the SAMEPAC report notes, "State agencies in Ohio have many segmented, individual programs, each trying to improve some aspect of the mathematics and science pipeline, but they are only loosely connected to long-term strategic planning for the state. This approach has worked well enough for Ohio in the past, but the state needs to invest in an infrastructure that can provide effective intermediate capacity focused on aligning Ohio's P-12 education system, institutions of higher education and industry and business."

The NGA STEM Center grant program is a timely and perfectly aligned resource for supporting, enhancing and accelerating Ohio's efforts to close these gaps.

Developing a Comprehensive STEM Agenda

This proposal outlines a strategy for (a) systemically supporting the development of a globally competitive citizenry capable of applying STEM principles, learnings and attributes across disciplines to think critically, solve problems creatively, and generate advantage and opportunity through invention and innovation, and (b) harnessing the power of scientific and technological expertise to support and stimulate regionally-focused, technology-based economic activity and growth. Key components of Ohio's STEM Agenda follow:

State Leadership Team and Membership (RFP SECTION B)

Ohio's STEM Leadership Team, which functions as a part of the Partnership for Continued Learning, has the bipartisan executive leadership needed to (a) guide productive connections between economic strategy in key emerging clusters and STEM policy development; (b) introduce and drive appropriate and enabling state policy; and (c) engage school districts, colleges and universities to implement a P-16 policy agenda that infuses STEM throughout the entire education system.

Ohio NGA STEM Leadership Team

| | |
|-----------------------|---|
| Ted Strickland, Chair | Governor |
| Lee Fisher | Lt. Governor, Director of the Ohio Department of Development |
| John Stanford | Executive Assistant to the Governor, Education |
| Wendy Patton | Executive Assistant to the Governor, Economic Development |
| Eric Fingerhut | Chancellor, Ohio Board of Regents |
| Susan Zelman | Superintendent of Public Instruction, Ohio Department of Education |
| Julie Schaid | Executive Director, Partnership for Continued Learning |
| Joy Padgett | Ohio Senator, Chair of the Senate Education Committee |
| Tom Roberts | Ohio Senator, Ranking Minority Member of the Education Committee |
| Arlene Setzer | State Representative, Chair of House Education Committee |
| Ken Carano | State Representative, Ranking Minority Member of the Education Committee |
| Chad Wick | President and CEO, KnowledgeWorks Foundation |
| Richard A. Stoff | President, Ohio Business Roundtable |
| Alexander M. Cutler | Chairman, President and CEO of Eaton Corporation and Immediate Past Chairman of the Greater Cleveland Partnership |
| Michael G. Morris | Chairman, President and CEO of AEP and current Chairman of the Ohio Business Roundtable |

Building on Ohio's Existing Capacity and Demonstrated Commitment to STEM Leadership. Ohio is rich in programs, initiatives and partnerships working to improve some aspect of the state's STEM pipeline, but they are loosely connected and insufficiently focused. Design and implementation of the NGA STEM grant will include significant and ongoing work with school districts, postsecondary education institutions, the business community and informal STEM education organizations. This will be accomplished through interaction with the State STEM Leadership Team, as well as regular STEM seminars convened by the Partnership for Continued Learning and within regional P-16 councils. The State STEM Leadership Team's critical partners will include:

- Ohio's **Third Frontier Project**, initiated by the Governor and state legislators in February 2002, is the state's largest-ever commitment to expanding Ohio's high-tech research capabilities and promoting innovation and company formation, which in turn will create high-wage jobs for Ohioans. A partnership of state government, public and private universities, and Ohio's business community, this 10-year, \$1.6 billion initiative is designed to build world-class research capacity, support early-stage capital formation and the development of new products, and finance advanced manufacturing technologies to help existing Ohio industries become more productive. Third Frontier Internship opportunities for university students studying in STEM disciplines are offered each year to build talent within the state.
- **Wright Centers of Innovation** are multi-organizational collaborations involving the state's universities, medical centers and other non-profit research organizations, as well as private-sector businesses. The 13 centers were established through Ohio's Third Frontier Project to support research and technology commercialization that will have a substantial and sustainable positive impact on Ohio's economy.
- Ohio is a national leader in College Tech Prep, including IT, biotechnology and **Project Lead the Way**, which is being implemented in 128 secondary schools across the state and has recently created a partnership to begin 13 summer academies. One of nation's premier community colleges, Sinclair Community College in Dayton, Ohio, hosts a national professional development center for this initiative.
- Five regional **Centers of Excellence for Mathematics and Science Education** are collaborative organizations of public and private two- and four-year colleges and universities to improve teaching, learning, teacher education and research statewide.
- The **Ohio Resource Center for Mathematics, Science, and Reading** provides peer-reviewed online mathematics and science instructional resources to educators across the state, and has shown the capability to take on other state priority initiatives.
- The **Ohio Mathematics and Science Coalition** is an advocacy group that has taken up teacher capacity as a major issue in supporting mathematics and science improvement. To this end, it seeks to increase student achievement by increasing the content knowledge and teaching skills of teachers.

Goals of the STEM Education Ohio Seeks to Support with this Grant (RFP SECTION C)

| Goals and Metrics | Indicators and Benchmarks |
|--|--|
| Gains in public understanding of and support for K-12 STEM education redesign and its link to improving opportunity for Ohio students and enhancing the state's innovation capacity | <ul style="list-style-type: none"> ▪ Amount of media coverage in targeted pilot regions about student achievement and attainment in K-12 STEM education ▪ Web survey results to determine public perception ▪ Attendance at grassroots and other community events <p>Benchmark: Establish baselines for 2007-08 school year</p> |
| Increased readiness of high school graduates for college-level work in STEM areas in targeted pilot regions, as measured by numbers of students taking upper-level math and science courses and data on student participation and achievement on college-readiness assessments | <ul style="list-style-type: none"> ▪ AP, ACT, SAT test scores ▪ ACT Work Keys ▪ Number of students in dual enrollment options, Tech Prep, Project Lead the Way and AP <p>Benchmarks: Readiness Benchmarks established by College Board and the ACT; Work Key assessment benchmarks; Early Math Placement Test; and AP rates in 2006-07</p> |

Increased readiness of high school graduates for postsecondary pathways in STEM areas in targeted pilot regions as measured by success in first-year STEM courses in postsecondary education (community colleges and four-year institutions) and training (e.g. industry certification programs)

- Number of students enrolled in STEM courses in Years 1 and 2 of program
- College attrition rates and graduation rates
- Demographic analysis
- Number of entry-level workforce certifications
- Number of college students enrolled in STEM programs

Benchmark: Establish baselines in 2006-2007

Identified STEM Center Grant Structure (RFP SECTION D)

Ohio's ultimate objective is to establish a statewide network of regional STEM Centers guided by a STEM Leadership Team at the Partnership for Continued Learning. With its emphasis on the cultivation of STEM literacy, talent and competencies throughout the state, regional networks are an appropriate design for Ohio.

Yet, the work supported by the NGA STEM Center grant program will have a narrower focus – that is, to develop an integrated STEM Center in the Dayton metropolitan area (southwest Ohio) that will directly enhance the research, economic development and employment prospects within two carefully defined economic clusters. While the Dayton Regional STEM Center becomes operational, a communication plan will be rolled out across the state to build understanding and support for STEM education and a regional network of STEM Centers, with southeast Ohio and northeast Ohio as the next likely candidates. Work products and lessons learned from the initial center will be leveraged toward the development of subsequent regional centers.

Ohio's "Proof of Concept" Stem Center Model.

Our proposed Dayton Regional STEM Center will be dedicated to transforming and supporting STEM education across the region. As a "proof of concept" model, it will be the first step in developing an integrated, statewide STEM Network. With this focused first step, Ohio will have an opportunity to (a) identify and build upon emerging best-practice models in collaborative regional work; (b) focus, leverage and expand existing statewide and regional resources toward identified goals in STEM education; and (c) develop a model for other regional STEM Centers to fulfill Ohio's vision of a statewide network of such organizations focused on strategic, STEM-centered education and workforce development.

The Dayton region was chosen as the site for the first Regional STEM Center for its demonstrated success in public/private partnerships, its tie to industry clusters critical to Ohio, and the existing educational assets within the region. The area offers many unique resources that support innovation and workforce development, including

The Miami Valley Math & Science Consortium, whose mission is to systematically, strategically and collaboratively support STEM talent development in the Dayton Region, will provide the Dayton Regional STEM Center with the critical leadership support for and access to education and business partnerships necessary to ensure its success. The Consortium will host a STEM Education Summit in June 2007 to begin developing a strategic STEM Talent Development Plan for the area.

The consortium is funded jointly by Sinclair Community College, Wright State University, University of Dayton, Montgomery County Educational Service Center and the Engineering & Science Foundation of Dayton. Its stakeholders include the Dayton Development Coalition, Dayton Area Chamber of Commerce, Air Force Research Laboratories at Wright Patterson Air Force Base, Dayton Area Defense Contractors, University of Dayton Research Institute, Institute for the Development and Commercialization of Advanced Sensor Technologies/ Wright Center for Innovation and many other organizations throughout the Miami Valley.

Having achieved success with innovative education models and programs such as the Dayton Early College Academy, the Ohio Core Accelerated Licensure Program for developing STEM secondary educators, and a national training site for Project Lead the Way, the Dayton region has already committed to other significant collaborative projects as well. Pending grant proposals that leverage public/private partnerships include the Dayton Area WIRED Initiative; a UTeach Replication Proposal to the National Math & Science Initiative submitted jointly by Wright State University, University of Dayton and Sinclair Community College; a National Science Foundation Grant submission to create a Tech Prep STEM Teacher Pathway for a new high school that will be run jointly by Dayton Public Schools and Sinclair Community College; and a newly formed internship program within the Air Force Research Labs for Dayton Early College Academy students.

a number of research universities, one of the nation's most outstanding community colleges, an emerging P-20 council with a defined focus on STEM, and the Wright Patterson Air Force Base – one of the largest and most comprehensive military bases in the world and the site of the headquarters for Air Force Research Laboratories.

The Dayton area also is distinguished by the commitment of its public and private partner organizations that are already building a strong STEM support infrastructure and are committed to seeking the resources and supports necessary to develop globally competitive talent in STEM disciplines.

A Focus on Two Economic Clusters. In 2003, the Ohio Business Roundtable issued a prospectus – *World Class Ohio* – that offered guidance to state policy makers on the strategic direction and investment priorities of the Third Frontier Project. Building on the work at Battelle, it focused attention on five core areas of economic strength where Ohio has already demonstrated world-class leadership: (1) advanced materials; (2) biosciences; (3) information technology, (4) instruments, controls, sensors, electronics, and advanced manufacturing technologies; and (5) power and propulsion.

Ohio's NGA proposal will focus specifically on the final two economic clusters for three reasons:

- Both clusters have sufficient size to make a positive impact on future Gross State Product and high-paying job growth. Aligning K-12 STEM standards and assessments with postsecondary and workforce expectations for what high school graduates should know and be able to do is critical to the long-term vitality of Ohio's economy.
- Each cluster has a strong and vibrant industry infrastructure in place that can be leveraged to both stimulate and take advantage of a breakthrough level of synchronization between increased supply of qualified STEM graduates and an increasing demand for employees with STEM skill sets.
- Combined, these clusters impact every region of the state. Success in our proposed proof-of-concept model will benefit other regions and can be used as a tool for encouraging private- and public-sector leadership to support replication of regional STEM Centers focused on other economic clusters. The resulting success will create the leverage to quickly take best practices in STEM education to scale.

Progress Measures for the Dayton STEM Site

In addition to the statewide indicators and benchmarks identified above, a number progress measures will be used:

- *Number of STEM problem-based lessons aligned to industry expectations, grounded in academic content standards and made available for use*
- *Number of classroom demonstration sites and number of participants*
- *Number of new lab use opportunities leveraged through business/industry and postsecondary institution partners*
- *Number of school leaders using STEM principles to enhance education in their schools as measured by attendance at a STEM Leadership Workshop and a STEM Learning Institute developed for their school/district*
- *Number of industry and higher education STEM Fellows involved on an ongoing basis to support K-12 teaching and learning*
- *Increase in the number of students earning early college credit (baseline data already developed; will be done through the Education Service Center.*
- *Number of teachers impacted through the use of problem-based lessons developed by the STEM Center, engaged in professional development activities, participating in externship opportunities, and earning a STEM Educator credential.*

Since 2002, the state of Ohio – through its Third Frontier Project and the Ohio Fuel Cell Initiative – has invested \$69.2 million in the Dayton area for these two economic clusters. State support in Dayton for all five clusters has totaled \$81.3 million during this same period. Statewide, total funding for the Third Frontier Project has totaled \$621.1 million since 2002. It should be noted that the Dayton area is poised to take advantage of the significant current and projected future job opportunities in these two industry clusters.

Objectives and Activities (RFP SECTION E)

Ohio's STEM Leadership Team has chosen to focus on five interrelated core objectives as the foundation of the state's STEM agenda. These objectives will be addressed at both the state level and regional proof-of-concept site, and will be supported by a communication plan. The five objectives include the following:

- ***Develop and sustain public-private partnerships in one or more regions of the state to redesign Ohio's K-16 STEM education system to support the regional economy's capacity for innovation.*** The partnerships involving leading economic clusters, K-12 school districts, postsecondary institutions, state, county and local government, and the general public will shape new education models of collective responsibility.
- ***Align K-12 STEM education requirements (standards, curricula, assessments) and outputs (achievement) with postsecondary and workforce expectations for STEM competencies of entering students and employees.*** Systems alignment for mathematics and English is largely complete through work with the American Diploma Project and the Ohio Core but must be expanded to the other STEM disciplines and workforce expectations for the targeted industry clusters.
- ***Seek innovative new school, curricula, assessment, and standards models in STEM education, and bring successful models to scale.*** New education models will include the six senses – design, story, symphony, empathy, play and meaning – can help create schools where education innovation is a product of combining technological and educational expertise upon which professional success and personal fulfillment now depend.
- ***Improve the quality of STEM teachers and the ability of school and district leaders to lead STEM education reform.*** Prepare teachers to work in the Conceptual Age with strong STEM academic content skills and the ability to design curriculum that helps students learn the content through a full range of senses to meet new era demands.
- ***Benchmark state K-12 standards, assessments and curricula in STEM areas to top-performing nations in STEM education achievement and attainment*** – for examples, through state participation in the Trends International Mathematics and Science Study (TIMMS) or the Program for International Students Assessment (PISA).

Two -Year Work Plan (RFP SECTION F)

The Ohio STEM Leadership Team will guide the NGA grant implementation over the two-year period. Through a combination of grant funds and matching resources, the leadership team will guide creation of the first regional STEM Center, implement a communication plan that includes public outreach as well as regular convenings of regional STEM stakeholder groups across the state, and provide seed grants for additional regional STEM Centers to come online.

The Ohio STEM Leadership Team expects public-private partnerships to play a major role in transforming STEM education in Ohio. Existing partnerships, at both the state and regional level, will be leveraged and new partnerships will be created where needed. The regional STEM Centers will be networked together with the state's STEM Leadership Team serving as the hub. This regional structure will allow Ohio to be a successful player in the global marketplace, pursue a collaborative sense of purpose for education and provide online opportunities for students to explore other cultures and collaborate with international peers.

The STEM Center(s) will use STEM Fellows – experts from P-12, higher education, business/industry and research – working in teams to (a) align P-12 STEM standards, curricula and assessments with the expectations of college and work in the targeted clusters; (b) create a regional STEM Educator credential; (c) conduct in-depth professional development experiences, including intensive mentoring for entry-year teachers; (d) design customized professional development services and coaching for practicing teachers; (e) conduct a STEM Leadership Workshop to assist building leaders and superintendents in creating STEM Learning Plans for their buildings/districts; and (f) identify internship and externship experiences for both teachers and students. Over time, the initial group of STEM Fellows will train the next group to serve as STEM Fellows, continuing to expand the capacity for STEM education throughout the region and state. The STEM Center(s) will contract with noted experts in the field to inform their work.

Following is a table outlining Ohio’s proposed two-year work plan and activities:

| Activity | Person/Groups | Time Frame |
|---|---|-------------------------|
| NGA Grant awarded | NGA | 8/07 |
| Facilitate support for the pilot; create plan for support of the other regional centers; begin deliberations on the 10-year performance goals | State STEM Leadership Team (SSLT) | 8/07 – 8/09 (quarterly) |
| Retain communications contractor to work with a state level communications team to coordinate the assessment of past marketing efforts and build a common language and message to explain the need and potential for STEM, and create and implement a statewide coordinated communications and public engagement plan | Communications TEAM (CT), SSLT; Regional STEM Center teams (RSCT) | 8/07 – 8/09 |
| Award Planning Grant for Regional STEM Center | SSLT | 9/07 |
| Ohio STEM Objective: Develop and sustain public-private partnerships. | | |
| Hire Regional STEM Center director | Regional STEM Center Board | 9/07 |
| Recruit and orient P-20 education, business/research STEM Fellows to conduct work at the Center | Regional STEM Center (RSC) | 10/07 – 1/08 |
| Identify teacher externship and student internship opportunities with industry partners in identified clusters | RSC | 1/08 – 6/08 |
| Ohio STEM Objective: Align P-20 STEM education requirements and outputs with postsecondary and workforce expectations for STEM competencies. | | |
| Conduct needs assessment of STEM readiness knowledge and skills for identified industry clusters, and identify professional development needs towards a regional P-12 STEM Educator credential and available industry resources/opportunities/lab sites to assist with this work | RSC | 12/07 – 2/08 |
| Conduct technical and content review of content standards | Ohio Department of Education; Ohio Board of Regents; Partnership for Continued Learning | 2007-2008 |
| Reconcile differences between content standards and math and English Expectations for Year 1 college document | | 2009 |
| Align American Diploma Project benchmarks to content standards | | 2009-2010 |
| Develop college/workforce readiness assessment, grounded in the reconciled document | | 2010-2011 |
| Continue and enhance the work of the Ohio Data Driven Decisions for Academic Achievement project and the federally-funded Longitudinal Study to efficiently and accurately manage data exchange systems to improve student achievement and promote linkages across the state. | | |
| Ohio STEM Objective: Establish innovative new school curricula, assessments and standards in STEM education and bring successful models to scale. | | |
| Refine and support new accelerated STEM learning options that leverage earning college credit early through a variety of mechanisms, including classes via distance and on the high school campus | RSC | 9/07 – 6/09 |
| Analyze existing curriculum and resources; align and adapt to identified industry clusters grounded in academic content standards; conduct Lesson Studies with peer review to test quality; and create repository of lessons/resources for use by educators | RSC | 12/07 – 12/09 |
| STEM Fellow Teams develop new courses, lessons and experiments using a problem-based approach aligned to industry clusters | RSC; STEM Fellow Teams | 1/08 – 1/09 |

| | | |
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| Create and expand availability of STEM schools; develop standards and assessments in engineering; support development of high-quality STEM curricula for voluntary use by districts; assess standards for rigorous and relevant Career Technical Education programs that prepare students for STEM-related occupations; organize standards around “big ideas” grounded in inquiry-based delivery with more hands-on application, including both the left-brained and right-brained skills; and increase the number of students who are fluent in world languages, knowledgeable about world regions and international commerce | Ohio Department of Education; Ohio Board of Regents; Ohio General Assembly | 7/07 – 12/11 |
| Using iEARN-USA, identify online international collaborative projects that align with Ohio’s Academic Content Standards; provide professional development to selected educators; pilot and evaluate projects; and disseminate the results | Ohio Department of Education | 7/07 – 6/09 |
| Ohio STEM Objective: Improve the quality of STEM teachers and the ability of school and district leaders to lead STEM education reform. | | |
| Develop STEM Leadership Academy and Regional STEM Educator Credential frameworks | RSC | 10/07 – 5/08 |
| Begin professional development activities of the STEM Leadership Academy and towards the Regional STEM Educator credential | RSC | 3/08 |
| STEM Leadership Academy participants create STEM Learning Plans for their buildings/districts | RSC | 6/08 |
| Begin teacher externship and student internship opportunities with industry partners in identified clusters | RSC | 6/08 – 6/09 |
| Provide intensive mentoring (via STEM Fellows) for selected entry-year teachers and offer customized professional development to teachers through group consultation and/or individual coaching | RSC | 8/08 – 6/09 |
| Ohio STEM Objective: Benchmark state K-12 standards, assessments and curricula in STEM areas to top-performing nations in education achievement and attainment. | | |
| Participate in the Program for International Student Assessment (PISA); benchmark Ohio Academic Content compared to Trends, International Mathematics and Science Study, PISA, Progress in International Reading Literacy Study, and Adult Learning and Literacy; conduct technical review of math (‘08) and science (‘09) content standards; integrate and benchmark against 21st Century Skills (‘09-10); integrate technology in other content areas or consider a separate application (‘09); and compare best practices from other countries | Ohio Department of Education | 2009-2010 |

Connectors between the STEM Center and Other State Initiatives (RFP SECTION G)

Governor Strickland and Lt. Governor Lee Fisher (who also serves as director of the Ohio Department of Development and heads up a small, focused Talent Integration Council), as well as other members of the State STEM Leadership Team, recognize that one of Ohio’s top priorities must be to enact and carry out policies and support practices that develop an educated and skilled adult workforce to fill the jobs of existing and new employers. In fact, earlier this year, the Administration issued a report that acknowledged that state economies, in large part, will thrive or decline in the 21st century economy based on how well they cultivate and retain workers who possess postsecondary educational credentials (though not necessarily a bachelor’s degree), technical aptitudes, the ability to learn rapidly and an entrepreneurial approach to employment.

Given this understanding, it is not surprising that the Strickland Administration is working to strengthen Ohio’s STEM-education pipeline by aligning state-funded initiatives at the Ohio Department of Development (including the Third Frontier Project’s research and technology commercialization initiatives) with several U.S. Department of Labor-funded programs (including the Workforce Investment Act) currently housed at the Ohio Department of Job & Family Services.

At the same time, state legislators are presently debating a budget bill that includes funds for several STEM initiatives. In addition, the state recently submitted two WIRED grant proposals – one from the Dayton region – that are designed to systematically strengthen the education pipeline in STEM disciplines.

Finally, the *Creating a World-Class Education System in Ohio* study, prepared by McKinsey & Company for Achieve, Inc., at the request of the State Board of Education (and with support from the Bill & Melinda Gates Foundation) calls for changes in prevailing teaching and learning practices that will better prepare Ohio students to succeed in a global knowledge economy.

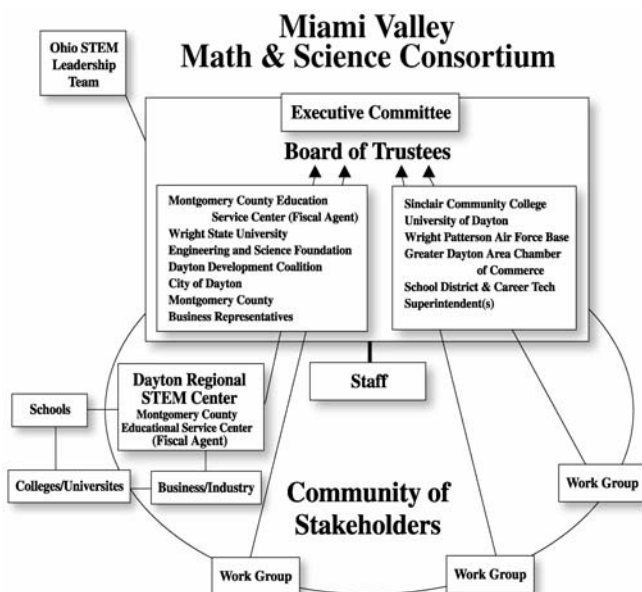
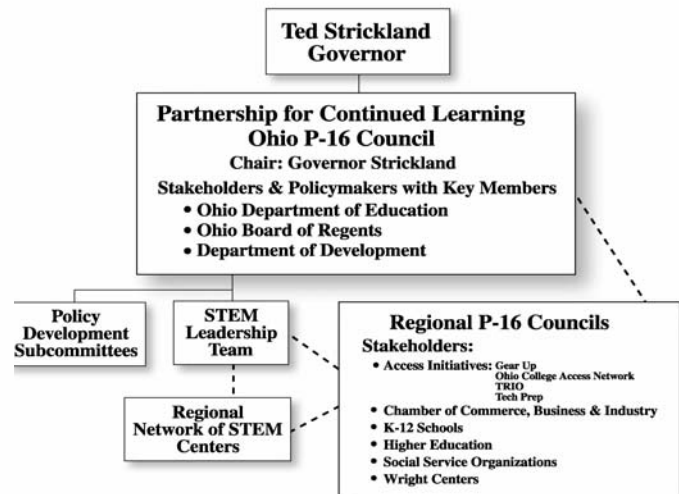
As the state of Ohio moves forward with these initiatives, the state’s Regional STEM Centers will:

- Leverage recent state education policy changes, including establishment of new graduation requirements through the Ohio Core curriculum, which requires high school students to take four years of mathematics to the level of Algebra II (or its equivalent) and three years of inquiry-based laboratory science, beginning with the graduating class of 2014.
 - The state already is providing support to local school districts to begin building capacity for the Ohio Core. In addition, College and Work Ready Expectations in mathematics and English are nearly complete, allowing Ohio to concentrate on alignment in the other STEM disciplines.
 - The spirit of the Ohio Core articulates the need to engage all students equitably in challenging coursework that prepares them for college and work.
- Connect with the efforts of the Ohio Board of Regents to enhance course articulation and transfer.
 - The state now has statewide articulation and guaranteed transfer of courses within the general education core requirements and many of the prerequisite classes for 38 majors within our public colleges and universities.
 - This work is extending now to industry recognized credentials, where course work is often available at the high school level, to common acceptable scores for credit on Advance Placement exams offered by the College Board and increasingly for early college credit programs.

Governance Structure of Network of Centers (RFP SECTION H)

The leadership for Ohio’s STEM agenda and the creation of the STEM Center network will come directly from the Governor’s Office through the Partnership for Continued Learning, as noted in the graphic to the right. A member of the STEM

**National Governors Association
Ohio STEM
Governance Structure**



Leadership Team will serve on the board of the pilot regional STEM Center and a liaison member of the STEM Center board will serve with the State Leadership Team to ensure an open channel of communication.

Ohio's P-16 council – the Partnership for Continued Learning – is chaired by the Governor, and includes bipartisan legislative members, P-12 and higher education leaders, business leaders and representatives from regional partnerships. The Partnership develops policy recommendations and provides guidance on P-20 education and its relation to business/industry, economic development and workforce efforts.

The Miami Valley Math & Science Consortium, which has broad representation across education, business, industry, research and civic leadership, will provide guidance to the Dayton Regional STEM Center. The fiscal agent and home for the STEM Center will be the Montgomery County Education Service Center, an organization with demonstrated success with project collaboration in several areas, including early childhood education, P-12 education, career-technical education, higher education and education/business partnerships.

Readiness for Change (RFP SECTION I)

The state's biennial budget process confirms Ohio's readiness for change and commitment to innovative STEM policies. The Governor made STEM education initiatives a top priority in his executive budget. STEM education initiatives remain a top priority in the state budget that was recently passed unanimously by members of the Ohio House of Representatives. While still requiring Senate and Executive approval, these budget initiatives document Ohio's pledge to make bold moves.

This commitment to STEM has been carefully cultivated over a long period of time. Through the proposed budget, the legislature is building on a foundation of Ohio-specific research and recommendations that date back to 2004, when the Governor's Commission on Higher Education and the Economy recommended that Ohio "increase the number and proportion of Ohioans with mathematics and science knowledge, skills, and degrees."

Since that time, the state legislature has established the Partnership for Continued Learning (PCL), chaired by the Governor and composed of a cross-section of state policy makers, educators and business leaders. The PCL has worked hand-in-hand with the Ohio Business Roundtable and its affiliate, the Ohio Business Alliance for Higher Education and the Economy, to gain 2006 legislative approval of the Ohio Core, a rigorous high school curriculum requirement focused on mathematics and science courses tied to college- and work-ready standards.

Most impressive, Ohio's commitment to innovative STEM policies is long-term. Two critical forces are driving this commitment: higher education and the business community. The SAMEPAC report referenced earlier in this proposal exemplifies the urgency behind STEM and sets out a roadmap to a strengthened system of STEM education. The Ohio Business Roundtable and the Ohio Business Alliance for Higher Education and the Economy bring to bear Ohio business leaders who stand behind STEM policies and investments.

The Vital Role of Public Engagement. In the initial pages of this proposal, the state of Ohio confirmed its commitment to develop and implement a ***comprehensive communications plan*** that builds and sustains public awareness, understanding and support for STEM education. The parameters of that work have not yet been established, but we know that such an effort is critically important.

- Polling data indicate that most Ohioans do ***not*** recognize that the rapid advance and application of technology and the impact of globalization require more rigorous and more extensive training, particularly in science and mathematics. For example, a survey conducted in 2005 for the State Board of Education's Task Force on Quality High Schools shows that less than half of those surveyed said that algebra, biology and chemistry should be required for graduation.
- The results of a 2006 statewide survey conducted for the KnowledgeWorks Foundation offer a somewhat more positive perspective with a majority of respondents saying that the state should make four years of mathematics, including two years of algebra and three years of science, mandatory for all high school students. Yet, in that same survey, only 55 percent of respondents indicated that high schools should aim to prepare all students for college, which was down from almost 78 percent just two years earlier.

For this reason, the state will develop and carry out a research-based public awareness campaign focused on the importance of STEM education to Ohio's citizens, as well as the state's future economic growth and prosperity. The state's strategic communications plan – grounded in clear messages and targeted to specific audiences at both the grassroots and grass-top levels – will be designed to ensure that citizens are informed about effective STEM-education programs and practices, and that they have a focused understanding of how they can take advantage of state and regional STEM-education programs.

Additional Considerations (RFP SECTION K)

Ohio holds a distinguished track record of engagement in NGA and NGA Center activities. Over the past 16 years, Ohio's two previous governors – George Voinovich and Bob Taft – held leadership positions in, and were primary contributors to NGA. Most recently, Governor Taft served as the Vice Chair of the NGA Health and Human Resources Committee and co-chaired the 2005 National Education Summit on High Schools. During his tenure, Ohio was involved in an array of NGA education-related initiatives: Taskforce on School Readiness, National Education Summit on High Schools, Graduation Counts, 21st Century Workforce, and the Pathways Academy on Creating the Next Generation of Workforce Development Policy. Despite severe budget challenges during Governor Taft's second term, the Administration kept NGA membership a priority through financial contributions.

Looking forward, newly elected Governor Strickland has signaled a commitment to an even greater partnership with NGA. Not only did he attend the 2007 National Governor's Association Winter meeting in February 2007, but he is a member of the Economic Development Committee. Also, he is working to ensure that Ohio is, and remains in, good standing with NGA.

Budget Narrative (RFP SECTION J)

The following narrative relates to the **budget presented in Attachment B**.

Activity #1: Create and execute a communications plan to build and sustain public support for K-12 STEM education redesign and improvement that will secure the state's economic future.

Employ consultant to coordinate statewide communications team (\$20,000) and conduct a public outreach campaign to build support for STEM education and the lessons learned from the "proof of concept" site in an effort to launch the statewide system of Ohio Regional STEM Centers (\$80,000). Matched with Business Roundtable, KnowledgeWorks and state funds (\$100,000).

Activity #2: Develop and implement an aligned governance structure for P-16 education to lead an aligned approach to STEM education redesign and improvement that supports the state economy's innovative capacity. Fund STEM Regional Center Planning and Implementation Grant for "proof of concept" pilot in Dayton (\$350,000) with local match (\$350,000).

Activity #3: Publicly report the objectives of the STEM Center Grant and identified 10-year goals. Create and publish 10-year goals (\$20,000) and conduct a coordinated public outreach campaign to distribute goals and build support for STEM education (\$30,000). Matched with Ohio Business Roundtable, KnowledgeWorks and state funds (\$50,000).

Final Comments

The introduction to this proposal highlighted a research-based equation: In the 21st century's global economy, ***innovation plus talent equal prosperity***.

It is a simple notion, but there are no simple, one-size-fits-all solutions for achieving long-term economic prosperity. Growth-promoting public policies must be the result of ***tough choices*** and ***well-reasoned strategies***. They must be supported by ***bold actions*** and a commitment to bring all of Ohio's schools out of the 20th century – to close the gap that too often separates the world inside the schoolhouse from the world beyond its walls. Public policies also must be guided by an understanding that when programs and organizations fall short of their objectives, it is usually not a matter of bad strategy; rather, it is ***the result of inadequate execution***.

Ohio has decided that ***good enough is no longer good enough*** – that "good enough" will not allow us to ensure that all of our citizens have the high-level knowledge and skills, as well as the creativity and ability to think for a living, that will help them succeed in the 21st century global economy.

In partnership with the National Governors Association, Ohio is ready to act – to drive STEM literacy for all students as they prepare for college and work.