MINUTES

Engineering Success for the Future of Kansas Task Force

March 9, 2009
Room 431-N - Statehouse

Members Present

Senator Pete Brungardt, Co-Chair
Representative Terrie Huntington, Co-Chair
Senator Roger Reitz
Senator Bob Marshall
Senator Oletha Faust-Goudeau
Representative Milack Talia

Members Absent

Representative Forrest Knox
Representative John Grange

Staff Present

Audrey Dunkel, Legislative Research
Reed Holwegner, Legislative Research
Kelly Navinsky-Wenzl, Legislative Research
Connie Burns, Committee Assistant

Others present:

See attached list

The meeting was called to order by Committee Co-Chairperson Pete Brungardt, Monday, March 9, 2009, Room 431-N of the Statehouse at 3:30 p.m.

Update on Engineering Shortage

Dr. Gary Alexander, Vice President of Academic Affairs Kansas Board of Regents, provided an update for the committee. (Attachment 1) Dr. Alexander stated that this not simply a problem for Kansas, as the United States in general has fewer students choosing to pursue degrees in science and engineering; engineering students comprise about 12% of undergraduates in most of Europe, 20% in Singapore, and 40% in China; they only represent 6% in the United States. Kansas' engineering schools need the resources to produce larger numbers of graduates; to address the engineering shortage. At the request of Senate President Steve Morris, recognizing the engineering shortage,

the Deans of the three engineering schools in the state, Kansas State University, the University of Kansas, and Wichita State University produced a "white paper" which provides a comprehensive overview of the situation in Kansas as well as possible recommendations to combat the shortage. (Attachment 2)

The Board of Regents, in consultation with the deans, invited a group of industry representatives to meet in Topeka for the purpose of discussing strategic responses to the engineering shortage. The group, comprised of 18 individuals representing private companies throughout Kansas, held a wide-range discussion of the reasons behind the shortage and of possible steps that might be taken to alleviate it. Some of the key issues emerging from the discussion included:

1. The need for strengthening the pipeline that develops potential engineers; in particular, improving the teaching of mathematics and science in the early grades and middle school.
2. The importance of developing strategies to retain a greater number of those students enrolled in engineering programs through graduation.
3. The feasibility and significance of strengthening the partnership between schools of engineering and community colleges in developing integrated programs for producing more engineers.
4. The importance of seeking funding from multiple sources to support engineering initiatives.
5. The importance of identifying the high-need engineering disciplines in Kansas and clearly aligning academic programs with them.

To adequately respond to the engineering shortage, it is also important to consider at least two other related concerns; namely the need to:

1. Increase the numbers of teachers qualified to teach mathematics and science in the early grades and middle school.
2. Align the mathematics and science requirement for graduation from high school with the knowledge and skills necessary to succeed in college

The shortage of engineers is interlaced with the shortage of math and science teachers in our K-12 educational system.

The schools of Engineering are committed to developing and implementing a strategic plan in collaboration with both each other and their industry partners. This will require both staff and resources, but if successful, the project will contribute to the state's economy by producing engineers who benefit the state, as wage-earning tax-paying citizens, and through their contributions to the success of their corporate employers.

Dr. Alexander provided:

- A time line of the group
- Membership list
- Initiatives in other states
- Summary Minutes from July 22, 2008

Reed Holwegner, Kansas Legislative Research Department, presented the 2008 Interim Report of the Joint Committee on Economic Development on the shortage of Engineers. (Attachment 3) The study included an examination of the impact that the shortage of

engineers has on the Kansas economy; review of the current and projected need for engineers across the Kansas economy, such as the sectors of transportation, aerospace, and biosciences; and a consideration of various options to attract and retain aerospace engineers in Kansas, including an analysis of legislation recently approved in Oklahoma. The following testimony is from the meeting on September 19,2008:

A. Jt. Committee on Economic Development Interim Report
B. Minutes of September 19, 2008, from the Jt. Committee meeting
C. *The Talent Imperative*, a printed booklet provided
D. Report of the Advisory Committee on Math and science Education to the 2008 Kansas Legislature
E. Testimony by Dr. Gary Alexander to the Jt. Committee
F. More Engineers for Kansas, testimony presented by the deans of Kansas state University, the University of Kansas and Wichita State University, to the Jt. Committee K-State
G. Comments by John R. English, Dean of Engineering to the Jt. Committee
H. KU School of Engineering to the Jt. Committee
I. Wichita State University College of Engineering, Dean Zulma Toro-Ramos, to the Jt. Committee
J. Memorandum from Kathie Sparks, Legislative Research, examining 2008 Oklahoma House bill No. 3239 enacted in July 2008, on the three new tax credits for the aerospace industry in Oklahoma, to the Jt. Committee
K. Rich Cram, Department of Revenue, analysis of the Oklahoma Legislation, to the Jt. Committee

Committee discussion followed the presentations.

The meeting was adjourned at 4:23 p.m. The next meeting is Monday, March 16, 2008.

Prepared by Connie Burns
Edited by Audrey Dunkel

Approved by Committee on:

3-5-10
(Date)

Task Force

ENGINEERING SUCCESS FOR THE FUTURE OF KANSAS

GUEST LIST

DATE 3-09-09

NAME	REPRESENTING
Eric Stafford	AGC of KS
Mike Reecht	Hackes Braden
Gary Alexander	KBOR
Kip Peterson	KBOR
[illegible]	[illegible] Inc
Andy Schlapp	WSU

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ENGINEERING SUCCESS FOR THE FUTURE OF KANSAS TASK FORCE
March 9, 2009

Engineering Shortage Overview

Dr. Gary Alexander
Vice President for Academic Affairs

Co-Chairs Brungardt and Huntington and members of the Task Force, thank you for the opportunity to appear before you this afternoon. I have been asked to provide you with a brief update on the engineering shortage issue as well as an overview of related work that has been conducted over the past year.

This is not, of course, simply a problem for Kansas, as the United States in general has fewer students choosing to pursue degrees in science and engineering than do other parts of the world. For example, while engineering students comprise about twelve percent of undergraduates in most of Europe, twenty percent in Singapore, and more than forty percent in China, they represent only about six percent of undergraduates in the United States. Likewise, Kansas' engineering schools need the resources to produce larger number of graduates if we are to address the engineering shortage in our state. Last year, at the request of Senate President Steve Morris, who was perhaps the first state policymaker to publicly recognize the engineering the shortage, the Deans of the three engineering schools in the state (Kansas State University, the University of Kansas, and Wichita State University) produced a "white paper" which provides a comprehensive overview of the situation in Kansas as well as possible recommendations to combat the shortage. This paper has been included as an attachment for your reference.

Last summer, the Board of Regents, in consultation with the Deans, invited a group of industry representatives to meet in Topeka for the purpose of discussing strategic responses to the engineering shortage. This working group, comprised of 18 individuals representing private companies throughout Kansas, held a wide-ranging discussion of the reasons behind the shortage and of possible steps that might be taken to alleviate it. Some of the key issues emerging from the discussion included: (1) the need for strengthening the pipeline that develops potential engineers, in particular, improving the teaching of mathematics and science in the early grades and middle school; (2) the importance of developing strategies to retain a greater number of those students enrolled in engineering programs through to graduation; (3) the feasibility and significance of strengthening the partnership between schools of engineering and community colleges in developing integrated programs for producing more engineers; (4) the importance of seeking funding from multiple sources to support engineering initiatives; and (5) the importance of identifying the high-need engineering disciplines in Kansas and clearly aligning academic programs with them.

E.S.F.O.K. Task Force
Attachment 1

3-09-09

If we are to respond adequately to the engineering shortage, it is also important to consider at least two other related concerns, namely, the need to: (1) increase the numbers of teachers qualified to teach mathematics and science in the early grades and middle school; and (2) align the mathematics and science requirements for graduation from high school with the knowledge and skills necessary to succeed in college. In other words, the shortage of engineers is interlaced with the shortage of math and science teachers in our K-12 educational system.

The Schools of Engineering are committed to developing and implementing a strategic plan in collaboration with both each other and their industry partners. Doing this will require both staff and resources, but if successful the project will contribute to the state's economy by producing engineers who benefit the state, on the one hand, as wage-earning, tax-paying citizens, and, on the other, through their contributions to the success of their corporate employers.

Again, thank you for the opportunity to visit with you about this important issue. I would be happy to stand for any questions that you may have.

February 20, 2008

"A White Paper on Increasing the Engineering BS Graduates in the State of Kansas"

Prepared by
Kansas State University, The University of Kansas, Wichita State University

Executive Summary:

Proposal description. The three schools of engineering in Kansas (KSU, KU and WSU) jointly propose a major and extensive expansion in the generation of new graduates. The target is a significant increase in undergraduate degrees awarded to students in their engineering programs. This will result in the annual upsurge of 490 additional successful graduates from the schools (up from a five-year average of almost 875 graduates). The demand for engineering graduates at national and state levels has been increasing rapidly, and projections indicate this trend will continue through 2016. Currently, 80 percent of all science and technology-based occupations in Kansas are in the engineering and IT fields. The state's three engineering schools are the primary source of this workforce. To fill this growing need for career-ready employees, resources are needed for:

1) new building facilities on each of the three university campuses, and
2) annual operating budget increases for new faculty and staff to accommodate added recruitment, teaching, advising, and retention activities for students.

Strategic alignment. In the National Academies report, "Rising Above the Gathering Storm," the shortage of professionals in the science, technology, engineering and mathematics (STEM) areas was reported to be staggering and leading to a national and state crisis. The report pointed out that as much as 85 percent of measured growth in income per capita in the United States and its states over the last several years has been due to technological change. And, unless we act, the technological innovation responsible for so much of the prosperity that Kansans and Americans enjoy will fade from our interests and our shores. In January, two of the literally hundreds of engineering firms of the region, Burns & McDonnell and Black & Veatch, publicly announced they will add 550 jobs in the Kansas City area by year's end. The news article cited that the "soaring demand for engineering work in areas such as energy, pollution control, water, health care and aviation facilities" is driving this demand. Garmin in Olathe has expressed its plans to hire 400 new engineers in 2008. And, the aviation industry in Wichita has seen between 350 to 400 engineering positions going unfilled in the last couple years, and this situation will continue at least for the next decade. Preparing a sufficient engineering workforce for Kansas is imperative to the economic development of the region. This is the focus of this proposal.

Budget requirements. The cost to the state for supporting this increase in engineering and IT graduates is estimated to be $15 million on a continuing basis. The costs include faculty, staff, operating expenses and costs for space expansion. A four-year phase in period is proposed as this growth is ramped-up at each university. The suggested phase-in timing is:

Year 1: $6 million
Year 2: $9 million
Year 3: $12 million and
Year 4 and beyond: $15 million.

Introduction:

In 2006 the National Academies released a report resulting from a congressional charge to investigate and address the national crisis in the shortage of professionals concentrating in basic areas of the science, technology, engineering and mathematics (STEM) in the United States. The shortage of professionals in the STEM areas described in the report "Rising Above the Gathering Storm" is staggering and is a national and state crisis. Just a few of the observations in this report include:

- Economic studies have shown that as much as 85 percent of measured growth in income per capita in the United States and its states is due to technological change.

- The United States is falling behind as a location for technology-based companies. One example cited: Chemical companies closed 70 facilities in the United States in 2004 and tagged 40 more for shutdown. Of 120 chemical plants being built around the world with price tags of $1 billion or more, one is in the United States while 50 are in China. No new refineries have been built in the United States since 1976.

- A company can hire nine factory workers in Mexico for the cost of one in America. A company can hire eight young professional engineers in India for the cost of one in America.

- The share of leading-edge semiconductor manufacturing capacity owned or partly owned by U.S. companies today is one-half what it was as recently as 2001.

These items are only a few of the facts put forward in that report, which documents a disquieting trend. The technological innovation responsible for so much of the prosperity that Kansans and Americans enjoy is fading from our interests and our shores.

If that's not enough, we also have fewer students in the United States choosing to pursue degrees in science and engineering, careers that fuel innovation in our state and nation. The American Society for Engineering Education (ASEE) reports that undergraduate graduation rates over the last several years have been essentially flat. Figure 1 shows the trends of science and engineering degrees in the United States for the last 20 years.

And, how do we do globally? Answer: Fewer U.S. students pursue science and engineering degrees than in other countries. About 6 percent of American undergraduates currently major in engineering; that percentage is the second lowest among all developed countries. Engineering students make up about 12 percent (double) of undergraduates in most of Europe, 20 percent (triple) in Singapore, and more than 40 percent (seven-fold) in China.

Is there an economic impact to Kansas and the nation? In 1986, the United States ranked no. 1 in the world in "high tech" exports and the United Kingdom ranked no. 4. By 2005, the United States had fallen to no. 2 and the U.K. to no. 10, likely to not return to a top-10 status again. Considering "new economy" indicators including entrepreneurial activity, initial public offerings, fast growing firms and inventor patents, today Kansas scores well below the U.S. national average and is lagging behind most of our neighboring states.

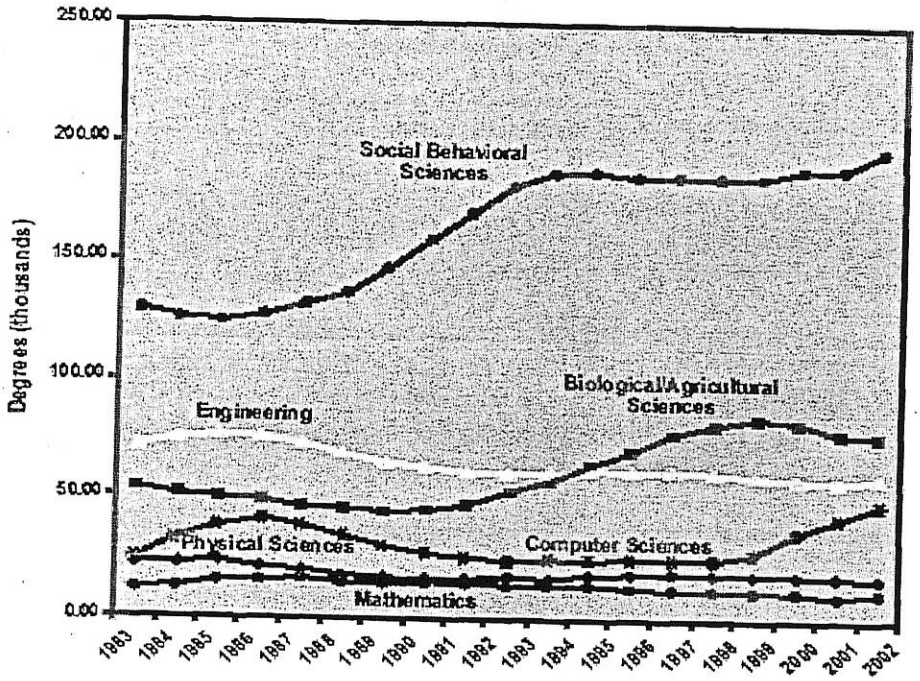

Figure 1. U.S. S&E Bachelor's Degrees by Fields 1983-2002. Source: *The Talent Imperative, Building Kansas' Capacity in Mathematics, Engineering, Technology and Science, December 2007.*

Today the demand for engineering graduates has been growing at a staggering rate. Evidence of this trend can be seen in career services data collected from any major university. In Kansas universities, the growth in number of engineering companies searching for graduates has more than doubled over the last three years. Similarly, job postings at the universities are providing conclusive evidence that the growth in engineering and IT career opportunities is dramatic and exceeds that of most other majors. These trends are being observed at all three of the engineering degree granting universities in Kansas.

The National Association of College and Employers released the publication *Job Outlook 2008* in November 2007. In that volume, engineering and computer-related fields were among the list of highest demand by employers. Of the top 10 bachelor's degrees in demand listed by this report, four were engineering programs. Of the top five master's degrees in demand, three were from engineering. Of the top five doctoral degrees in demand, four were engineering. Kansas has an opportunity to better meet these demands and strengthen the state economic development for years to come.

According to a recent report prepared by *Building Engineering & Science Talent (BEST)*, the engineering and information technology sectors in Kansas account for 80 percent of all science and engineering occupations. The data from the report are shown in Figure 2. Clearly, if Kansas

is to position itself to meet the growing demand for high-tech jobs in the state and attract more companies, engineering graduates are going to drive this process.

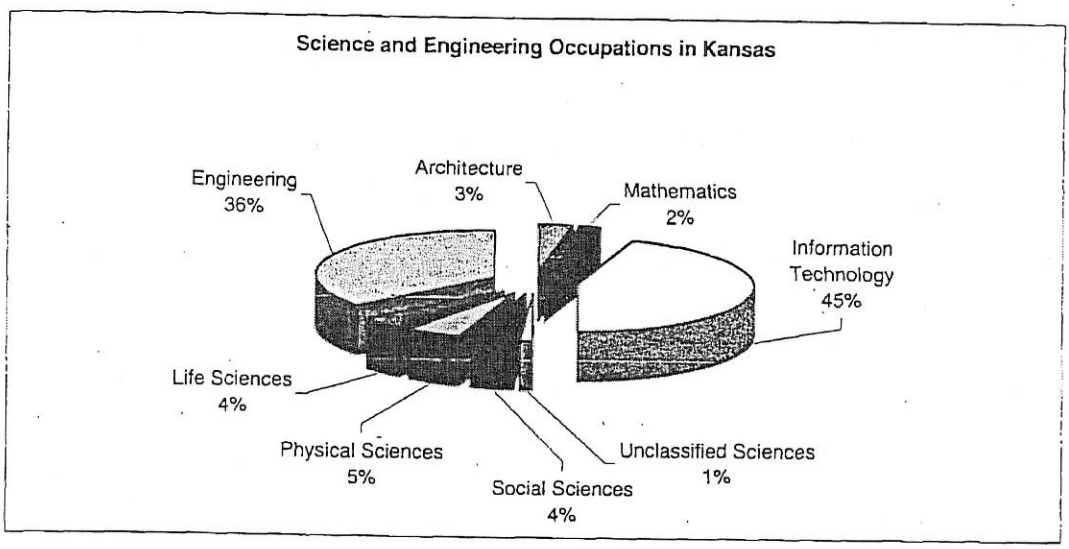

Figure 2. Science and Engineering Occupations in Kansas. Source: *The Talent Imperative, Building Kansas' Capacity in Mathematics, Engineering, Technology and Science, December 2007.*

Recently in the *Kansas City Star* (1/24/2008), Burns & McDonnell and Black & Veatch announced they will add 550 jobs in the Kansas City area in 2008. The article states, the "soaring demand for engineering work in areas such as energy, pollution control, water, health care and aviation facilities" is driving this demand. Furthermore, Garmin in Olathe has expressed its plans to hire 400 new engineers in 2008. And, the aviation industry in Wichita has seen between 350 to 400 engineering positions going unfilled in the last couple years, and this situation will continue at least for the next decade. A recent *Seattle Times* article (2/10/2008), which included several sources and referenced the Wichita, Kansas, market, "The demand for aerospace, electrical, mechanical and computer engineering disciplines is expected to be double what it was 10 years ago... and...analysts and corporate bosses say higher education is turning out far too few engineering and aeronautical graduates to fill future vacancies."

The state's three engineering programs produce more than 800 undergraduates annually, approximately 70 to 80 percent of these are native Kansans. The employment base in the state is doing an exceptional job in recruiting local engineering graduates. To meet the dramatic growth in demand for engineers in Kansas, the state must invest in the promotion of the engineering programs and synergistically grow the student enrollment and generation of successful undergraduates.

Proposed Goals:

In order to meet the needs of the engineering companies in Kansas and to support the growth of high tech opportunities for Kansas students, the deans of the three engineering degree granting institutions have prepared this joint plan. With the necessary resources being provided by the state, the engineering schools propose to increase the number of engineering graduates by almost 500 graduates within the next five years. Table 1 shows the five-year average production of BS degrees in engineering degrees from KSU, KU and WSU.

Table 1. Five-year Averages of Undergraduate Degree Earners in Engineering Programs in Kansas.

School	Undergraduate Engineering Degrees Awarded Annually
Kansas State University	423
University of Kansas	255
Wichita State University	197
Total	**875**
Increase Goal:	*490 additional graduates*

This growth goal is aggressive and will require considerable investment on the part of the state, universities and constituent companies. It is anticipated the growth will be accomplished through integrating our efforts in:

1) recruiting more Kansas high school students to study engineering, and

2) retaining a greater fraction of those students who start in these fields through graduation.

Currently, less than one-half of students who begin their studies in engineering complete degrees in such a field. Though shocking to some, this is common. Many of those students transfer to other fields and still complete a bachelor's degree, and as a result, the institutional graduation rates of students starting in engineering, although they may not graduate in engineering, are often the highest for the university. The synergistic impact of enhanced recruitment and retention will improve the effectiveness of each dollar spent and will increase the number of engineering graduates.

The institutions will work with prospective students to help them find the degree program that best fits their career aspirations. The institutions also will share best practices in recruitment and retention to ensure more students seek and earn their degrees.

Proposed Plan:

While each of the three institutions will implement a unique plan for its campus that maximizes the effectiveness of this proposal, there are several cross-cutting strategies common to the universities.

First, engineering programs are somewhat atypical to most academic units in universities in that they have very close ties to their constituent companies. For example, the engineering schools in Kansas all have multiple industry boards that serve the schools and departments. These boards provide a direct link between the academic programs and the needs in industry. Companies in Kansas already provide excellent support to the schools through student scholarships, assistance

in K-12 recruiting (such as support for Boosting Engineering, Science & Technology (BEST) Program and FIRST Robotics Competition, and Project Lead The Way), and through career services. This proposal requires further collaboration and support from our engineering companies. The schools will rely on additional support for scholarships, K-12 recruiting assistance and continued service through industrial advisory boards. This assistance will be sought by the three universities as the growth program ramps up during the next five years.

Second, each of the universities will require additional capacity for handling the planned enrollment and graduation increases. Specifically, resources will be needed for faculty, staff and space for the growth. The planned resources are consistent with the magnitude of the proposed growth goal. The staff resources will focus on recruiting new students and improving retention of those students through graduation. Faculty resources will focus on the increased demand in academic and career advising and classroom and laboratory teaching. To as great of an extent as possible the three schools will coordinate the recruiting and retention activities. The schools already coordinate student competition activities such as MathCounts and the Future City Competition. Project Lead the Way is another program that is gaining widespread national attention and WSU is currently coordinating that effort in Kansas.

Building space is a third cross-cutting area. Each of the engineering programs had already begun informal planning for increasing space in its school to meet a variety of program needs. While this aggressive growth effort exasperates the space needs on campuses, it dovetails nicely with planning already under way on each of the campuses. The needs include space required for new classrooms, academic laboratories and offices for faculty and staff as well as other needs such as laboratory space. Funding of new facilities will be realized through institutionally specific combinations of new bonds, increased tuition revenue from the growth in student enrollment, private donations and the proposed increased state appropriation. The service of new bonds will be met through institutionally specific combinations of increased tuition revenue and the proposed increased state appropriation.

Budget:

The three engineering schools in the state propose increasing the number of successful engineering graduates by 490 over the next five years. The cost to the state for supporting this undergraduate degree goal is estimated to be $15 million on a continuing basis. In addition to the increase in state appropriation, significant leveraging of new private donations, issuance of new bonds, and increased tuition revenue due to the increase in enrollment institutionally will be supplied to meet the staffing and infrastructure expansions required for the aggressive growth program.

The suggested phase-in timing for the budget is shown in Table 2 and is Year 1: $6 million; Year 2: $9 million; Year 3: $12 million: and Year 4 and beyond: $15 million.

Table 2. Requested State Support

Year →		Year 1	Year 2	Year 3	Year 4 & beyond
State Support		$6,000,000	$9,000,000	$12,000,000	$15,000,000

TIMELINE:

February 20, 2008: *A White Paper on Increasing the Engineering BS Graduates in the State of Kansas*, prepared by the engineering deans of Kansas State University, the University of Kansas, and Wichita State University

March 20, 2008: Telephone Conference to discuss engineering deans' white paper

Participants: Reggie Robinson, President and CEO, Board of Regents; Stuart Bell, Dean of Engineering, the University of Kansas; Dr. Gary Alexander, Vice President for Academic Affairs, Board of Regents

July 22, 2008: Meeting of the Kansas Board of Regents Engineering ~~Task Force~~ Working Group

Participants included Deans of Engineering; representatives of various engineering firms; Senator Stephen Morris, Board of Regents' staff

September 19, 2008: Presentation to the Joint Committee on Economic Development

Kansas Board of Regents panel: Dr. Alexander, Board of Regents, and the three Engineering Deans

Industry panel: David Brant (Cessna Aircraft Company); Sam Bruner (Hawker Beechcraft Corporation); Jennifer Mehnert (Garmin International); and Christopher Price (HNTB Corporation)

Engineering Working Group		
Name	**Title**	**Business/University**
Stuart Bell	Dean, School of Engineering	University of Kansas
David Brant	Sr. Vice President Product Engineering	Cessna Aircraft Company
Sam Bruner, Ph.D.	Chief Scientist	Hawker Beechcraft Corporation
John English	Dean, College of Engineering	Kansas State University
Shirley Gaufin	Chief Human Resources Officer	Black & Veatch Corporation
Richard Kerschen	President	The Law Company
Thomas Konieczny	Chief Engineer	The Boeing Company
Jennifer Mehnert	Recruiting Manager - Engineering/IT	Garmin International Inc
Stephen Morris	Senator	Farming
Christopher Price	PE, Vice President	HNTB Corporation
Doug Sterbenz	Executive VP/Chief Operating Officer	Westar Energy
Tom Swenson	Senior Vice President/Principal	TranSystems
Zulma Toro-Ramos	Dean, Collge of Engineering	Wichita State University
Keith Warta P.E.	Executive Vice	Bartlett & West, Inc.
Dan Wheeler	Director, Twin Aisle New Program	Spirit AeroSystems, Inc.
Gary Alexander	Vice President for Academic Affairs	Kansas Board of Regents
Reginald L. Robinson	President/CEO	Kansas Board of Regents

INITIATIVES IN OTHER STATES:

Utah System of Higher Education (USHE)

June 2008 Study of *Engineering Education in Utah*

- In 2001 the Utah Legislature passed SB 61, dubbed the "Engineering Initiative," which had as its objective "to double the number of engineers and computer scientists graduating from Utah higher education institutions." While this worked to increase the number of graduates, the USHE still received requests to initiate new engineering programs

- A Technology Initiative Advisory Board (TIAB) was created to make recommendations to the USHE board of Regents regarding the Engineering Initiative.

- Even with the Initiative, Utah experienced "unprecedented" demand for computer scientists and engineers. To help it plan "wisely and efficiently" the USDHE brought in three experienced engineering educators/administrators to review existing programs. The consultants provided a report on the system with specific recommendations regarding the need for new programs; which institutions would be best suited to offer new programs, should those be added and related issues.

Kentucky Council on Postsecondary Education

Statewide Engineering Collaborative

- In 2000 the Council on Postsecondary Education approved a *Statewide Strategy for Engineering in Kentucky* to integrate secondary-post-baccalaureate programs to address the state and nation's workforce needs. The strategy was developed in collaboration with deans of engineering schools, community and technical college representatives, practicing engineers and was designed to be comprehensive for the education system including high schools, community and technical colleges, independent institutions, and public postsecondary institutions.

- The strategy focused on two primary goals: increase the number of baccalaureate engineers and provide greater access and productivity in engineering education. Intervention activities included development of a pipeline of students in the STEM disciplines; emphasizing recruiting, mentoring and placements of engineering students; development of joint degree programs at the research institutions; development of pre-engineering curricula at the technical and community college level that would enable

students to meet all third-year engineering entrance requirements at public universities; and development of additional engineering technology programs at the associate degree level.

- Review of the strategy suggests some successes and adaptations are necessary to accomplish the stated objectives. Two notable successes are that access to programs (at all educational levels) has increased, and the capacity of institutions to deliver engineering programs has increased. A notable item for consideration of the Council is the future of the economy and the number of employment opportunities available for graduates of the program, especially if production is increased and sustained.

Oregon State Board of Higher Education (OSBHE)

- More than 10 years ago the Oregon Legislature, Oregon public universities, and the state's high-tech industry had a big idea: by working together and investing public and private dollars, Oregon could create world-class engineering and computer science programs in the state. The Legislature passed SB 504 in 1997 and thus was born ETIC. Goals: double the number of engineering degrees in Oregon, create world-class institutions, and increase research funding five-fold. Accomplishment of these goals would provide new opportunities for Oregon's best and brightest young students to study at home, provide skilled and "work-ready" graduates for the state's largest industry, and to link universities and companies in research projects to solve problems.
- $21.4 million in public funds was allocated in the 2003-2005 biennium to implement the Engineering and Technology Industry Council (ETIC) proposal to support education investments in engineering and computer science education. These funds were used to invest in engineering and technology programs at eight campuses, increasing the growth in graduates and externally funded research of these programs as well as their national rankings.
- Results to date will need to be directed to the board or ETIC group directly.

Miscellaneous Notes

- Indiana, New York, and California also appear to have/had engineering focused initiatives in place. For Indiana and New York the focus was on several career/workforce shortage needs (i.e. nursing, teaching, etc) that included engineering. Additional contact with the state higher education offices is necessary. In California the initiative started in 1982 and reports on the success and longevity of the program will require contact with the California Postsecondary Education Commission.

Engineering Working Group
Kansas Board of Regents

Tuesday, July 22, 2008
1:00 – 4:00 p.m.

MINUTES

Participants: Doug Griswold, Hawker Beechcraft; Tom Swenson, TranSystems; Don Brushwood, Boeing; Stephen Morris, Senator; Shirley Gaufin, Black & Veatch; Dan Wheeler, Spirit; Keith Warta, Bartlett & West; John English, Kansas State University; Stuart Bell, University of Kansas; Reggie Robinson, Kansas Board of Regents; Zulma Toro-Ramos, Wichita State University; Chris Price, HNTB; Jennifer Mehnert, Garmin; Doug Sterbenz, Westar; Blake Flanders, Kansas Board of Regents; Gary Alexander, Kansas Board of Regents; and Roxanne Kelly, Kansas Board of Regents.

Background

The Kansas Engineering Working Group met in the Kathy Rupp Conference Room of the Kansas Board of Regents, 1000 S.W. Jackson, Suite 520, Topeka, Kansas, at 1:00 p.m. on Tuesday, July 22, 2008. The purpose of this meeting was to develop strategies for responding to the state's shortage of engineers. In the recent past, the Kansas legislature has responded to the nursing initiative, the pharmacy effort, teacher education, mathematics, science, special education, etc. It is now time to address engineering needs.

Reggie Robinson introduced Stephen Morris, President of the Kansas State Senate. Senator Morris thanked all present and commented on the group's diversity. He noted that his interest in the state's shortage of engineers has increased over the last few years and was further triggered by the legislature's addressing the pharmacist shortage this year. He listed several possible reasons for the shortage of engineers:

- Poor student retention due partially to the lack of adequate advising regarding engineering;
- Many students' lack of awareness of the work involved in obtaining an engineering degree;
- Shortage of university classroom space and the need for extensive building maintenance.

Noting that it will be difficult in the current economic climate to obtain resources based on a short term proposal, Senator Morris asked the group to consider the following:

- How all stakeholders can work toward increasing the numbers of qualified engineers.
- Funding sources in addition to state appropriations.
- Creative approaches to the issue.
- How best to tap the expertise of the group.

Reggie Robinson presented the perspective of the Kansas Board of Regents regarding the engineering shortage related to the Board's set of five strategic questions.

- Is there appropriate alignment between K-12 and postsecondary education?
- Are we satisfied with the participation levels?
- What is the persistence to completion number?

- Learner Outcomes should be looked at from two perspectives: (a) students who pursue a course of study and master the program; and (b) whether those students have the non-discipline specific competencies (soft-skills such as writing, critical thinking, etc.) that leaders in the business industry need;
- Are we satisfied that the programs offered provide the credentials and competencies that will satisfy the needs of the State of Kansas?

White Paper

The Deans of Engineering briefed the group on the white paper they prepared on a proposal to respond to the engineering shortage.

Dean Stuart Bell, University of Kansas, offered the following background and comment: Many of the professionals from business and industry are already tied to the universities through participation on various boards. In January 2008 Senate President Morris gave the deans the charge to develop a white paper regarding the engineering needs of the state of Kansas. They tapped human resources staff, various publications, *Job Outlook 2008*, etc and set a target of a little over 50% for state funds, tuition, companies to match, leverage funds, etc., and helped put together this working group. He also noted that there is an interim legislative group studying this issue.

Dean Zulma Toro-Ramos, Wichita State University, indicated that they reviewed various national and state level reports regarding engineering and global competition in the engineering market (the United States advantage has decreased). In the last two decades the number of engineers produced has been flat in both Kansas and the nation as a whole. Issues that were identified are:

- K-12.
- Programs capacity.
- Program curricula.

Multiple steps have been proposed:

- Internally – programs/curriculum.
- External outreach and recruitment – marketing with K-12, etc.
- Retention rates (currently less than 50% of students entering engineering graduate as an engineer).

Dean John English, Kansas State University, noted that Senator Morris' request for a plan enhanced the working relationship among the three Deans. The plan they developed identifies the following core issues:

- Faculty.
- Facilities.
- Capacity (to increase the number of students who graduate and increase the number of students who stay in the state).
- Further collaboration and support from our engineering companies (additional support for scholarships, K-12 recruiting assistance and continued service through industrial advisory boards).
- The need for additional capacity to handle the planned enrollment (resources for faculty, staff and space for growth). Staff resources will be centered on recruiting new students, improving retention, and increasing graduation rates. Faculty resources will be focused on the increased

demand in advising both academically and professionally, as well as, teaching in the classroom and laboratory. The three universities will address as much of the recruiting and retention activities as is possible;.

- Accrediting Board for Engineering and Technology (ABET) measures outcomes: (a) whether schools provide the skills that make students qualified engineers; (b) alliances/connections to industry; (c) availability of stipends; and (d) relationships with alumni.
- Schools need to increase their cooperation with the industry to develop more internships and scholarships.
- More staff support is needed for recruitment and retention.
- New buildings or maintenance of existing buildings is needed to improved infrastructure.

Discussion

The group's initial discussion covered a range of topics.

- Three key areas on which to focus are: (a) K-12 preparation; (b) facilities; and (c) handling student expectations in order to retain them to graduation.
- How to obtain feedback from graduates: (a) early in the educational experience; (b) in the middle of the educational experience and (c) immediately following graduation.
- Curriculum, e.g., add some real-life business skills training to the beginning of the program.
- During K-12 begin working with students in middle school, as well as high school with programs like "Project Lead the Way."
- Have engineering graduates give feedback regarding engineering to the K-12 students;
- Provide more engineering internships.
- Businesses need to dedicate staff to promote engineering in K-12, and support science and math teachers.
- Universities need to further develop partnerships with superintendents.
- Universities are working on proposals to dedicate staff for promoting engineering.
- Business and industry continue to develop partnerships with school districts to help prepare students earlier.
- All agree there is a shortage of Engineers. In comparative terms, Kansas is seventh of seven states in the Big Twelve in the percentage of students enrolled in engineering programs.
- Wichita State University is developing Great Expectations: Engineering Kansas Scholars. (GEEKS), a comprehensive tutoring program in which upper classmates will mentor lower classmates. Industries will also be encouraged to mentor students. Retention rates are expected to increase with the additional mentoring and tutoring.
- Two problem areas that have been identified in freshman students are: (a) poor study habits and (b) poor mathematical skills.
- One reason students give for entering engineering is "I like to use my hands." One way to address this interest is to introduce some of the engineering curriculum earlier in the engineering program.
- Provide exposure to engineering earlier to K-12 students. An example of this sort of exposure is a national museum program in which young children learn about engineering tasks as they build a potato chip factory.
- Parents have a big influence on student choices.
- Begin early connecting students' aptitudes with specific areas of study, such as engineering.

- Marketing for potential engineers needs to include information about career opportunities that come with a degree in engineering (e.g. approximately twenty percent of CEOs have engineering degrees).

Reggie Robinson summarized the previous discussion. He suggested considering the following :

- How can we increase the number of potential engineering students by reaching out to and seeking to form partnerships with the K-12 community? More specifically: (a) what kinds of partnerships among Schools of Engineering, the Kansas Board of Regents, K-12, and Industry make sense; (b) what should the partnerships focus on for the purpose of increasing the number of engineering students; and (c) what strategies should the partnerships employ to increase the number of engineers?
- How can we do a better job of retaining engineering students through to graduation, keeping in mind that many entering students are not fully aware of what is required to become an engineer. In particular, what should the three universities employ to enhance retention?

The following issues were raised in further discussion:

- The working group is encouraged by the partnership among the universities. A great way to leverage support is to have one group dedicated to promoting engineering in Kansas.
- Benefits of earning an engineering degree (a) wages are higher, (b) jobs are plentiful (not enough graduates to fill all of the available positions), and (c) engineers make significant contributions to the world.
- Better inform teachers, parents and students about engineering.
- Connect the products made with the career person who made it.
- Kansas Board of Regents should develop partnerships with K-12 to open communication with teachers and school counselors.
- Would the focus be specific to engineering or would it be broader.
- A strong focus should be placed on marketing.
- A partnership with mathematics and science is important for moving students into engineering.
- The three important focuses are K-12, retention, and facilities expansion.
- A question for the Engineering Deans: Is there a significant number of students who transfer into engineering.
- A question for industry/business is whether there are shortages of degreed engineers.
- Are there engineering related fields that require a two-year associate degree, a certificate, etc? One example provided was Engineering Technician.
- Many individuals with engineering aptitude, but lacking a four-year engineering degree, become technicians.
- Provide awareness of continuing education for the non-traditional students to obtain two-year degrees.
- Concern was expressed regarding the condition of the engineering facilities on the three university campuses.
- Donations are often made for new buildings not for renovating/maintaining existing buildings.
- There is a shortage of Engineering Technicians but there is less need for technicians than engineers.
- Industry is moving production staff into engineering technician positions as they gain experience.

- Distance education could help address educating those workers who need to continue to work while pursuing a masters degree.

Reggie Robinson suggested focusing on the following areas:

- Priming the Pump
    - Kansas Board of Regents - link to K-12 to prime the pump.
    - Consider the feasibility of engaging community colleges.
    - Seek state funds, grants, etc.
- Investment for Expansion

Further discussion included the following issues:

- Has there been any consideration of individual engineering specialties, e.g., civil, electrical, chemical, mechanical, etc.
- Future projections of Kansas' need for engineers in high demand areas.
- Implications of the fact that demand for engineers is well above the supply in all specialties.
- Would it make sense to present the legislature with a five-year plan? Yes, from a legislative perspective.
    a. Consider using the nursing initiative as an example of a successful plan.
    b. The plan could address: If you give us resources we will use them to correct – priming the pump, retention of students, and if those two work, the capacity would not meet the flow.
- Consider the reasons for students' failure to continue, e.g., lack of preparation in math and science; lack of connection to their specific discipline.
- There are several articles that present data on retention.
- Increasing the number of graduates will take twice as many students entering engineering as is currently the case.
- Many students who are drawn to computer programs/engineering because of the games they like find that the programs do not match their expectations.
- The better prepared the students are in math and science the more capable they are to handle the curriculum.
- Capacity is difficult to accomplish quickly.
- Fast forward – prime the pump – what occurs – students waiting at your door.
- The capacity issue is a reason for developing a five-year plan that is systematic;
- Cost per student is a consideration. Engineering programs are more expensive than Liberal Arts programs.
- Historically, universities address expansion by hiring more faculty members and building new buildings.
- We need to be able to convince policy makers of the need to address the engineering shortage.
- The plan needs to be strategic, showing a return on investment and the significance of the issue.
- The question was raised regarding how industry get the message out.
- It was suggested that industry representatives visit with legislators, (Ways & Means, etc.).
- Concern was expressed about building the road/priming the pump without providing facilities/faculty to accommodate students.
- A two to three year lag is easier to sell to the legislature.
- Currently there are many fields where students exceed the capacity.

- More concern was expressed regarding the delay of funding because increasing the number of students, facilities and faculty are interdependent.
- There might be some federal funds available for increasing the number of students.

In summary, the critical pieces are: (a) number of professors; (b) quality advising; (c) teaching; (d) labs; (e) curriculum; and (f) recruitment and retention.

Next Steps

Senator Morris thanked everyone for being a part of this working group. He requested another meeting in a couple of months to discuss a comprehensive strategy regarding the engineering shortage. The White Paper developed by the Deans of Engineering could be developed with more specificity – consistent with a five-year strategy. Senator Morris and other key legislators, as well as business, industry, and community representatives supporting this initiative will encourage the legislature to take a serious look at any proposal. A legislative committee is currently carrying out an interim study of the engineering shortage that will provide information and support for the initiative. Anyone willing to testify at this interim committee would be helpful and welcome. The goal is to serve the needs of industry and success will be dependent on industry's getting the word out!

It was agreed that members will be provided with a summary of the discussion. Kansas Board of Regents staff will develop the rudiments of a strategic planning proposal based on the Dean's white paper and follow-up with the Deans. Working Group members will be asked for their reactions to the proposal.

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March 9, 2009

To: Task Force on Engineering Success for the Future of Kansas

From: Reed Holwegner, Research Analyst

Re: 2008 Interim Report of the Joint Committee on Economic Development on the Shortage of Engineers

This memorandum provides a synopsis of the recommendations and testimony of the Joint Committee on Economic Development during the 2008 Interim regarding the shortage of engineers. The Legislative Coordinating Council assigned the study topic to the Joint Committee. The study included:

- An examination of the impact that the shortage of engineers has on the Kansas economy;
- A review of the current and projected need for engineers across the Kansas economy, such as the sectors of transportation, aerospace, and biosciences; and
- A consideration of various options to attract and retain aerospace engineers in Kansas, including an analysis of legislation recently approved in Oklahoma.

You will find several pieces of written testimony enclosed with this memorandum. Attachment A is a copy of the Joint Committee's Interim Report devoted to this subject. The following conclusions were made by the Joint Committee in its 2008 Interim Report regarding the shortage of engineers:

- Expresses satisfaction with the fine job the public high schools are doing to prepare students for careers in math and sciences, especially engineering.
- Encourages the Kansas Board of Regents to consider providing college credit for high school programs in Computer Assisted Design (CAD) for engineering and related fields.
- Encourages further collaboration between the Kansas Board of Regents, technical colleges, Kansas high schools, and the Kansas business community with K-12 schools.
- Encourages the higher education institutions to expand programs for engineers in all fields, but the Joint Committee is cautious that new funding should not be added during challenging economic times.

The Joint Committee dealt with this issue during its meeting on September 19, 2008. Approximately sixteen individuals and other entities (including high school students, college faculty, and engineers in the private sector) provided testimony. Attachment B to this memorandum is a copy of the Joint Committee's minutes dealing with the subject. The remainder of this memorandum describes some of the written testimony that may be of further interest to the Task Force.

Advisory Committee on Math and Science Education

During the 2007 Interim, the Legislature's Advisory Committee on Math and Science Education received a data book compiled by an organization called Building Engineering and Science Talent (BEST) that studied the capacity of K-12 and higher education in the state and the importance of engineering and technical professions. See Attachment C. BEST identified several indicators that could be used to determine performance in producing technical talent. One of the conclusions that BEST made was that, "Kansas' economic future depends on deepening its pool of technical talent. The state is not producing sufficient technical talent to meet near-term needs and capitalize on long-term opportunities."

From this information and its other work, the Advisory Committee made several recommendations. See Attachment D. The recommendations dealt with strategies for public awareness, teacher preparation, teacher recruitment, alignment (that is, exposing children at an earlier age to math and science and prolonging that exposure), and coordinate future activities by policy makers.

Private Sector

Several engineers and business executives also testified before the Joint Committee. The observation of John Pilla, Senior Vice-President and Chief Technology Officer of Spirit Aerosystems, perhaps best encapsulates the shortage of engineers as perceived by the private sector:

> The engineering shortage is not entirely about access to education. There are over 3,500 colleges and universities in the United States with engineering or technical education programs, but there are not enough students interested in the challenges of a rigorous engineering discipline. Engineering success depends on the mathematics and science curriculums being started at an earlier age and then being strengthened and developed throughout a lifetime of learning. With coordinated effort of high school preparation and the support of the aerospace community, students can be nurtured to consider the fun and challenges of engineering as a career path.

Higher Education

The Board of Regents, along with faculty engineers from Kansas State University, the University of Kansas, and Wichita State University, also testified. See attachments E, F, G, H, and I. Previously the Board held a meeting with faculty and the private sector to identify ways to address the shortage of engineers. According to the Board, currently less than one half of the students who begin studying engineering complete their degrees. Several issues that the working group identified include:

- Strengthening the pipeline that develops potential engineers, in particular, improving the teaching of math and science in elementary and secondary education;

- The importance of developing strategies to retain a greater number of those students enrolled in engineering programs;

- Strengthening the partnerships between schools of engineering and community colleges in developing integrated programs;

- Funding from multiple sources to support engineering initiatives; and

- Identify the engineering disciplines with the highest need and align academic programs with them.

Oklahoma Legislation

The Legislative Research Department provided the Joint Committee with an analysis of the recent tax credit legislation contained in 2008 Oklahoma HB 3239 that took effect on January 1, 2009. See Attachment J. Oklahoma's legislation created three new tax credits:

- A tax credit for aerospace employers who reimbursed an employee for tuition so long as the employee had been awarded a degree from a higher education institution in Oklahoma within one year of starting employment. The tax credit cannot exceed 50.0 percent of the average annual amount of tuition paid by the engineer for enrollment at a public institution in Oklahoma.

- A tax credit for aerospace employers against compensation paid to qualified employees. If the employee graduated from Oklahoma, the tax credit would be equal to 10.0 percent of the compensation paid for the first five years of employment. If the employee graduated from an out-of-state institution, the tax credit would be equal to 5.0 percent compensation. In either case the maximum credit would be equal to $12,500 per employee.

- A tax credit for the employee of $5,000 for the first five years of employment

The Department of Revenue provided an analysis of the Oklahoma legislation, assuming that the same provisions were adopted in Kansas. The agency estimated that the tax credit would reduce revenues by $11.5 million in FY 2010, and that cost would increase to $72.2 million by FY 2014. The estimate excludes administrative costs necessary to implement the tax credits. The assumptions relied upon to generate the estimate can be found in Attachment K.

RLH/kal

Enclosures

Joint Committee on Economic Development

Shortage Of Engineers, Including Attracting Aerospace Engineers, And The Impact On The Kansas Economy

Conclusions and recommendations

The Committee expresses its satisfaction with the fine job the public high schools are doing to prepare students for careers in math and sciences, especially engineering.

The Committee encourages the Kansas Board of Regents to consider providing college credit for high school programs in Computer Assisted Design (CAD) for engineering and related fields.

The Committee encourages further collaboration between the Kansas Board of Regents, technical colleges, Kansas high schools, and Kansas business community with K-12 schools.

The Committee encourages the higher education institutions to expand programs for engineers in all fields, but the Committee is cautious that new funding should not be added during challenging economic times.

Proposed Legislation: None.

Background

The Joint Committee on Economic Development is statutorily authorized to set its own agenda. The Legislative Coordinating Council asked the Committee to study the impact on the Kansas economy of the shortage of engineers. The study should review the current and projected need of engineers across the Kansas economy and the review should include potential impact on such economic sectors as transportation, aerospace, and biosciences; study various options to attract and retain aerospace engineers within Kansas and review recent Oklahoma legislation for aerospace engineers and aerospace companies.

Committee Activities

The Committee had testimony from high school programs (which included the Paola Panther Robitcs Team, the Gardner-Edgerton National Engineer Design Challenge Team, and the Olathe Northwest Aerospace and Engineering Team), the Regent's institutions, and industry personnel. In addition, staff reviewed the Oklahoma legislation and the Department of Revenue provided a fiscal impact statement.

Conclusions and Recommendations

The Committee wishes to express its satisfaction with the fine job the public high schools are doing to prepare students for careers in math and sciences, especially engineering.

The Committee encourages the Kansas Board of Regents to consider providing college credit for high school programs in Computer Assisted Design (CAD) for engineering and related fields.

The Committee encourages further collaboration between the Kansas Board of Regents, technical colleges, Kansas high schools, and Kansas business community with K-8 schools.

The Committee encourages the higher education institutions to expand programs for engineers in all fields, but the Committee is cautious that new funding should not be added during challenging economic times.

work comp insurance. The penalty for not following the law is a $25,000 fine or double the annual premium.

As the discussion moved on it was noted that if the employer does not have a job that accommodates the injured worker's restrictions, he does not have to create one. In these cases the injured worker gets work disability. If the employer can bring the employee back to work at 90 percent of wages, the injured worker does not qualify for work disability. Scheduled injuries were also a topic of the discussion.

Chairperson Brownlee asked if anyone had any additional comments on *Casco* they could come forward at this time. A short discussion followed with pro and cons of the *Casco* ruling.

Chairperson Brownlee stated workers compensation is too big an issue to have final conclusions tomorrow, but the Committee can discuss it again tomorrow afternoon. She also called the Committee's attention to the "written only" testimony of the Kansas Restaurant Hospitality Association (Attachment 26).

Chairperson Brownlee called on Kathie Sparks, Legislative Research. Ms. Sparks stated she had the answer to the question Representative Winn asked earlier regarding Schlitterbahn and if their bonds would be affected by the fall of Lehman Brothers. Ms. Sparks contacted Bob North, Legal Counsel, Kansas Department of Commerce, and he stated Schlitterbahn had only talked to Lehman Brothers and decided to front the money themselves at this time and later down the road they would be looking at bonds.

Chairperson Brownlee adjourned the meeting at 5:45 p.m. with the next scheduled meeting tomorrow, September 19, 2008, at 9:00 a.m. in room 143N.

Friday, September 19
Morning Session

Subject of meeting

Study the impact on the Kansas economy of the shortage of engineers and review the current and projected need of engineers across the Kansas economy. The review should include potential impact on such economic sectors as transportation, aerospace, and biosciences. Also, study various options to attract and retain aerospace engineers within Kansas.

Chairperson Brownlee called the meeting to order at 9:00 a.m. and introduced Sharon Wenger, Principal analyst, Kansas Legislative Research Department, to present the Report of the Math and Science Education Advisory Committee. Ms. Wenger presented written copy (Attachment 27). She also presented a printed booklet entitled *The Talent Imperative* (Attachment 28). Ms. Wenger stated the Math and Science Advisory Committee was created at the request of Representative Winn and Senator Jordan. She stated in order to create and maintain the competitive advantage with other states, Kansas must produce a deeper pool of technically skilled workers, while at the same time building capacity in frontier research and product development in selected fields.

She stated that improving Kansas' capacity in mathematics, engineering, technology, and science is vital if Kansas is to remain nationally as well as internationally competitive. Improving this capacity will increase awareness of the issue among students and parents, improving the salary and benefits of the state's teachers, aligning classroom learning with the requirements of the marketplace, and keeping the state at the cutting edge of innovation in math and science teacher preparation and education.

In acknowledgment of this, the Math and Science Advisory Committee developed the following recommendations:

- To raise public awareness;
- Teacher preparation strategies such as giving higher pay;
- Develop teacher recruitment and retention strategies;
- Develop alignment strategies; and
- Coordinate activities statewide through a METS Education Innovation Council.

Upon the conclusion of Ms. Wenger's testimony, she stood for questions. Being none, Chairperson Brownlee stated next the Committee will be hearing from some of the Kansas schools regarding special programs that encourage math and science.

Chairperson Brownlee stated she had attended a Robotics meet and she was very impressed. She introduced the Paola Panther Robotics Team and the team advisor, Kathy Shirk, to give their presentation. They presented written copies of the "Panther Robotics 2008 Chairman's Award;" a written copy of "More than Robots: An Evaluation of the First Robotics Competition Participant and Institutional Impacts, Excecutive Summary;" a written copy of "Kansas First Robotics Team;" and "Building for the Future" (Attachment 29) and began their presentation. Over the past two years, Paola has sponsored 15 Robotics teams in Kansas and has also won awards in the Robotics competitions. First Robotics has been a part of Paola High School for the past six years. First Robotics is a national organization that promotes teamwork and interpersonal skills; learning problem solving and time management skills; how to apply traditional academic skills in real-world settings; and promoting math, science, and engineering. They obtain financial support from student fund raisers, grants, and financial awards. They establish partnerships with engineers in the community that mentors them. They give back to the community by doing workshops and presentations to younger local students, promoting First Robotics. Their program has doubled in size since the first year. They believe First Robotics is a great program for students to find their talents and skills and is a positive investment in Kansas youth. The team explained the process when competing. Each team builds a robot and each year it is a different task the robot must do. It was noted that some of the other states have funding for their First Robotics team. The team showed the Committee by way of computer and screen what the competitions are like through their website. It was noted that there are 21 First Robotics teams in Kansas. Usfirst.org is the national website and offers information on how to get started in this program.

The Chairperson introduced David Kling for the Gardner-Edgerton National Engineer Design Challenge Team to give their presentation. They won 1st place in a national competition with their own design. This is a joint venture with the Junior Engineering Technical Society. This program is to help promote and encourage students to consider careers in engineering. The Gardner-Edgerton Nation Engineer Design Challenge team is challenged to design and build an assistive technology device to help a person with severe disabilities succeed in his or her workplace. Students must work together using their creativity, problem solving, math, science, research, writing, presentation, drafting, and design skills to advance through three rounds of competition. Due to problems with the computer and screen, Chairperson Brownlee asked the Gardner-Edgerton Team if they would like to work on it and finish their presentation after Olathe Northwest. They decided that would be best.

With that, Chairperson Brownlee called on the Olathe Northwest Aerospace and Engineering Team and introduced Dr. Gwen Poss, Principal, Olathe Northwest High School, to begin their

presentation which starts with a power-point program (Attachment 30) on their program and what makes their program successful:

- Supportive and engaged community and a qualified staff;
- Motivation of students;
- Students can earn college credits with online courses;
- Aerospace and Engineering students participate in other math and science activities;
- Students have access to industry and its current technology and software
- Aerospace and Engineering core subjects are made up of both core and elective courses, allowing a more in-depth understanding of the subject matter; and
- By developing relationships, students learn key 21st century skills.

A short discussion followed regarding the online college credits these students can get from the University of Utah while attending high school and if these credits will transfer to Kansas colleges and universities. The discussion continued with what preparation teachers needed to be a part of this program. It was noted they had gone to some outside training, mostly at conferences, but have not received any formal training. The cost of the program was also discussed and the funding stream.

Upon the conclusion of the discussion, Chairperson Brownlee called the Committee's attention to the packet of information presented by Olathe Northwest Aerospace and Engineering team.

Chairperson Brownlee called on Gardner-Edgerton to complete their presentation. They presented written testimony (Attachment 31) and stated in the essence of the time they would show a short video of the students using the product they produced last year. They designed a device for someone with use of only one arm working as a custodian, who was unable to tie trash bags to the trash can and also tie up full trash bags. The video showed how he could take a trash bag off the roll of bags, open it up and put it into the trash can and tie it off. When the bag was full it showed how he could tie it up.

Upon completion of the presentation there was a question-and-discussion session regarding patents and if the authority had applied. It was noted they had not and it is an expensive process.

Chairperson Brownlee introduced Shirley Antes, Wichita Area Technical College, who presented written testimony (Attachment 32). Ms. Antes stated her testimony was regarding the efforts of Wichita Area Technical College and the National Center for Aviation Training in expanding educational opportunities for students in the field of engineering. The National Center for Aviation Training will offer a number of two-year degrees in Engineering Technology, Aviation Maintenance, and Avionics. The Sedgwick County Technical Education Authority was established by Sedgwick County to oversee the effort. She also stated that Wichita Area Technical College and the National Center for Aviation Training are committed to developing this innovative new approach to develop new engineering opportunities. This partnership, along with the inclusion of the National Institute for Aviation Research in the National Center for Aviation Training, will provide opportunities for the industry and students never before seen in education.

A short discussion followed regarding the courses offered and having a bachelors degree available.

Chairperson Brownlee announced that next on the agenda would be a panel discussion with the Kansas Board of Regents. The following is a list of the members of the panel:

1) Dr. Gary Alexander, Vice-President of Academic Affairs, Board of Regents;
2) Dr. Stuart Bell, Dean of Engineering, University of Kansas;
3) Dr. John English, Dean of Engineering, Kansas State University; and
4) Dr. Zulma Toro-Ramos, Dean of Engineering, Wichita State University.

Dr. Gary Alexander, Vice-President of Academic Affairs, Board of Regents, was the first to speak. Dr. Alexander presented written copy of his testimony (Attachment 33). He stated he was pleased to join the Deans of Kansas' three Schools of Engineering in discussing strategies for responding to the state's shortage of engineers. He stated the Board of Regents, in consultation with the Deans, invited a group of industry representatives to meet in Topeka for the purpose of discussing strategic responses to the engineering shortage. He stated they are working on a strategic plan and will present that to the Committee when it is finished, which should be in a couple of months. In closing, he stated the Schools of Engineering are committed to developing and implementing a strategic plan in collaboration both with each other and their industry partners. Dr. Alexander also presented written copy of a power-point presentation entitled "More Engineers for Kansas."

The Chairperson called on Dr. John English, Dean of Engineering, K-State, to offer his comments. Dr English presented written copy (Attachment 34). He stated that all the panel members are unified and recognize the state crisis in the shortage of engineers in the state. He touched on the following:

- A need to recruit and retain diverse, highly qualified academic achievers;
- Provide outstanding and diverse faculty and technical facilities;
- Establish focused, high impact, nationally recognized research programs;
- Prepare students and faculty for the changing global environment; and
- Disseminate new knowledge to a global society and the citizens of Kansas.

Chairperson Brownlee introduced Dr. Zulma Toro-Ramos, Dean of Engineering, Wichita State University, to give her testimony regarding the Engineering crisis. Dean Toro-Ramos presented written copy of her testimony (Attachment 35). She stated that Wichita State University, College of Engineering, will be recognized nationally and internationally for its: experience-based undergraduate and graduate degree programs; collaborative efforts with industry; and research programs to support the economic development and global competitiveness of the Wichita metropolitan area, the State of Kansas, and the nation. She stated there is a need for engineers in the Wichita area and they will need to collaborate with the community and work closely with industry in an effort to help elevate this problem.

Chairperson Brownlee introduced Dr. Stuart Bell, Dean of Engineering, University of Kansas to give his testimony regarding the shortage of engineers in Kansas. Dr. Bell produced written copy (Attachment 36). Dean Bell stated that the University of Kansas School of Engineering works to serve Kansas by providing exceptionally qualified graduates to companies and agencies throughout the state, as well as graduates who have started new companies in Kansas. Engineering graduates have literally been built, fueling and moving the world, beginning right here in Kansas. In closing, he stated the school stands ready to expand its programs and help the state as it looks to strengthen

opportunities for economic development by providing excellent graduates and by serving the needs of companies through its visionary research and service programs.

"A white Paper on Increasing the Engineering BS Graduates in the State of Kansas" was presented to the Committee as a collaborative effort of the Kansas State University, the University of Kansas, and the Wichita State University Schools of Engineering (Attachment 37).

Chairperson Brownlee announced that next there would be an Industry Panel Discussion. The Panel members were:

- David Brant, Senior Vice-President of Product Engineering, Cessna Aircraft Company;
- Dr. Sam Bruner, Chief Scientist, Hawker Beechcraft Corporation;
- Jennifer Mehnert, Recruiting Manager, Engineering/IT, Garmin International Inc.; and
- Christopher Price, Vice-President, HNTB Corporation.

The panel did not submit any written testimony. The discussion started with Mr. Brant, Senior Vice-President of Product Engineering, Cessna Aircraft Company, stating there is a shortage of engineers in Kansas at the present time. This shortage must be addressed and we must find a solution to our problem because the need for engineers will be even greater in the near future. He stated during the years 1999 through 2005 the number of foreign students growth in Kansas has peaked in the areas of math and science, yet we still have a shortage of engineers in Topeka. We must develop a program of incentives that will entice these graduates to live and work in Kansas. Cessna is offering scholarship programs and also works with First Robotics as mentors. They also mentor at elementary schools to try to keep young students engaged in math and science.

Next, Mr. Sam Bruner, Chief Scientist, Hawker Beechcraft Corporation, joined the discussion stating aviation has made a great contribution to the economy of Kansas, especially the Wichita and Olathe areas. The shortage of engineers in the aerospace industry affects the ability to produce new products. If this shortage continues then we will be forced to go out of state to contract work. We must take action to retain Kansas as the Aeronautics Capital of the world. This issue must be addressed in K-12 to attract students to the engineering fields. Mr. Bruner stated that Hawker Beechcraft Corporation has developed strong partnerships with the universities in Kansas, especially in Pittsburgh and Salina.

Jennifer Mehnert, Recruiting Manager-Engineering /IT, Garmin International, Inc., entered the discussion, saying Garmin has an interest in retaining engineers in Kansas. It is being pro-active by providing scholarships to K-State University. She believes they must start at K-12 to encourage a career in engineering and offer incentives to keep engineers in Kansas. They must form partnerships with the schools and get the word out to the parents as well as their children. Ms. Mehnert stated they are only taking interns from Olathe schools. They are also active in First Robotics.

Next, Christopher Price, Vice-President, HNTB Corporation, joined the discussion stating they have recognized the shortage of engineers becoming greater for the past 20 years. They feel that more youths need to be recruited into various programs for engineering. The state needs more outreach so that children and parents understand the skills best suited for engineers. He stated that HNTB has several mentoring programs with young professionals and they also are working with middle school areas in the Kansas City areas.

Upon the conclusion of the panel discussion, Chairperson Brownlee adjourned for lunch and stated the afternoon session would start at 1:45 p.m.

Afternoon Session

Chairperson Brownlee called the meeting to order at 1:45 p.m. and introduced Kathie Sparks, Principal Analyst, Kansas Legislative Research Department, to review the Oklahoma Conference Committee Substitute for Engrossed House Bill No. 3239 (Tax Credit for Hiring Engineers) Ms. Sparks presented written testimony (Attachment 38).

Ms. Sparks stated the bill was enacted in July 2008 and provides three new tax credits for the aerospace industry in Oklahoma. She went on to say that a qualified employer in the aerospace industry would receive a maximum of 50 percent tax credit against tuition reimbursement to qualified employees who have been awarded an undergraduate or graduate degree within one year of commencing employment with the employer.

A short discussion followed.

Chairperson Brownlee introduced Richard Cram, Director of Research and Policy, Kansas Department of Revenue, to give a fiscal note of the Oklahoma Aerospace Engineering Tax Credits if they were implemented in Kansas. Mr. Cram presented written copy (Attachment 39). By gathering data from the Engineering Schools located at K-State University, Kansas University, and Emporia State University, Mr. Cram estimated the total Fiscal Note for 2010 would be $11.5 million.

A short discussion followed regarding having an engineering incentive for all engineers. It was noted that there was presently a federal deduction for college.

Chairperson Brownlee introduced Alison Felix, Economist, Federal Reserve Bank of Kansas, to give the Committee an update on the Kansas economy. Ms. Felix presented written copy of testimony (Attachment 40) and stated the views expressed today were her own and not necessarily those of the Federal Reserve Bank. Ms. Felix stated the national economy has slowed the last two years due to mortgage loans. The world economy is also beginning to slow but the U.S. dollar is strengthening overseas and by 2010, she felt things would be back to normal.

In her update Ms. Felix stated the economy is failing in some states on the East and West Coasts and slowing in others areas of the United States. In almost every area Kansas is faring better than most states.

A discussion followed regarding the economy and the present situation with financial institutions failing all across the United Stated. Ms. Felix stated the hardest hit area due to the financial institutions was in the eastern part of the United States. She stated the failing mortgage loans which were having a negative effect on the economy were rippling into other parts of the economy. The value of the dollar overseas was also discussed.

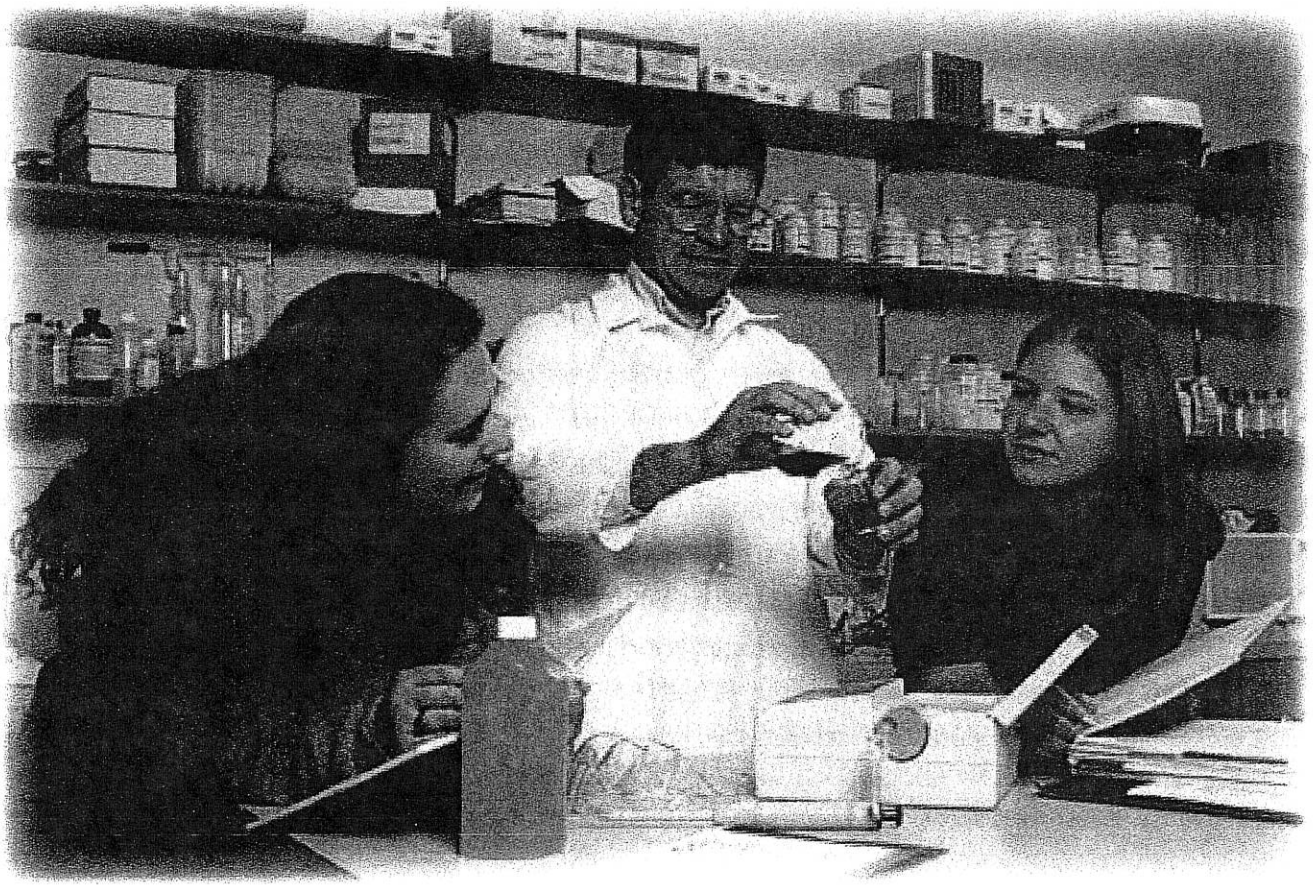
Upon the conclusion of the discussion, Chairperson Brownlee introduced Stan Ahlerich, President, Kansas, Inc., to give an update on Kansas, Inc. Mr. Ahlerich presented written copies of information on the *2007 Kansas Economic Development Strategic Plan of Kansas, Inc.* and the *2007 Kansas Economic Development Strategic Plan* (Attachment 41).

ATTACHMENT C
Task Force on Engineering Success
for the Future of Kansas
March 9, 2009

The Talent Imperative

BUILDING KANSAS' CAPACITY IN MATHEMATICS, ENGINEERING, TECHNOLOGY, AND SCIENCE

January 2008



BEST
Building Engineering & Science Talent

Prepared by Building Engineering & Science Talent

About this Data Book

This data book was assembled to help inform the work of the Kansas Legislature's Advisory Committee on Mathematics, Science, & Innovation. The Committee met monthly from September through December 2007 under the chairmanship of Senator Nick Jordan and co-chairmanship of Representative Kenny Wilk. Drawing upon the experience and insights of legislators, educators, and private sector representatives, the Committee took a fresh overall look at the challenge of equipping Kansans with the skills needed to underpin the state's prosperity in a 21st century economy. A list of Committee members is on Appendix I.

The data presented are meant to illuminate two basic questions. First, why does building capacity in mathematics, engineering, technology, and science (METS) matter to the nation as a whole and especially to the state of Kansas? Second, where does Kansas stand? The effort was made possible by a grant from the Ewing Marion Kauffman Foundation to Building Engineering and Science Talent (BEST), an independent San Diego-based non-profit organization that specializes in education and workforce development in technical fields. BEST assembled a comparable data book for the state of Missouri in 2006.

This project could not have been completed on the timeline requested by the Committee without its active engagement as well as that of concerned government agencies. BEST wishes to thank the chair, co-chair, and members of the Committee for their helpful insights every step of the way. The Kansas Department of Education, Board of Regents, and Department of Labor also provided their full cooperation. In addition, BEST was able to draw upon site visits to Kansas State University and the University of Kansas. Sharon Wenger, a research analyst in the Kansas Legislative Research Department, played an indispensable coordinating role. BEST also wishes to thank Dr. Linda Rosen, president of Education and Management Innovations, Inc. and former Mathematics Advisor to U.S. Secretary of Education Richard Riley; and Dr. Robert D. Muller, founder, Practical Strategy LLC, and former Deputy Assistant Secretary of Education, for sharing their insights.

BEST assumes sole responsibility for the selection and interpretation of the data presented here.

BEST
Building Engineering & Science Talent

Building Engineering & Science Talent
5143-C Renaissance
San Diego, CA 92122
www.bestworkforce.org

Table of Contents

Section I: Why METS and Innovation Matter for the U.S.

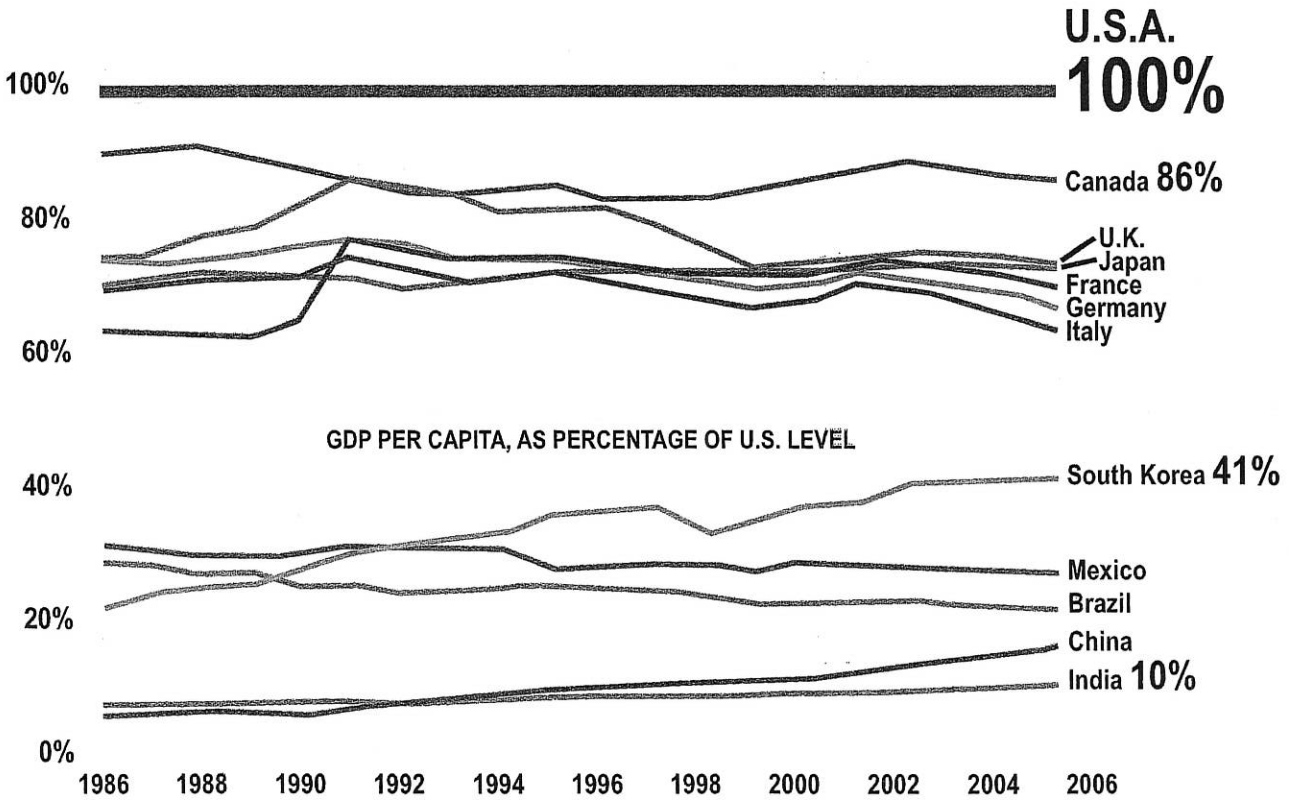
National Indicators

The United States comprises five percent of the world's population and produces 20 percent of global economic output. Technological innovation lies at the heart of this economic capacity. Half of our nation's growth stems from the creation of new knowledge and its translation into high-value products and services. The power that flows from U.S. strength in mathematics, engineering, technology and science (METS) makes the U.S. workforce the world's most productive and underpins the world's highest standard of living.

U.S. leadership cannot be taken for granted in today's global economy. Others are racing to catch up - making investments in education, infrastructure, and R&D that will position them to capture the high end of the value chain. A recent report of the National Academy of Sciences aptly described the forces at work as a "gathering storm" that requires a nationwide call to action. This section highlights some of the international and domestic indicators that have made METS a focal point of concern leading to passage of the 2007 America Competes Act.

Why METS and Innovation Matter for the U.S.

The United States leads all major economies in per capita GDP



Source: Competitiveness Index: Where America Stands. Council on Competitiveness, 2006.

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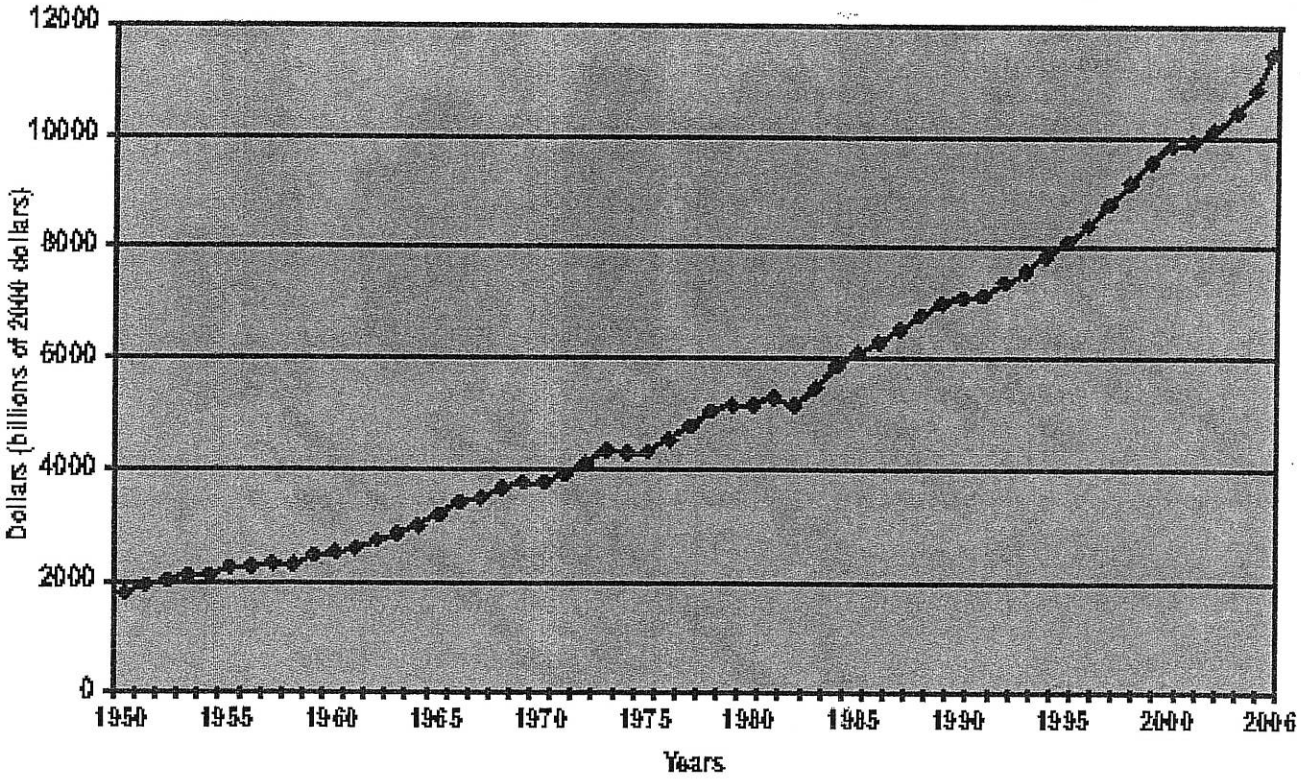
Why METS and Innovation Matter for the U.S.

Technological innovation accounts for 50% of US economic growth*

Real Gross Domestic Product
1950-2006

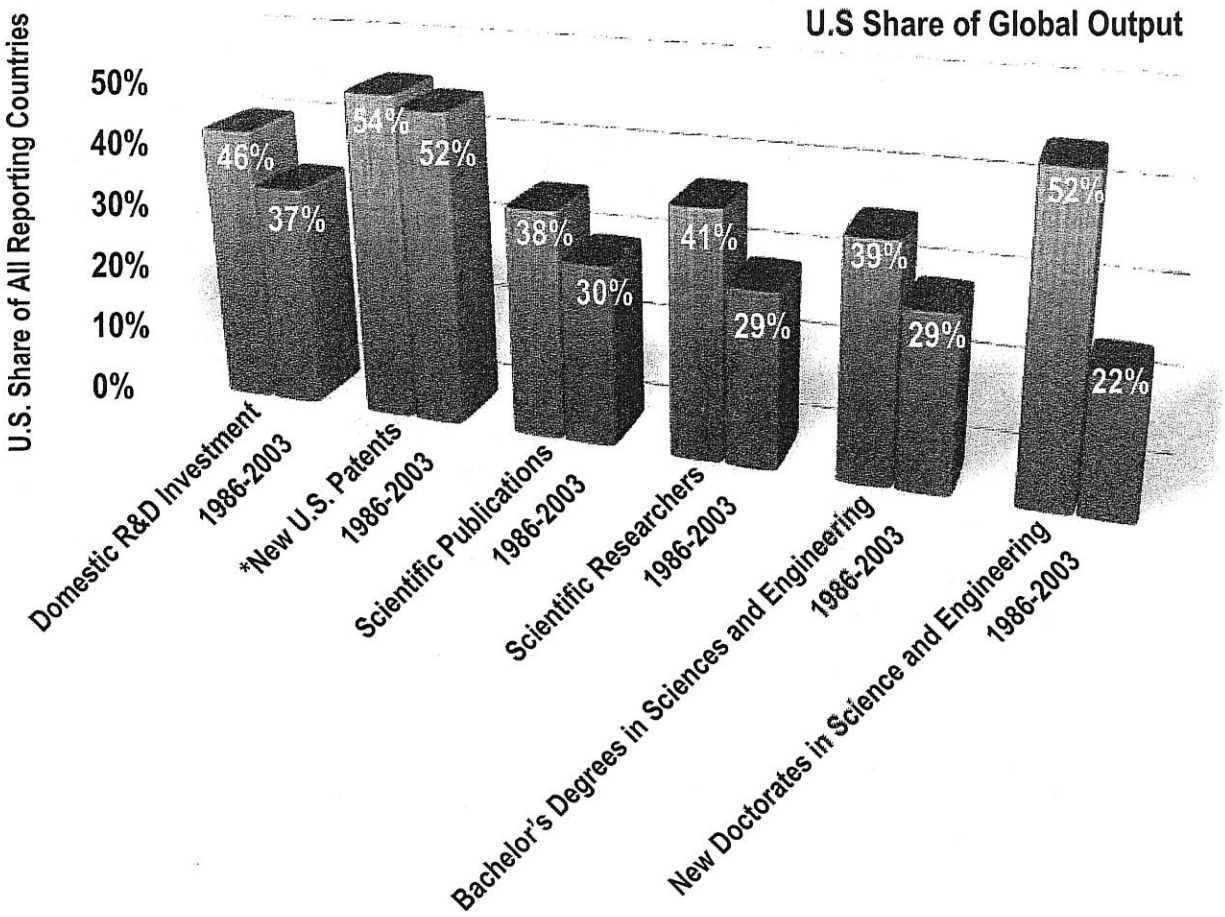


*For research supporting this chart, see Michael J. Boskin and Lawrence J. Lau. 1992. Capital, Technology, and Economic Growth. In Nathan Rosenberg, Ralph Landau, and David C. Mowery, eds. Technology and the Wealth of Nations: Stanford University Press. Stanford, CA

Source: Bureau of Economic Analysis, U.S. Department of Commerce.

Why METS and Innovation Matter for the U.S.

The U.S. global lead in science and technology is narrowing



* Countries from around the world register their patents in the U.S. because it is such a key market.

Source: Competitiveness Index: Where America Stands. Council on Competitiveness, 2006.

Why METS and Innovation Matter for the U.S.

Emerging economies have joined the high technology club

Top Ten High Tech Exporters (1986)	Top 10 High Tech Exporters (2005)
In billions of 1997 U.S. Dollars	
1. United States $65	1. China $406
2. Japan $53	2. United States $284
3. Germany $31	3. Japan $212
4. United Kingdom $24	4. Germany $$183
5. France $14	5. South Korea $167
6. Netherlands $9	6. Hong Kong $157
7. Italy $8	7. Taiwan
8. Switzerland $8	8. Singapore $126
9. Taiwan $7	9. Malaysia $99
10. South Korea $7	10. United Kingdom $95

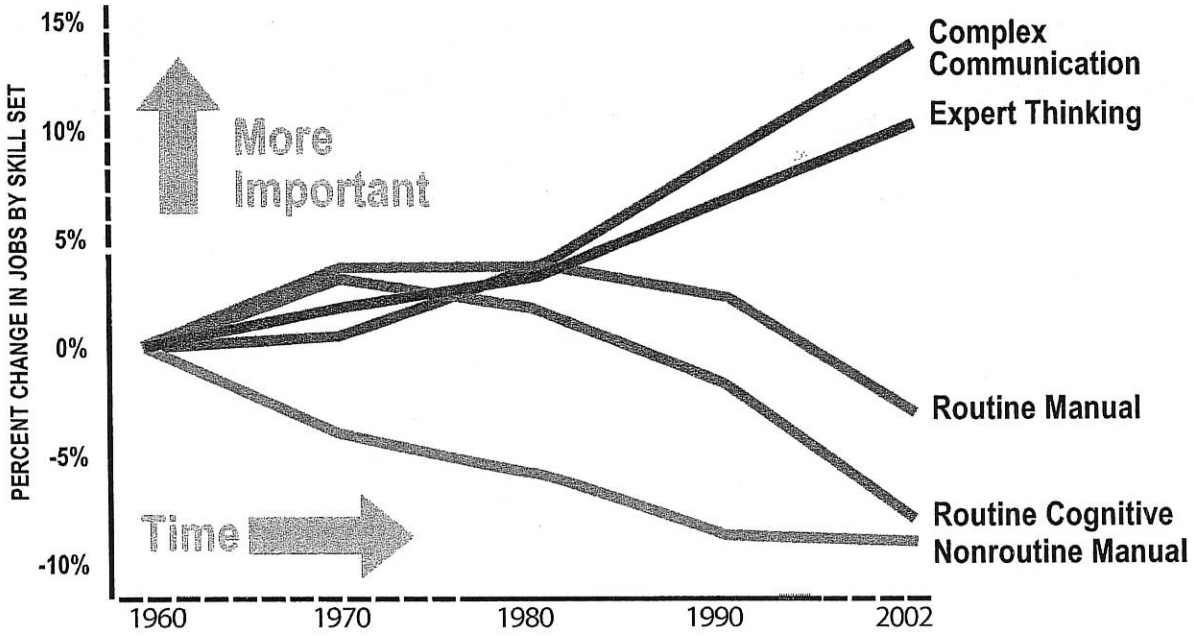
Emerging economies

Developed economies

Source: Competitiveness Index: Where America Stands. Council on Competitiveness, 2006.

Why METS and Innovation Matter for the U.S.

Innovation-based economies require higher skills

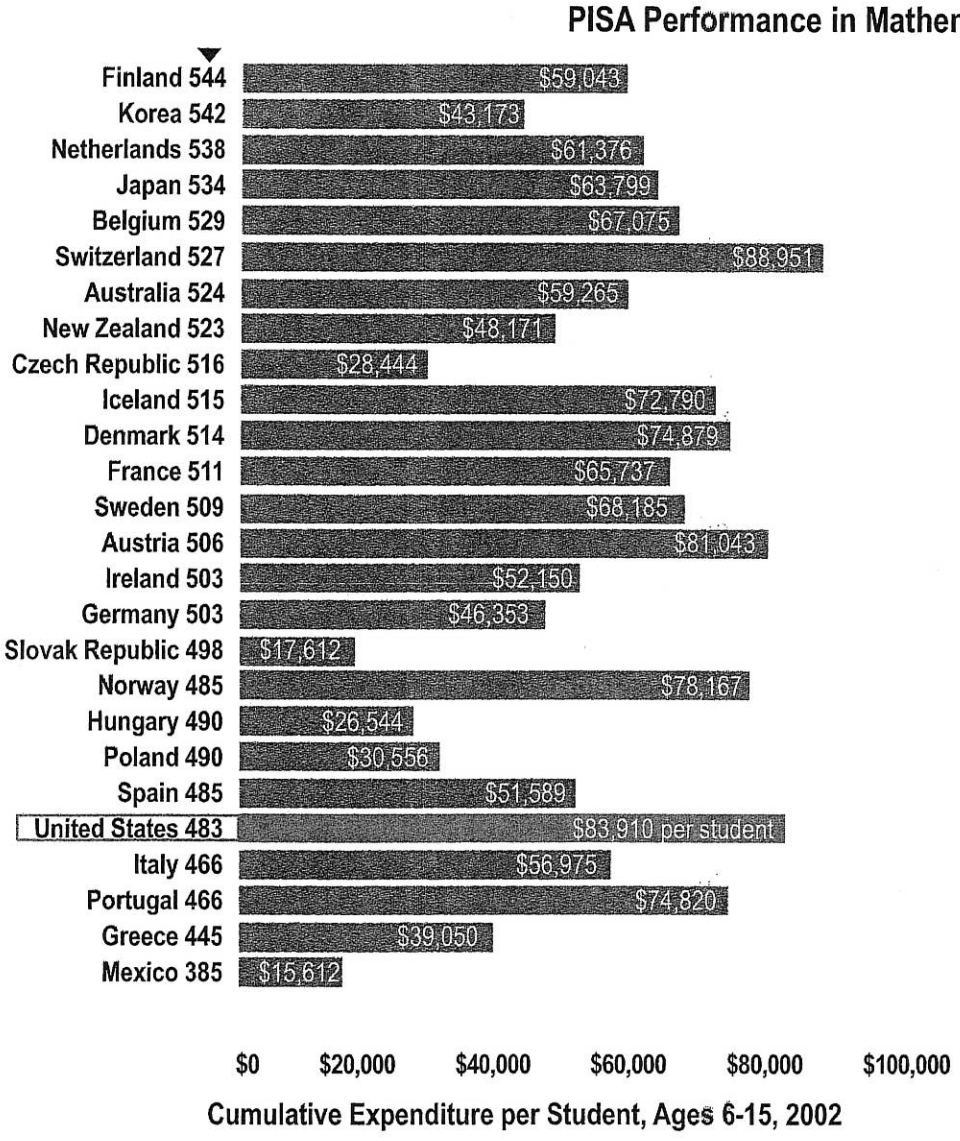


Source: Competitiveness Index: Where America Stands. Council on Competitiveness, 2006.

3-20

Why METS and Innovation Matter for the U.S.

The U.S. outspends others in K-12 education, but return on investment in math and science is low*



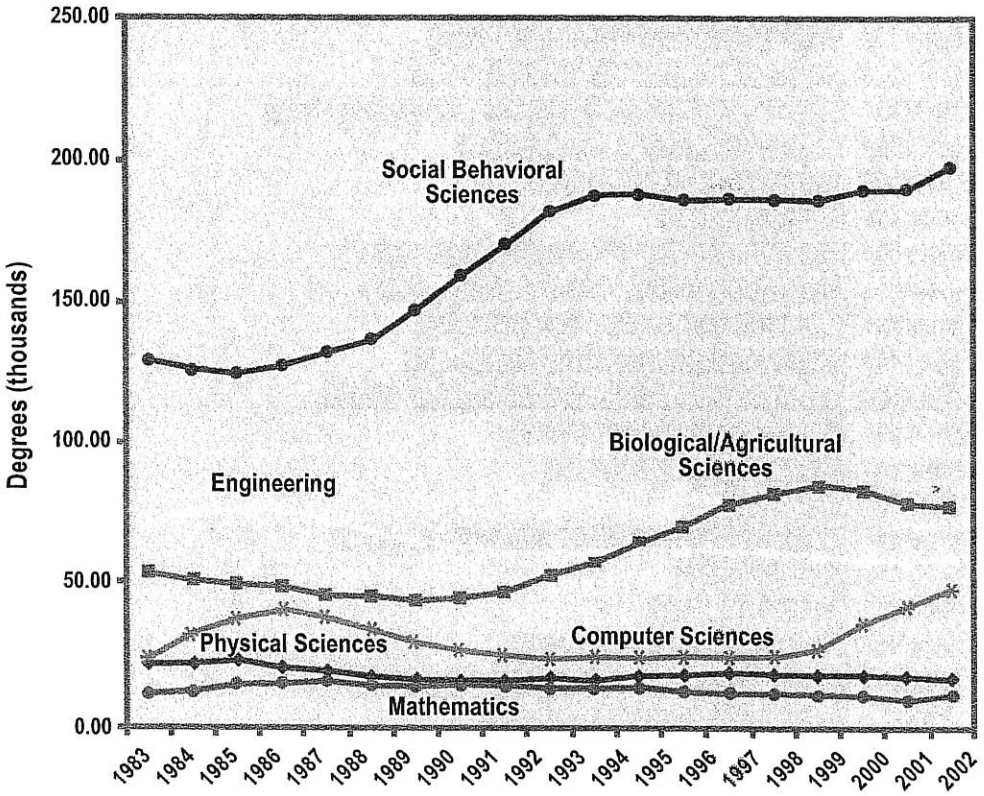
*The chart on this page summarizes the results of an international comparison of math proficiency of 15-year-olds sponsored by the Program for International Assessment (PISA) of the Paris-based Organization for Economic Cooperation and Development (OECD). Only member countries of the OECD participated in the assessment. The 2006 PISA assessments of math and science, released in December 2007 show comparable results.

Source: Competitiveness Index: Where America Stands. Council on Competitiveness, 2006.

Why METS and Innovation Matter for the U.S.

With few exceptions, US bachelor degree production in technical disciplines has remained flat or declining for the past two decades*

U.S. S&E Bachelor's Degrees by Field
1983 - 2002

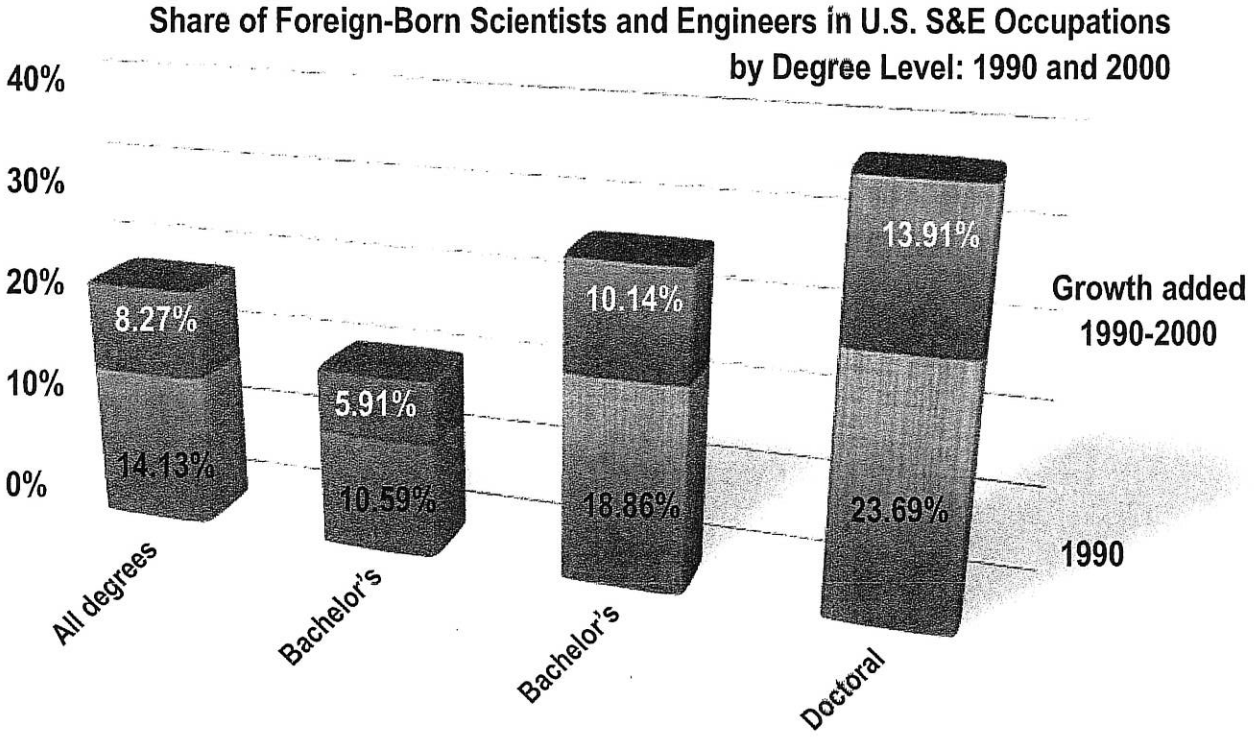


* The number of foreign-born students earning U.S. degrees increases significantly at the Master's and Doctoral level.

Source: NSF, Science and Economic Indicators, 2006.

Why METS and Innovation Matter for the U.S.

The U.S. is relying increasingly on foreign-born science and engineering professionals, even though opportunities are growing in their home countries



The Bottom Line

Americans will not continue to enjoy the world's highest standard of living without building capacity in METS

U.S. reliance on foreign-born technical talent is a natural result of globalization, but also a warning sign that home-grown does not measure up

Source: National Science Board, Science and Engineering Indicators, 2006.

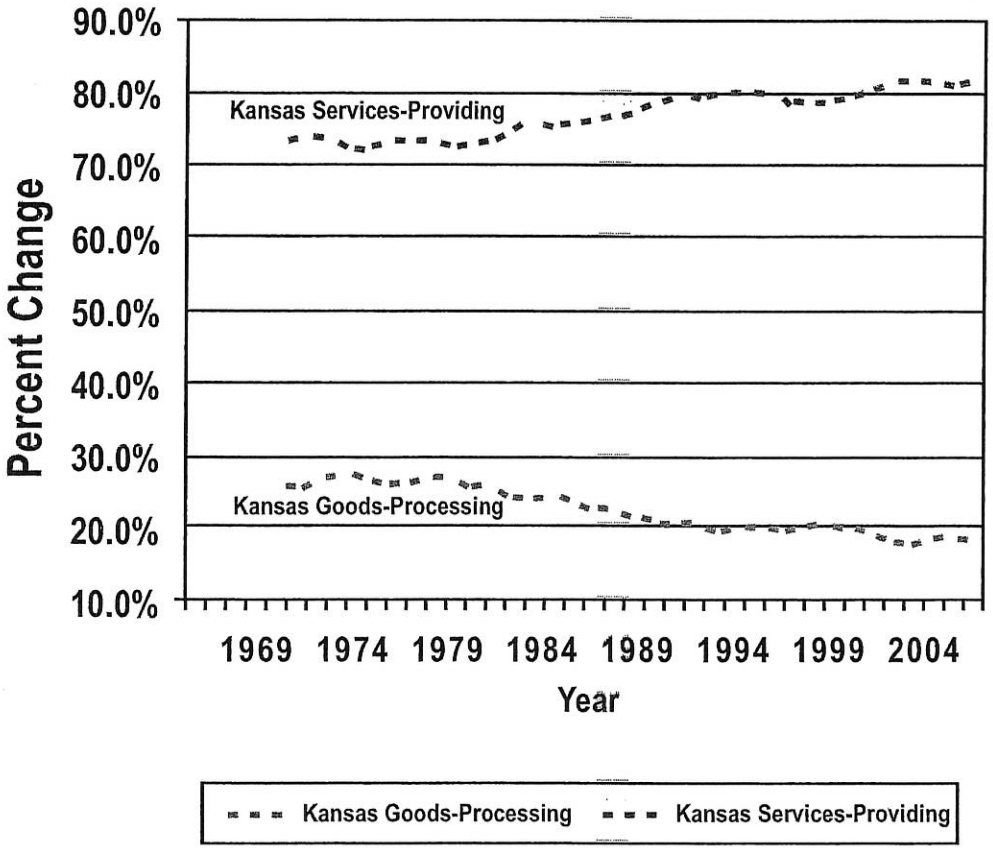
Section II: Why METS and Innovation Matter for Kansas

Although Kansas leads the world in production agriculture, the economy of the state is more diverse and more service-oriented than many may realize. The sectors that are most likely to generate significant numbers of high-wage jobs are knowledge-based. Most of these high-growth sectors are also intensely competitive. In order to create and maintain competitive advantage, Kansas must produce a deeper pool of technically skilled workers, while at the same time building capacity in frontier research and product development in selected fields. This section of the data book presents selected indicators highlighting why METS and innovation matter to Kansas.

Why METS and Innovation Matter for Kansas

Although Kansas is a world leader in production agriculture, service industries account for more than 80% of the state's Gross Domestic Product (GDP)*

Share of Goods-Producing and Service-Producing Industries
1970-2005



* Key service-producing industries include wholesale and retail trade, transportation, utilities, financial activities, professional and business services, education, health, leisure and hospitality, and government. Key good-producing industries include natural resources and mining, construction, durable goods manufacturing, (e.g., aviation) and non-durable goods manufacturing (e.g., food processing).

Source: Bureau of Labor Statistics, Labor Market Information Services, Kansas Department of Labor.

Why METS and Innovation Matter for Kansas

The manufacturing sector in Kansas is stronger than neighboring states and the U.S. economy as a whole*

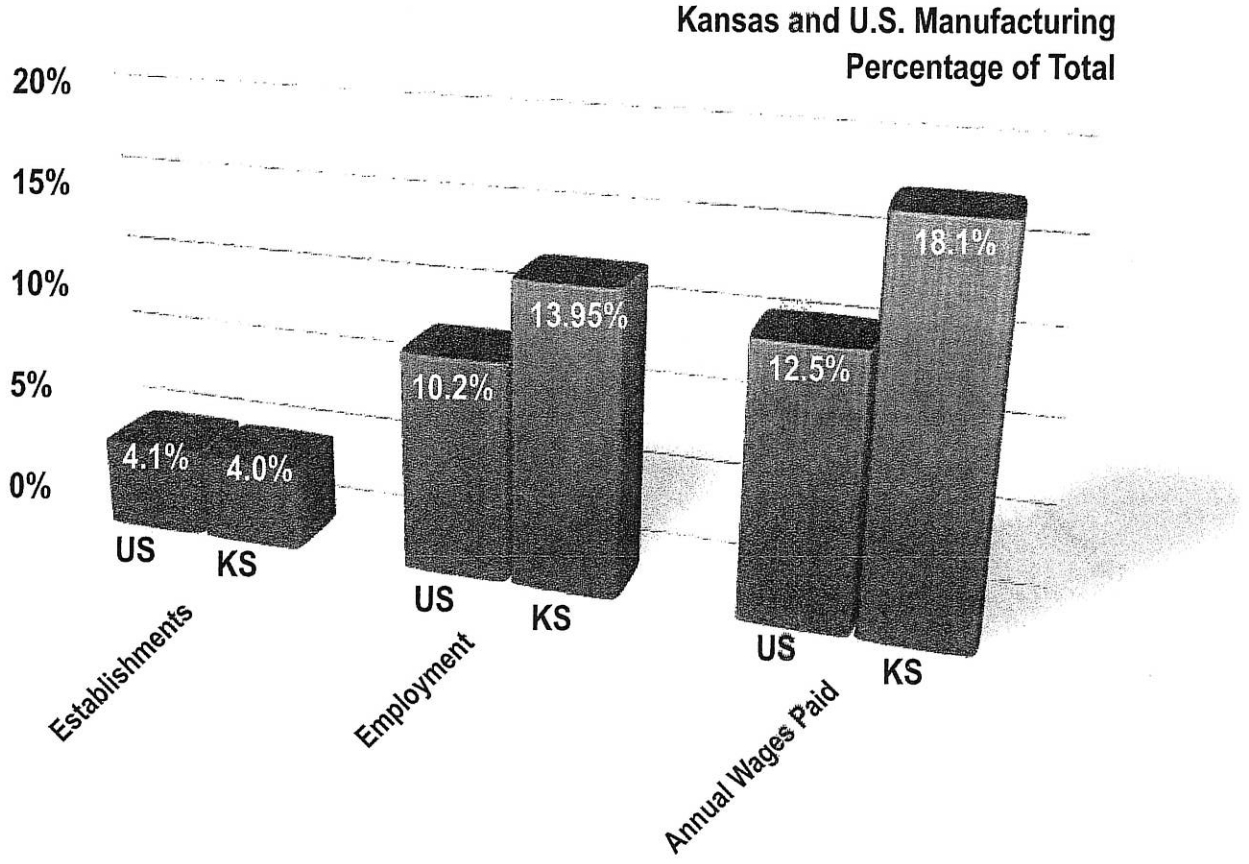
Manufacturing Employment							
All employees, thousands							
	Aug - 97	Aug - 02	Aug - 06	Aug - 07	1 - year change	5 - year change	10 - year change
Kansas	200	184.8	184.6	187	1.3%	1.2%	-6.5%
6-State Region	1,334.8	1,188.2	1,140	1,118.2	-1.9%	-5.9%	-16.2%
U.S.	17,552	15,272	14,303	14,098	-1.4&	-7.7%	-19.7%

* Whereas the national share of goods producing industries fell nearly 6 percent from 1990 to 2007, the Kansas share fell roughly 2 percent. This explains why the trend toward a service-driven economy is less pronounced in Kansas than the U.S. economy as a whole.

Source: Bureau of Labor Statistics, Labor Market Information Services, Kansas Department of Labor.

Why Math, Science and Innovation Matter to Kansas

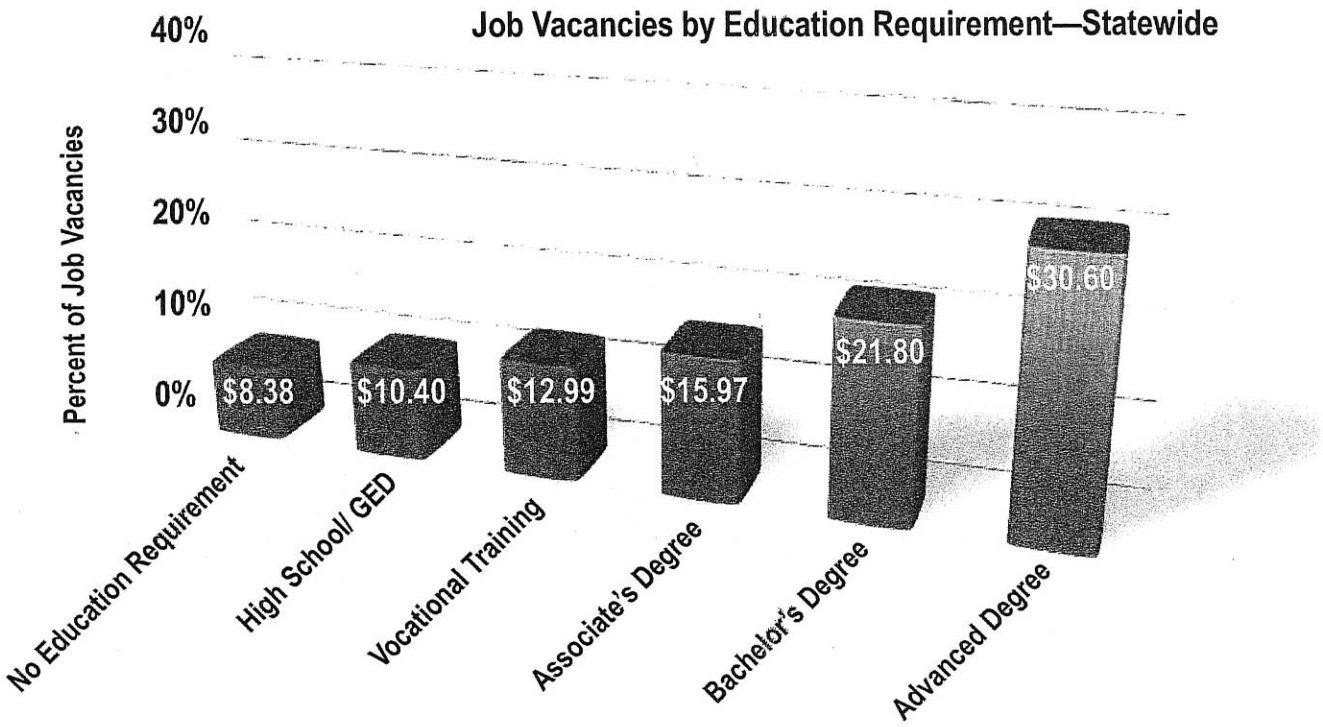
Manufacturing accounts for a larger share of employment and wages in Kansas than the U.S. economy as a whole



Source: Bureau of Labor Statistics, Labor Market Information Services, Kansas Department of Labor.

Why Math, Science and Innovation Matter to Kansas

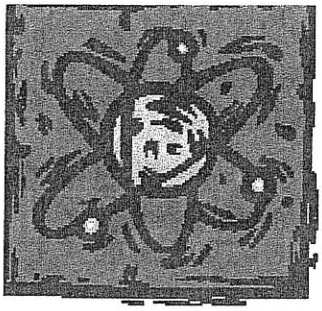
More education commands higher-paying jobs in all economic sectors



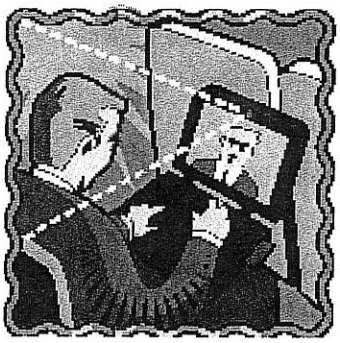
Source: Kansas Department of Labor, Labor Market Information Services. Second Quarter 2007 Job Vacancy Survey.

Why Math, Science and Innovation Matter to Kansas

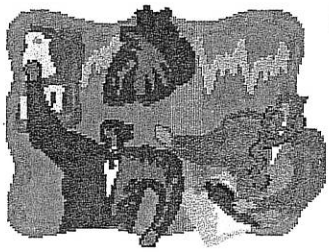
A recent study by Kansas, Inc. identifies five high-growth industry clusters in which the state has the potential to create competitive advantage*



Bioscience§



Communications



Healthcare

Energyχ

Advanced Manufacturing/Aviation

§ *Includes animal health*
χ *Includes bio-fuels*

* A February 2007 competitive benchmarking of the Kansas economy by the Monitor Group and the National Governors' Association Center for Best Practices reaches roughly the same conclusions, while also drawing a distinction between industry clusters that are exposed to national and international competition ("traded clusters") and those that are not ("local clusters"). Crop agriculture and food processing are defined in the Monitor-NGA benchmarking report as traded clusters, as are the five clusters called out in the Kansas, Inc. study.

Source: Positioning Kansas for Competitive Advantage: Aligning Key Industry Clusters and Occupations with Postsecondary Education and Workforce Development. Kansas, Inc. 2007. "A Competitive Benchmarking of the Kansas Economy," Monitor Group and NGA Center for Best Practices, February 2007.

Why Math, Science and Innovation Matter to Kansas

These high-value sectors will generate growing demand for highly-skilled workers

Bioscience

- R&D in physical, engineering, and life sciences
- Animal Health
- Pharmacology
- Clinical testing
- Manufacturing
- Software development and application
- Management and sales

Communications

- R&D in new products, methods of transmission, and services
- Systems engineering
- Systems software
- Network and computer administration
- Business operations

Energy

- R&D in bio-fuels and other renewable resources
- Cost analysis
- Information systems support
- Production
- Maintenance
- Transportation

Advanced Manufacturing/Aviation

- R&D in new materials, electronics, information systems
- Production and installation
- Maintenance
- Supply Chain Management
- Transportation
- Business and Finance

Health Care

- R&D in devices, genetics, nanotechnology, and robotics
- Diagnostics
- Health information
- Medical services (physicians, nurses, therapists)
- Clinical and dental technology
- Management

Source: The 2007 State New Economy Index: Benchmarking Economic Transformation in the States, The Information Technology and Innovation Foundation and Ewing Marion Kauffman Foundation.

Why Math, Science and Innovation Matter to Kansas

The educational attainment of the Kansas workforce is slightly above the national average

State Ranking by Educational Attainment		
State	**Rank**	**Score (Weighted Average*)**
Massachusetts	1	52.4
Colorado	2	50.0
Kansas	**19**	**40.8**
Nebraska	21	40.1
Iowa	36	35.2
Missouri	38	35.9
Arkansas	49	28.7
US Average		*39.7*

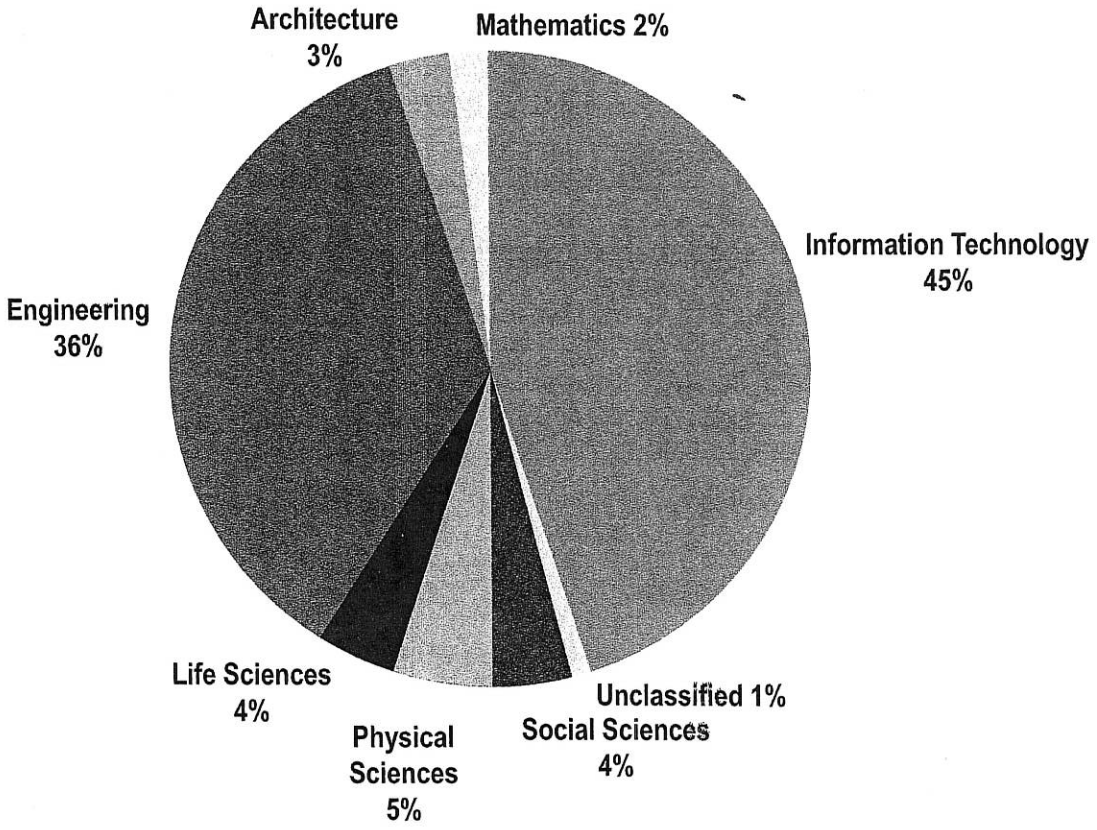
* A weighted average of advanced degrees, bachelor's degrees, associate's degrees, and some college coursework.

Source: State "New Economy" Index.

Why Math, Science and Innovation Matter to Kansas

Information technology and engineering loom large in the state's technical workforce of baccalaureate and advanced degree holders

Science and Engineering Occupations in Kansas



Source: 2007 Population Reference Bureau.

Why Math, Science and Innovation Matter to Kansas

Kansas ranks above average in meeting its own needs in computer science and especially in engineering

In-State Degree Production in Selected Tech Fields (by 1,000 jobs, 2005)					
National Ranking		**Bachelor's Degrees Awarded per 1,000 Tech Jobs**	**Change from 2001 to 2005**	**Degrees Awarded**	**Tech Jobs in Selected Fields**
Engineering Bachelors	14	69.5	25.7%	697	10,034
Engineering Tech Bachelors	24	72.6	6.7%	466	6,422
Computer Science Bachelors	16	47.3	9.3%	475	10,040
Computer Science Associates	42	18.2	-2.0%	193	10,620

Source: NCEMS Information Center for State Higher Education Policy Making and Analysis, www.higheredinfo.com.

Why Math, Science and Innovation Matter to Kansas

Nevertheless, almost one out of every three reported employment vacancies requires post-secondary education

All Job Vacancies	Number of Job Vacancies	Percent of All Job Vacancies	Average Minimum Wage Offer	Average Maximum Wage Offer
All Job Vacancies	*52,229*	*100*	*$11.97*	*$13.80*
No Education Requirement	14,132	27	$8.38	$9.70
High School or GED	19,692	38	$10.40	$11.87
→ Vocational Training	4,438	9	$12.99	$16.10
→ Associate's Degree	2,715	5	$15.97	$18.06
→ Bachelor's Degree	6,904	13	$21.80	$25.05
→ Advanced Degree	1,234	2	$30.60	$33.69
No response	3,114	6	$11.53	$13.26

* Percentages may not add up due to rounding.

Source: Kansas Department of Labor, Labor Market Information Services. Second Quarter 2007 Job Vacancy Survey.

Why Math, Science and Innovation Matter to Kansas

Employer surveys and gap analysis also indicate long-term shortfalls in job categories requiring post-secondary education in technical fields*

Projected Occupational Shortages
Accounting
Agriculture
Aviation
Engineering
Information-Technology
Nursing
Protective Services
Skilled Trades
Teachers of Math and Science*

* K-12 teachers of math and science did not fall within the purview of the 2007 cluster study, but the shortages estimated in this data book prompted the Legislature's Advisory Committee to include this occupation.

Source: Positioning Kansas for Competitive Advantage: Aligning Key Industry Clusters and Occupations with Postsecondary Education and Workforce Development. Kansas, Inc. 2007.

Why Math, Science and Innovation Matter to Kansas

Historically, Kansas has been less competitive than most states in winning federal research awards

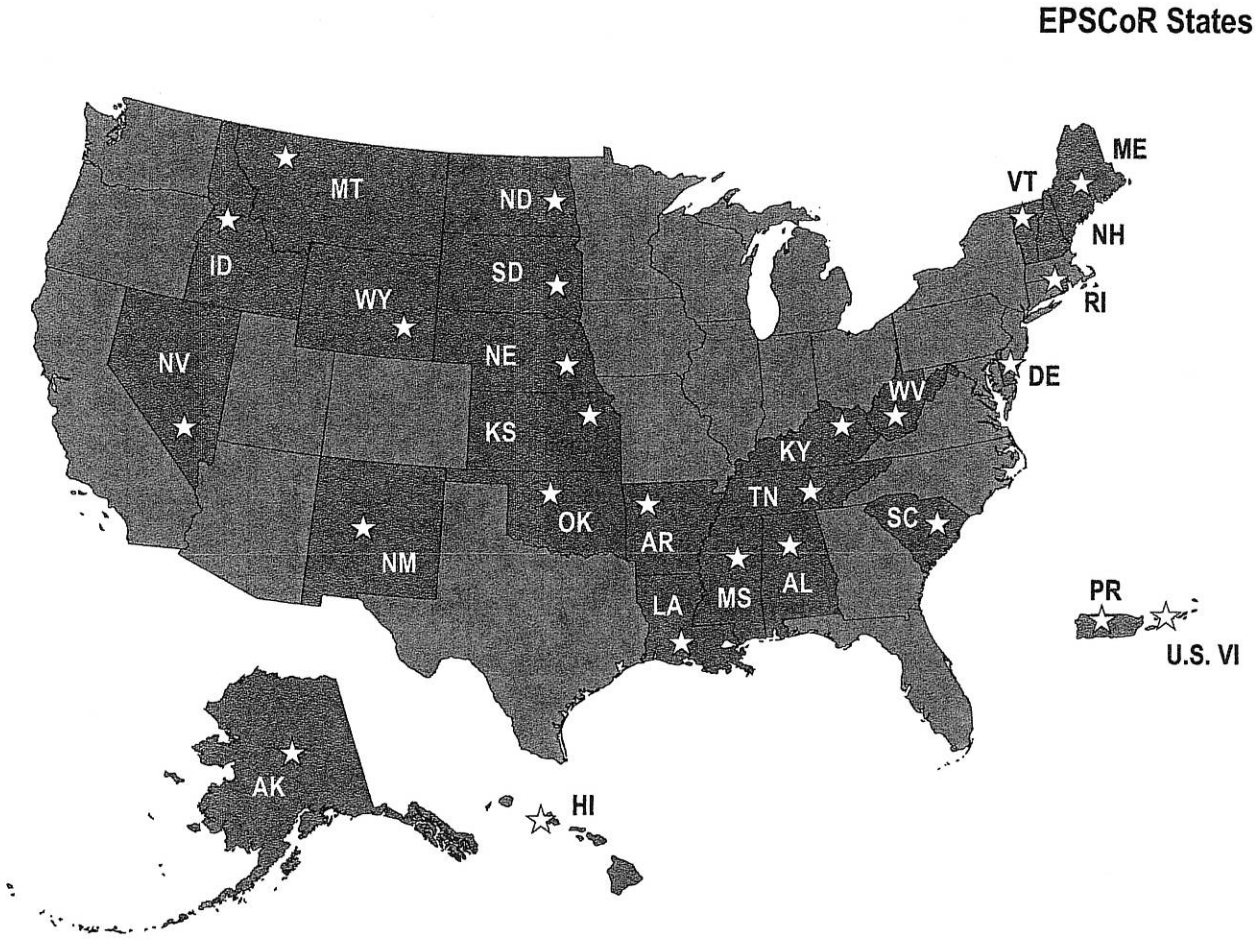
Federal Grants to Kansas FY 2002					
Agency	**Total**	**Industrial Firms**	**Universities & Colleges**	**Other Non-Profits**	**Rank**
All agencies	290,516	21,030	17,154	106,164	38
Dept. Agriculture	16,907	0	8,118	0	36
Dept. Commerce	835	835	0	0	45
Dept. Defense	17,941	8,887	5,150	0	45
Dept. Energy	8,193	462	7,731	0	34
Dept. HHS	207,653	3,415	69,907	105,159	27
Dept. Interior	2,940	2	556	0	37
Dept. Transportation	9,444	4,448	3,200	0	18
EPA	459	0	208	126	43
NASA	4,311	1,190	2,242	879	44
NSF	21,833	1,791	20,042	0	32
Rank	**38**	**43**	**35**	**13**	**na**

Note: Federal R&D obligations are as reported by funding agencies. Ranks and totals are based on data for 50 states, District of Columbia and Puerto Rico.

Source: National Science Foundation/Division of Science Resources Statistics.

Why Math, Science and Innovation Matter to Kansas

As a result, Kansas is one of 24 states qualifying for federal support under the Experimental Program to Stimulate Competitive Research (EPSCoR)



Source: National Science Foundation.

Why Math, Science and Innovation Matter to Kansas

The state also lags in key "new economy" indicators including entrepreneurial activity, initial public offerings, fast-growing firms and inventor patents*

New Economy Indicators		
State	**Rank**	**Score**
Utah	1	13.78
Colorado	3	13.23
Arkansas	25	9.16
Missouri	37	7.30
Kansas	**45**	**6.11**
Iowa	48	5.59
US Average		*10*

* Kansas has taken action to strengthen the state's "new economy" assets through the 2004 Kansas Economic Growth Act, a key component of which included the establishment of a Bioscience Authority to attract world-class talent and guide cutting-edge investments.

The Bottom Line

Kansas' economic future depends on deepening its pool of technical talent.

The state is not producing sufficient technical talent to meet near-term needs and capitalize on long-term opportunities.

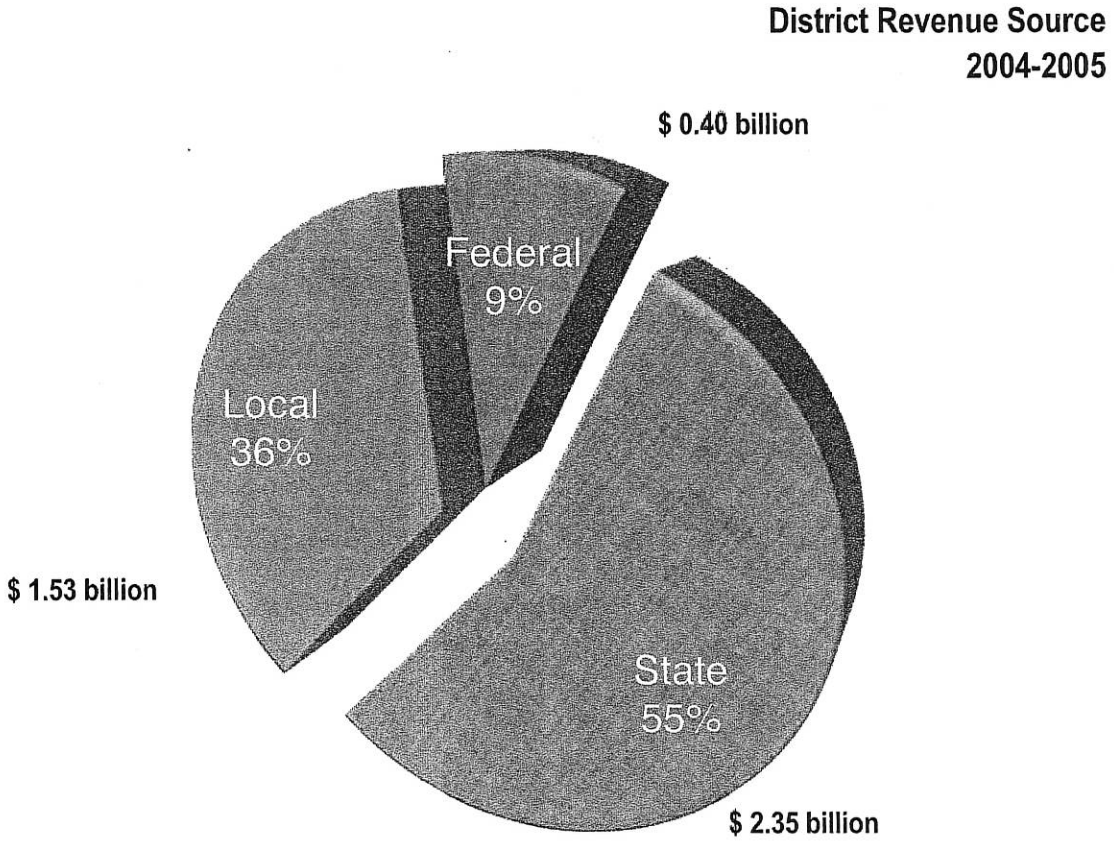
Source: The 2007 State New Economy Index: Benchmarking Economic Transformation in the States, The Information Technology and Innovation Foundation and Ewing Marion Kauffman Foundation.

Section III: K-12 Indicators

K-12 math and science education in Kansas is shaped by the interplay of federal, state, and local decisions. The federal No Child Left Behind Act sets national achievement goals and holds schools accountable for annual progress toward reaching them. The State Board of Education determines what students are expected to learn at each grade level and what qualifications teachers of math and science must hold. The state also develops and administers tests to measure student proficiency. Two hundred ninety-six local school districts, varying widely in size, enrollment, and resources, have the last word on matters of governance, curriculum, and teacher hiring. This section of the data book highlights the performance of Kansas' K-12 enterprise in equipping students with foundational skills in math and science.

K-12 Indicators

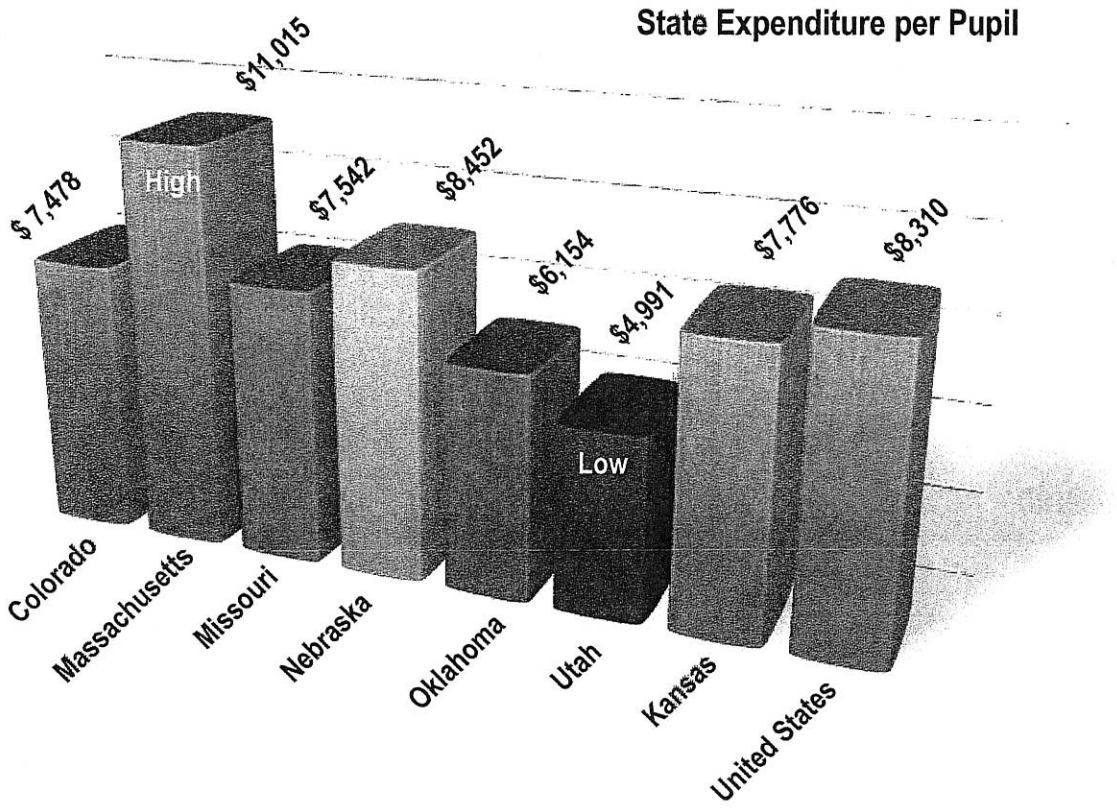
Kansas' $4 billion K-12 enterprise draws upon federal, state, and local resources



Source: U.S. Department of Education, National Center for Education Studies.

K-12 Indicators

Kansas K-12 spending per pupil is not as high as most states



Source: National Center for Education Statistics: Digest of Education Statistics 2006.

K-12 Indicators

The student population of about 465,000 is less diverse than the U.S. as a whole, but the pace of recent change has been dramatic

Racial/Ethnic Composition of Students		
	Kansas	**National**
White	73.4	59.2
African-American	8.4	17.7
American Indian	1.4	1.2
Asian	2.3	4.4
Two or more races	2.6	-
Hispanic	11.8	18.1

Recent Changes in Kansas K-12 Enrollment by Race and Sex													
				White		**Black**		**Hispanic**		**Amer. Ind./Alaska**		**Asian/Pac Is.**	
	Total	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
1999	469,205	242,149	227,056	193,538	180,949	20,949	19,998	19,808	18,375	2,941	2,836	4,910	4,896
2006	465,135	240,147	224,988	174,394	162,306	18,724	17,652	28,743	27,159	3,277	3,134	5,405	5,436

Source: Kansas Department of Education.

K-12 Indicators

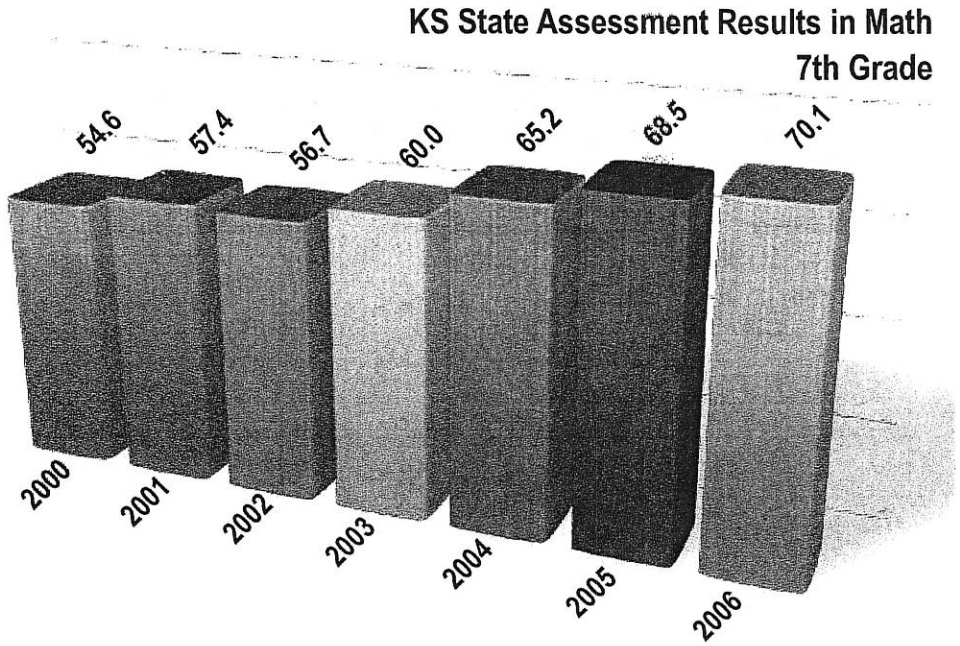
Steady enrollments have produced about 30,000 high school graduates per year

High School Graduates	
2005-06	29,836
2004-05	30,192
2003-04	30,123
2002-03	29,930
2001-02	29,510

Source: Kansas Department of Education.

K-12 Indicators

State math assessments show impressive gains since 2000 as well as 2006 achievement levels exceeding performance targets in all grades

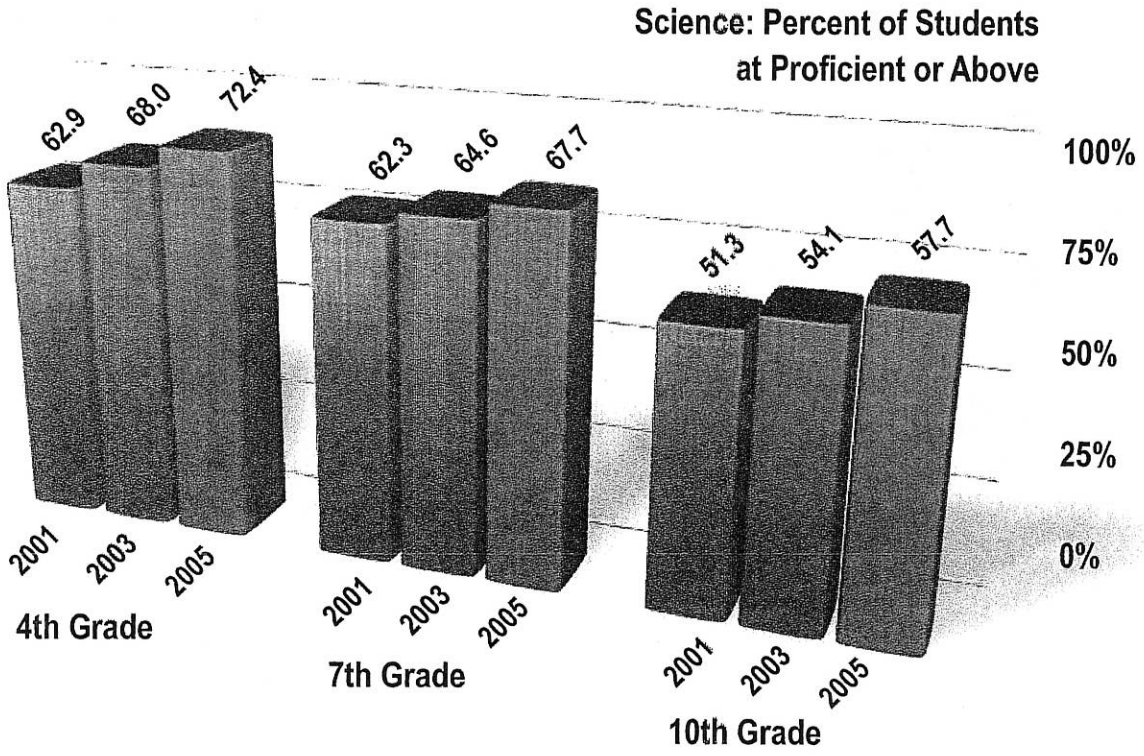


Kansas State Assessment Results: Math			
State	**Grade**	**Score**	**No Child Left Behind Target Score**
Student achievement in the top three performance categories remain strong: - meets standard - exceeds standard - exemplary	3	80.9	66.8
	4	80.7	66.8
	5	78.8	66.8
	7	74.3	66.8
	7	70.1	66.8
	8	66.6	66.8
	HS	58.3	55.7

Source: Kansas Department of Education.

K-12 Indicators

State science assessments also show gains in achievement

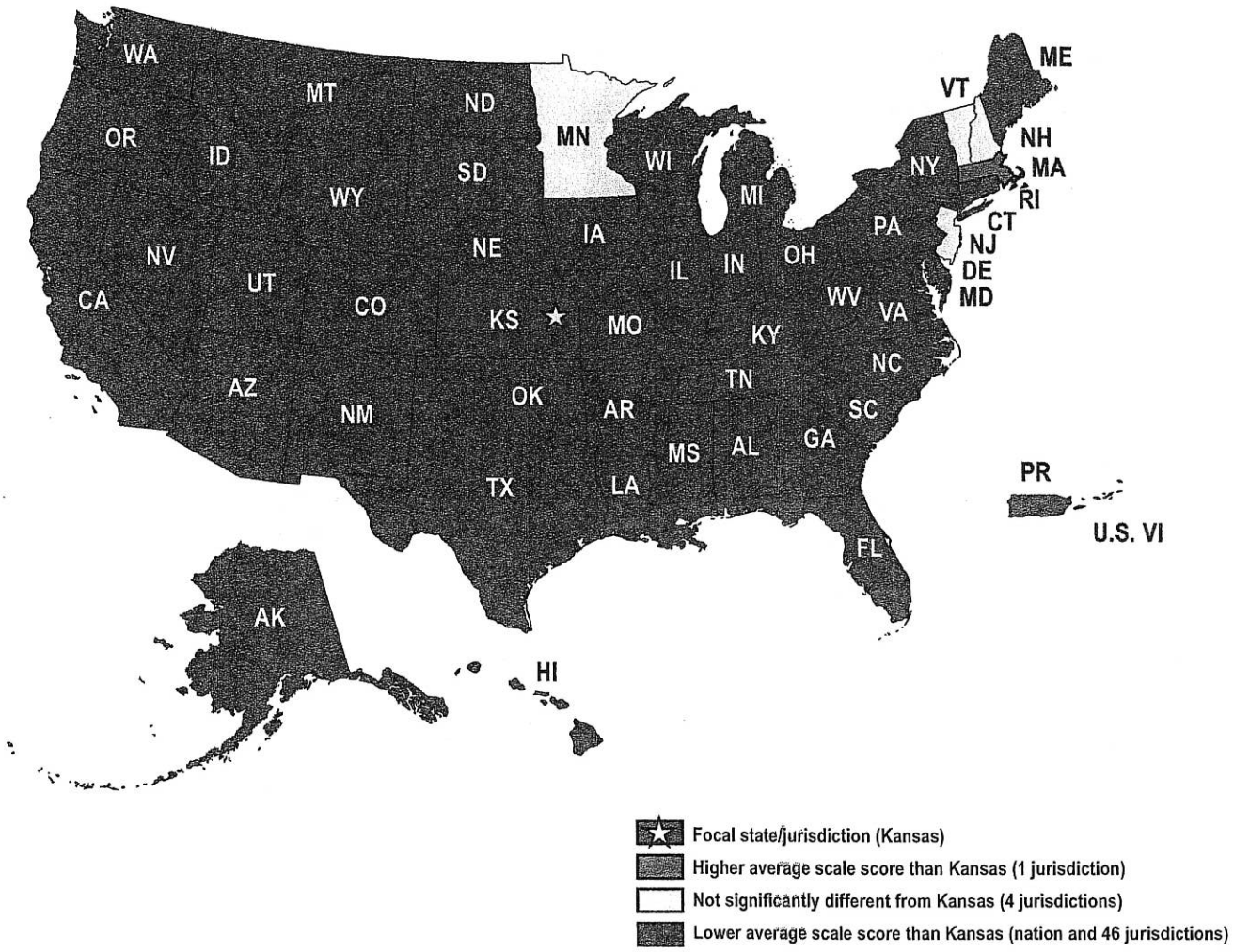


Source: Kansas Department of Education.

K-12 Indicators

National 4th grade math assessments confirm that Kansas is a high-performing state

Kansas Scores in Comparison with NAEP, 4th Grade

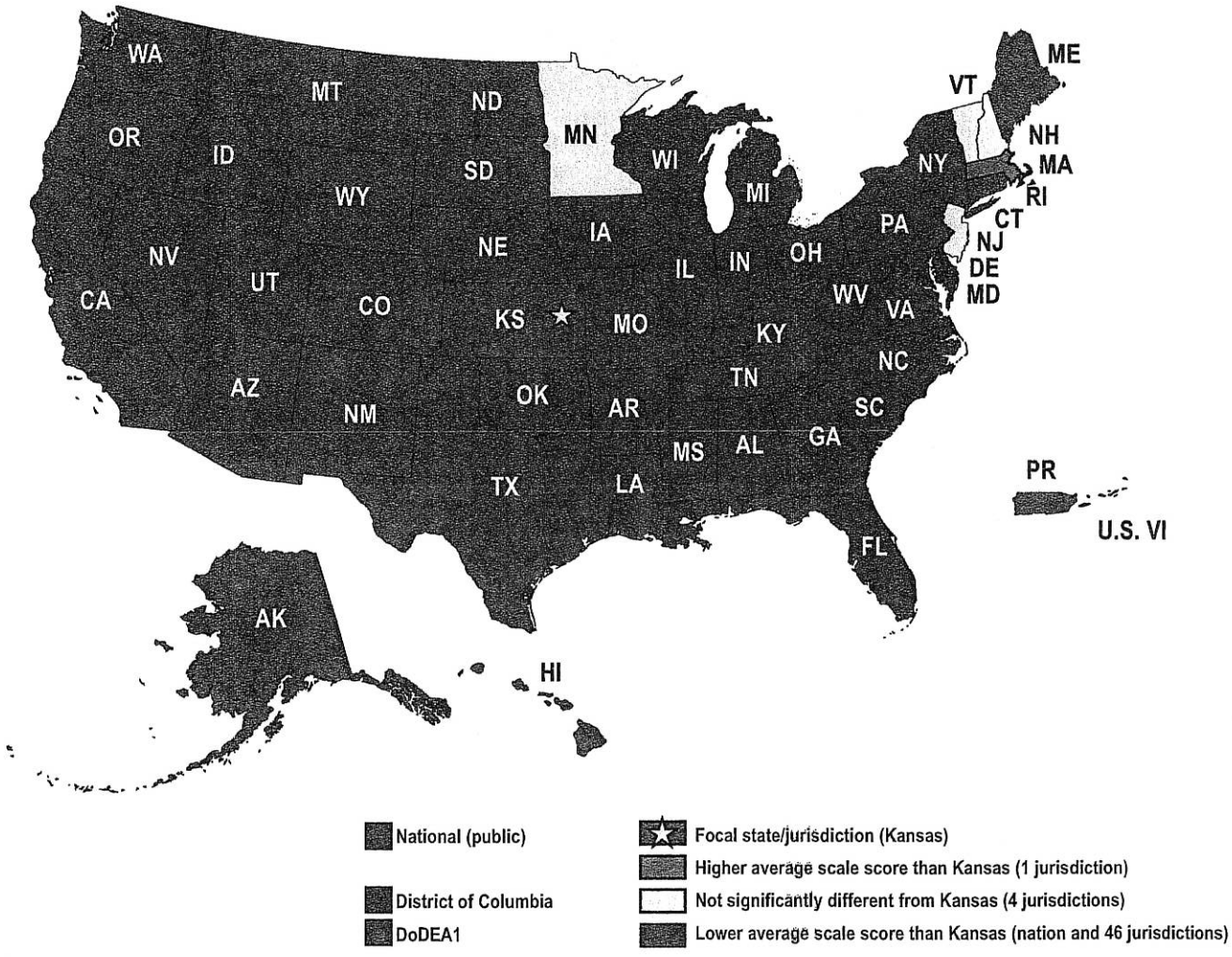


Source: U.S. Dept. of Education, Institute of Education Sciences/National Assessment of Education Progress (NAEP) 2007.

K-12 Indicators

National 8th grade assessments also show high relative performance

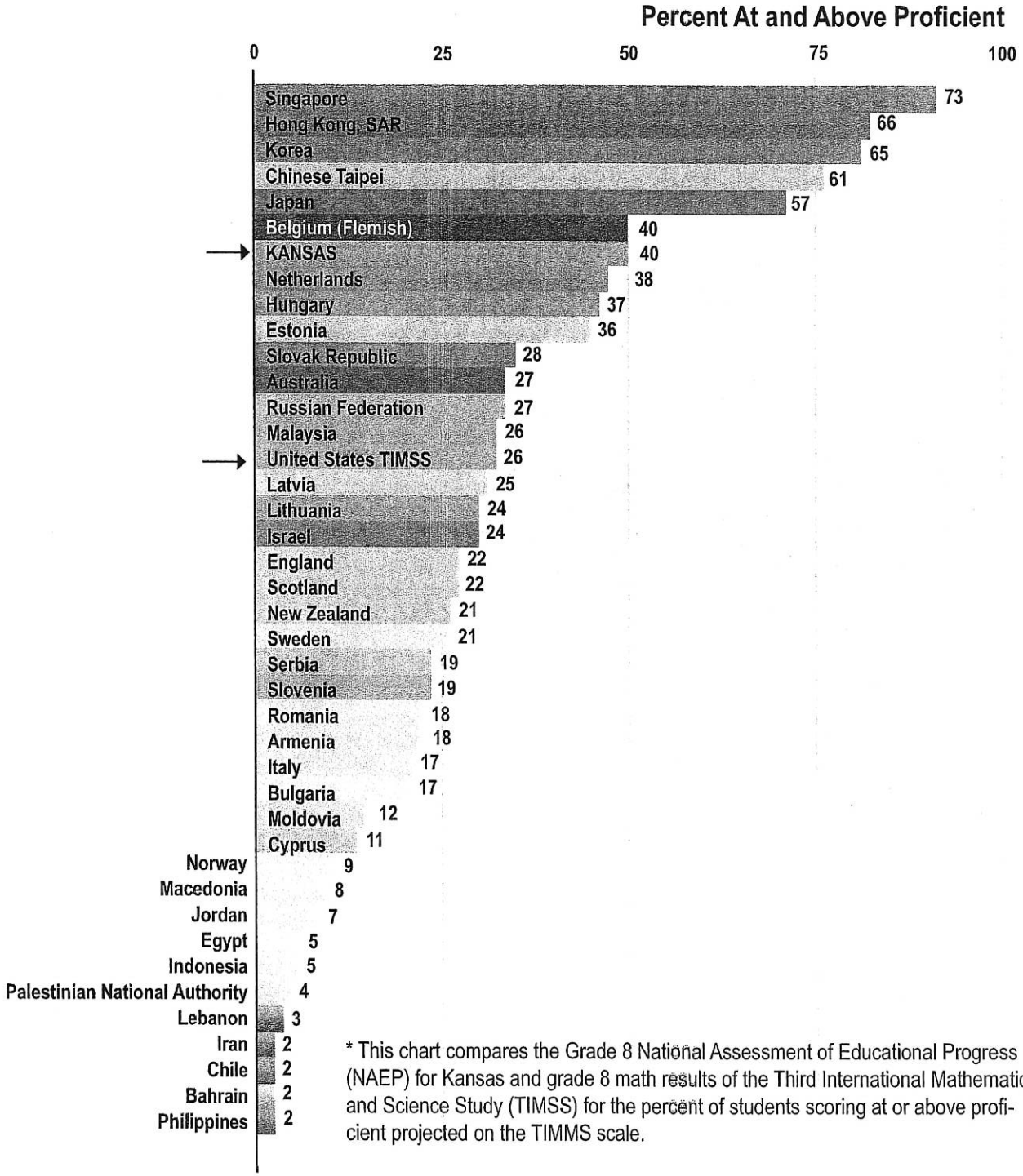
Kansas Scores in Comparison with NAEP, 8th Grade



Source: U.S. Dept. of Education, Institute of Education Sciences/National Assessment of Education Progress (NAEP) 2007.

K-12 Indicators

Math achievement in Kansas compares favorably with many countries, but significantly lags the highest-achieving countries*



* This chart compares the Grade 8 National Assessment of Educational Progress (NAEP) for Kansas and grade 8 math results of the Third International Mathematics and Science Study (TIMSS) for the percent of students scoring at or above proficient projected on the TIMMS scale.

Source: Phillips, Gary W., Chance Favors the Prepared Mind: Mathematics and Science Indicators For Comparing States and Nations, AIR: Wash., DC, 2007. Kansas did not participate in the grade 8 state NAEP in science.

K-12 Indicators

Despite comparatively high achievement in math, about half the Kansas student sample taking the national assessment scores below grade level*

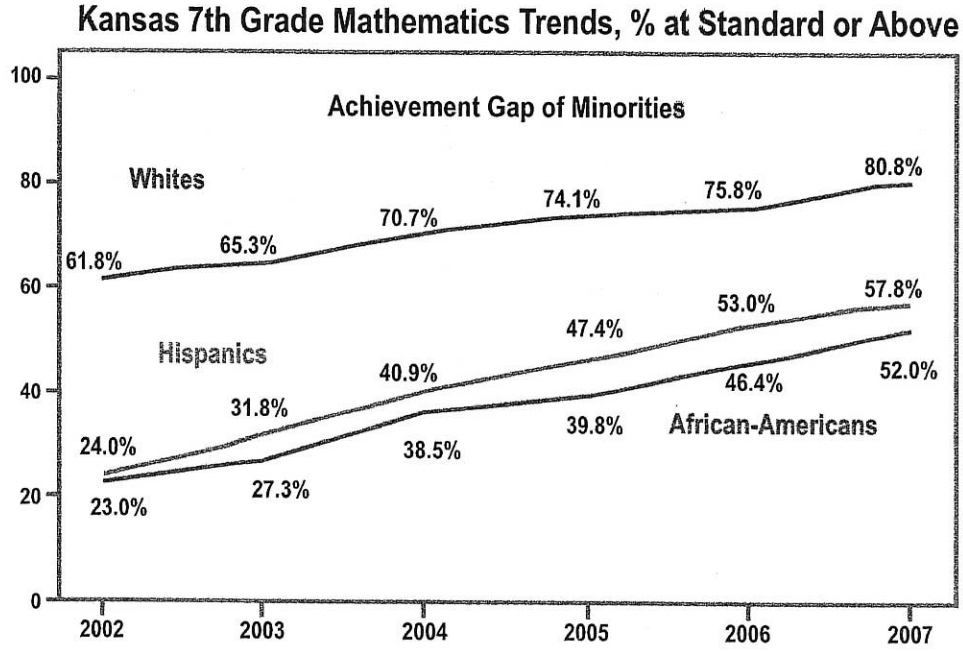
Proficiency of Kansas Students in Math					
		Below Basic	**Basic**	**Proficient**	**Advanced**
		Percentage at Grade Level			
Grade 4	2000	24	47	26	2
	2003	15	44	36	6
	2005	12	41	39	8
	2007	11	38	42	9
Grade 8	2000	24	43	29	5
	2003	24	42	28	6
	2005	23	42	29	5
	2007	19	41	32	9

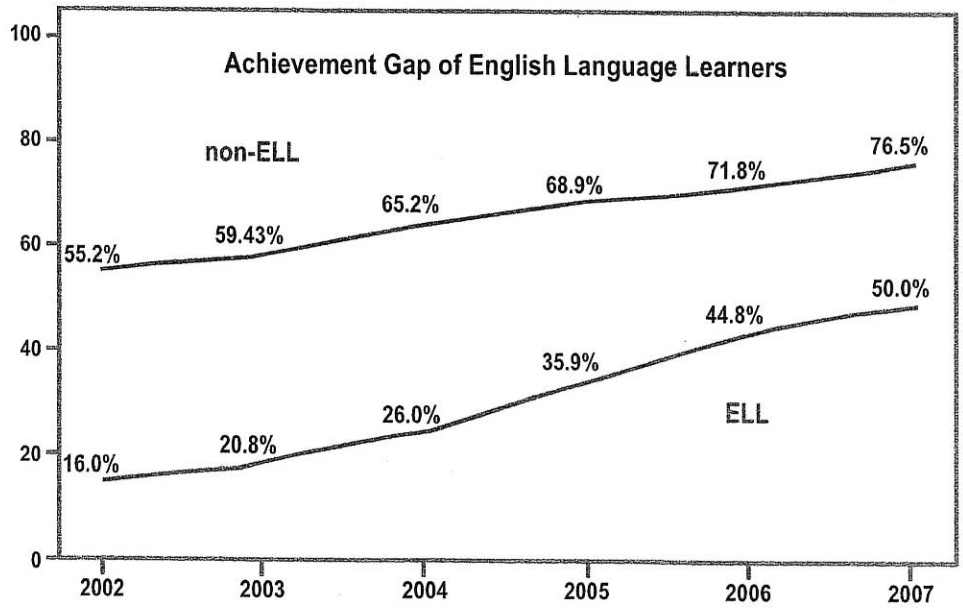
* Grade level is the equivalent of "proficient."

Source: U.S. Department of Education, National Assessment of Educational Progress (NAEP).

K-12 Indicators

Despite gains across all groups, achievement varies widely among income level, race and ethnicity, language status, and special learning needs.





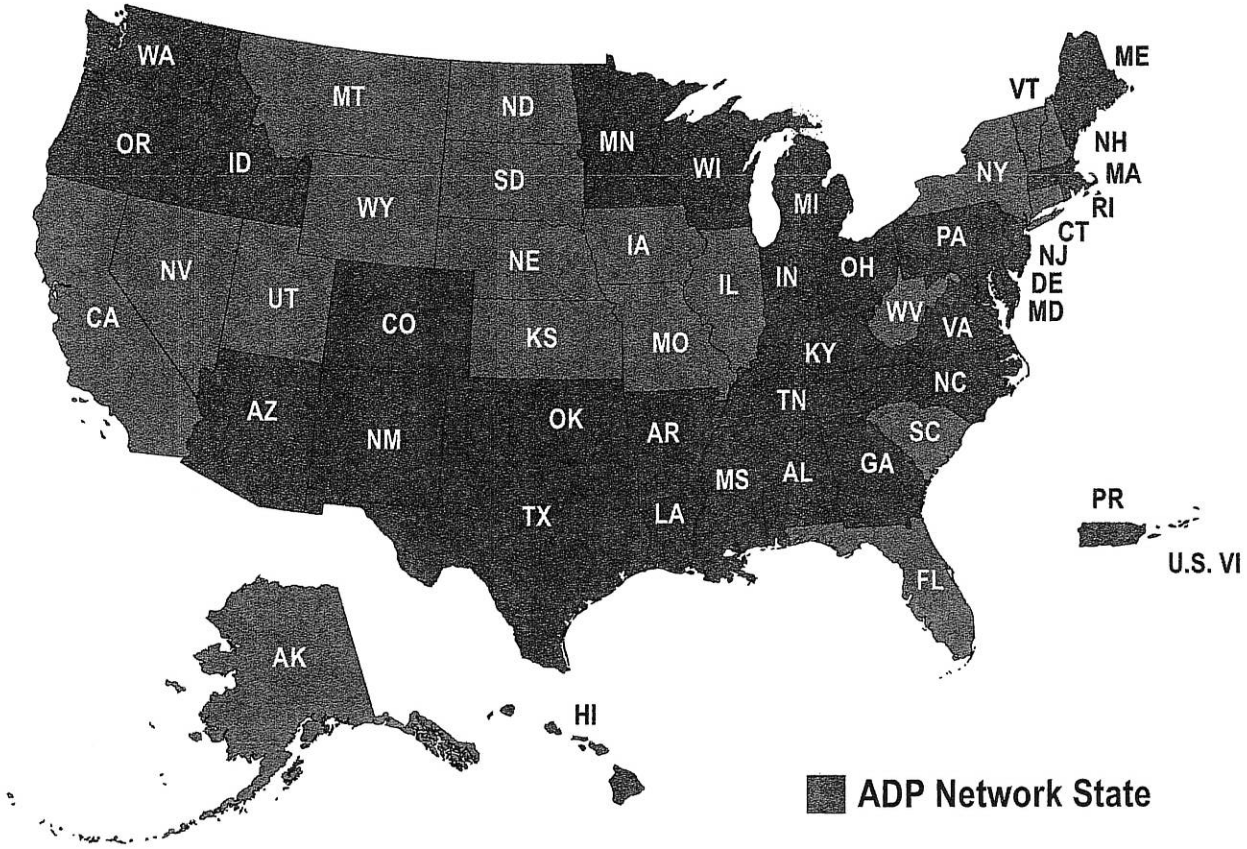
Source: Kansas State Department of Education.

K-12 Indicators

Math course requirements are on par with many states, but not among the most rigorous

High School Math Course Requirements	
Kansas	3 units including Algebra I and geometry concepts
Guidelines for 30 state members of American Diploma Project Network	4 units, including the content equivalent of Algebra I and II, geometry, and statistics or pre-calculus

Member States of the American Diploma Project Network



Source: American Diploma Project, www.achieve.org.

K-12 Indicators

Kansas science course requirements are not among the most rigorous

	High School Science Course Requirements
Kansas	3 approved units Including chemistry or physics and one lab course
National	35 states require (or are phasing in) three or more units of science. 17 states require (or plan to require) at least two lab sciences. Georgia, Indiana and West Virginia require explicit lab-based science

Source: Education Commission of the States, State Notes Mathematics/Science June 2007.

K-12 Indicators

Science assessments mandated under No Child Left Behind will begin in 2007-2008, but will be less frequent and less high stakes than those mandated for math

High School Science Course Requirements	
Math	**Science**
Tests administered annually in every grade span 3-8 and at least once in grade span 10-12	Tests administered at least once annually in grade spans 3-4, 6-9, 10-12
Results Factor in school accountability	**Results** Do not factor in school accountability

K-12 Indicators

Kansas high school students take the ACT college admission test at comparable rates to most surrounding states and score above the national average in math and science

2007 ACT-Tested High School Graduates	
State	**Percent of Graduates Tested**
Arkansas	75
Colorado	100 (required)
Iowa	66
Kansas	**76**
Missouri	74
Nebraska	77
Oklahoma	71
National	**42***

Five-Year Trends - Average ACT Scores						
	Number of Students Tested		**Average ACT Scores**			
			Mathematics		**Science**	
Grad Year	**State**	**National**	**State**	**National**	**State**	**National**
2003	23,813	1,175,059	21.2	20.6	21.5	20.8
2004	23,472	1,171,460	21.1	20.7	21.5	20.9
2005	23,106	1,186,251	21.2	20.7	21.6	20.9
2006	23,056	1,206,455	21.3	20.8	21.6	20.9
2007	23,196	1,300,599	21.4	21.0	21.7	21.0

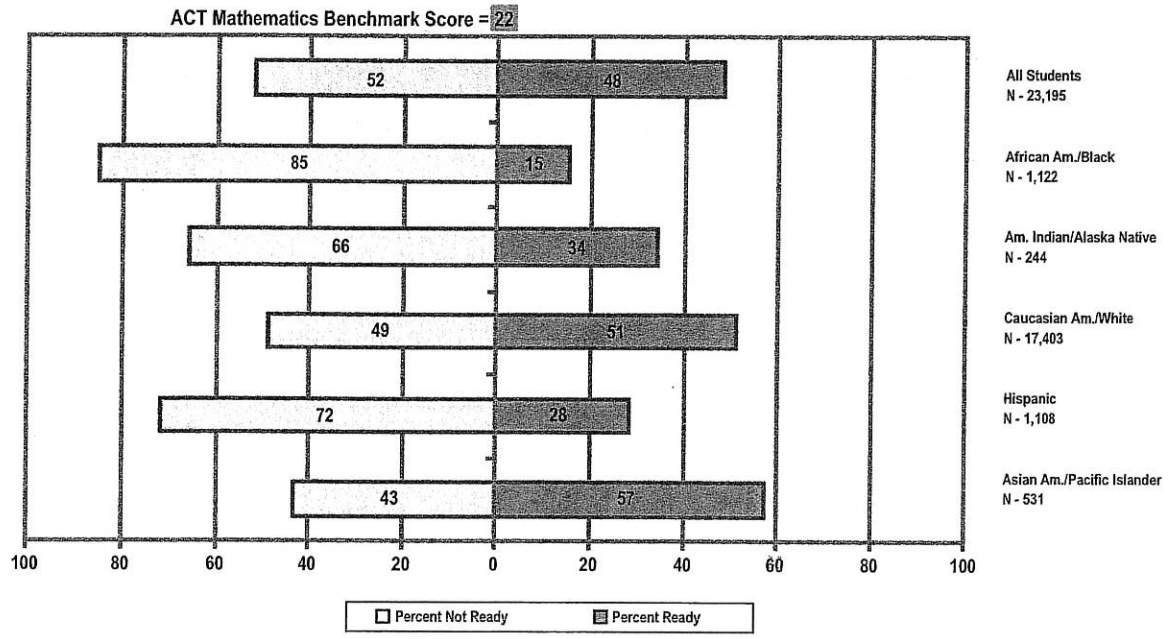
** The Scholastic Aptitude test (SAT) of the College Board is used in many high-population states outside the Midwest.*

Source: ACT High School Profile Report: The Graduating Class of 2007/Kansas www.act.org/news/data/07/pdf/states/Kansas.pdf.

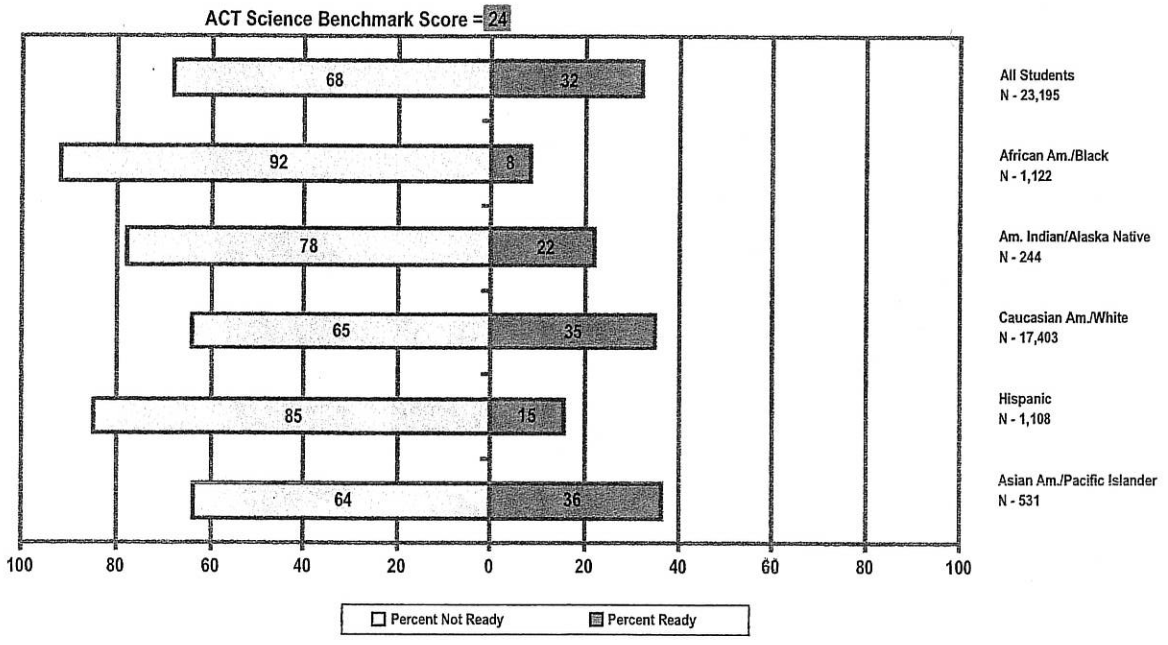
K-12 Indicators

However, only about half of ACT test takers are deemed college ready in math and only about one-third are college ready in science

Percent of Students Meeting ACT College Readiness Benchmark Scores by Race/Ethnicity: Mathematics



Percent of Students Meeting ACT College Readiness Benchmark Scores by Race/Ethnicity: Science

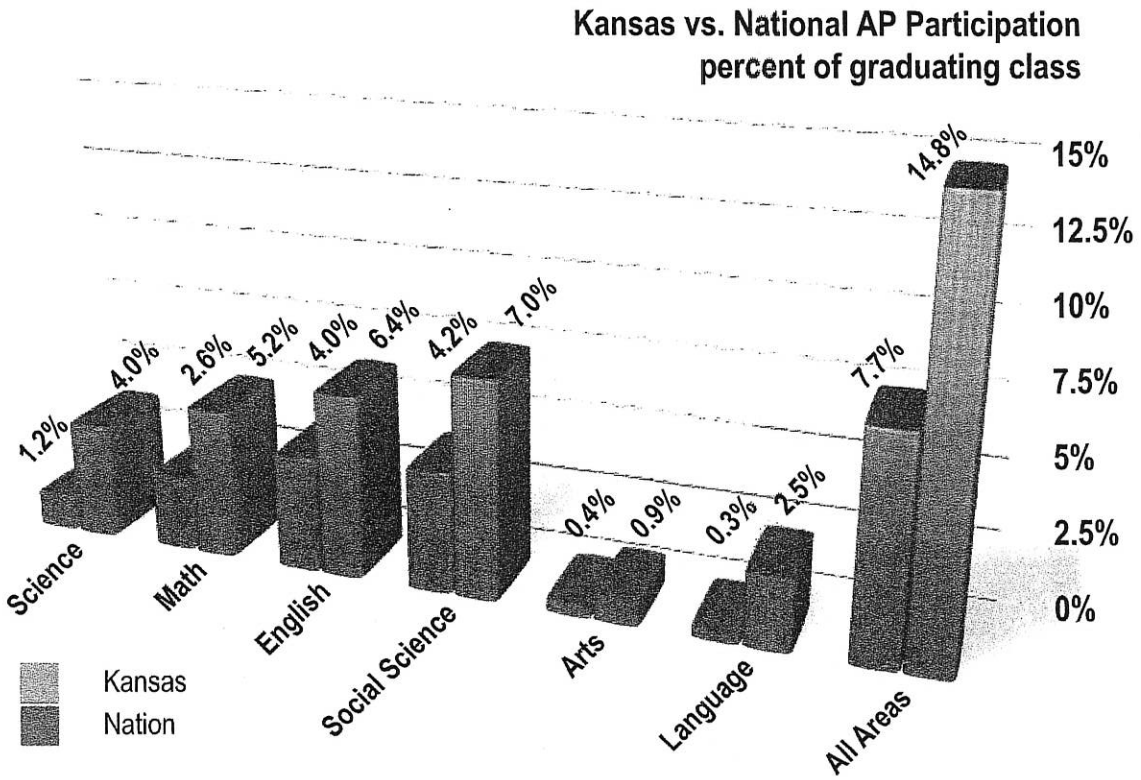


Source: ACT Kansas Profile 2007.

K-12 Indicators

Concurrent enrollment in Kansas provides readily available college opportunities, limiting participation in nationally benchmarked Advanced Placement courses

Concurrent Enrollment in Kansas	
Vocational Tech	2,080
Community College	5,564
State University	341
Private College	370
Total	8,355

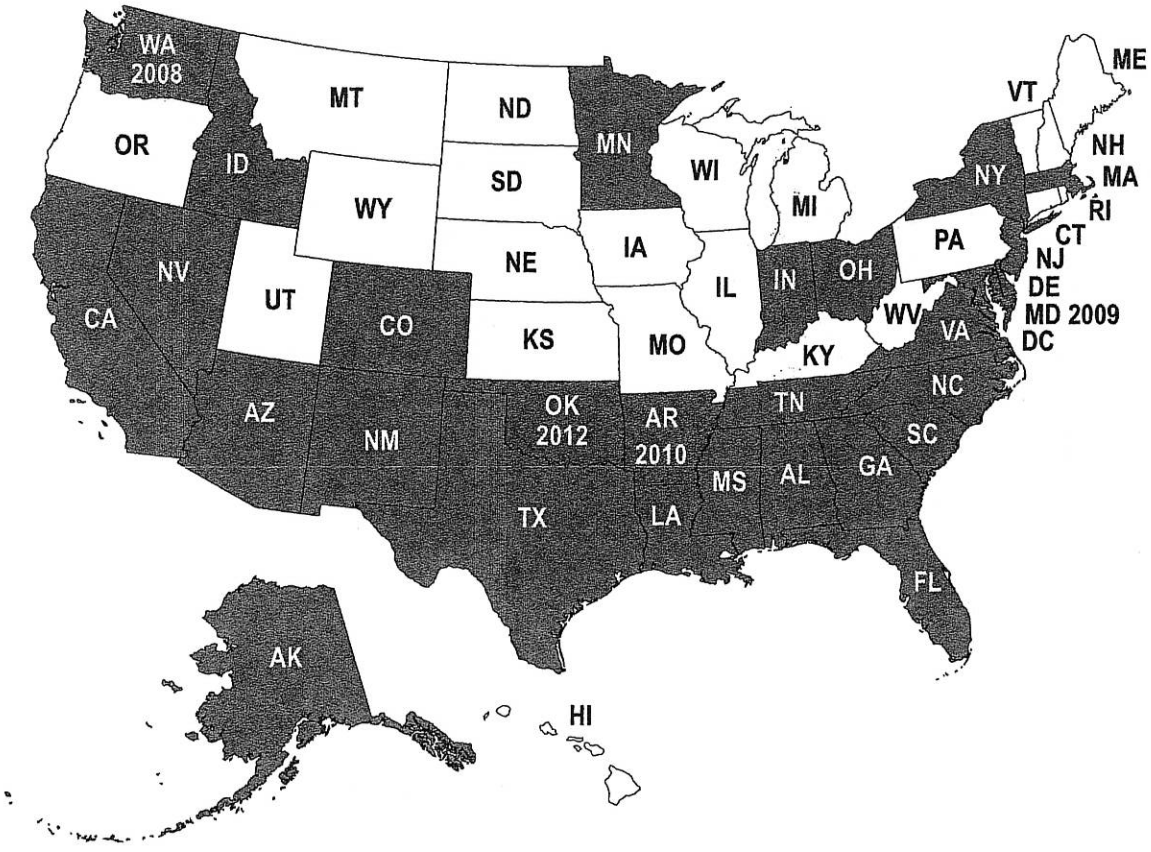


Source: AP Report to the Nation 2007 Kansas State Report.

K-12 Indicators

Kansas does not use a high school exit exam to establish an achievement "floor" in math

States with Mandatory Exit Exams (2007)



States with mandatory exit exams in 2007:
AL, AK, AZ, CA, FL, GA, ID, IN, LA, MA, MN, MS, NV, NJ, NM, NY, NC, OH, SC, TN, TX, VA
(22 states)

States phasing in exit exams by 2012 but not yet withholding diplomas:
AR (2010), MD (2009), OK (2012), WA (2008)
(4 states)

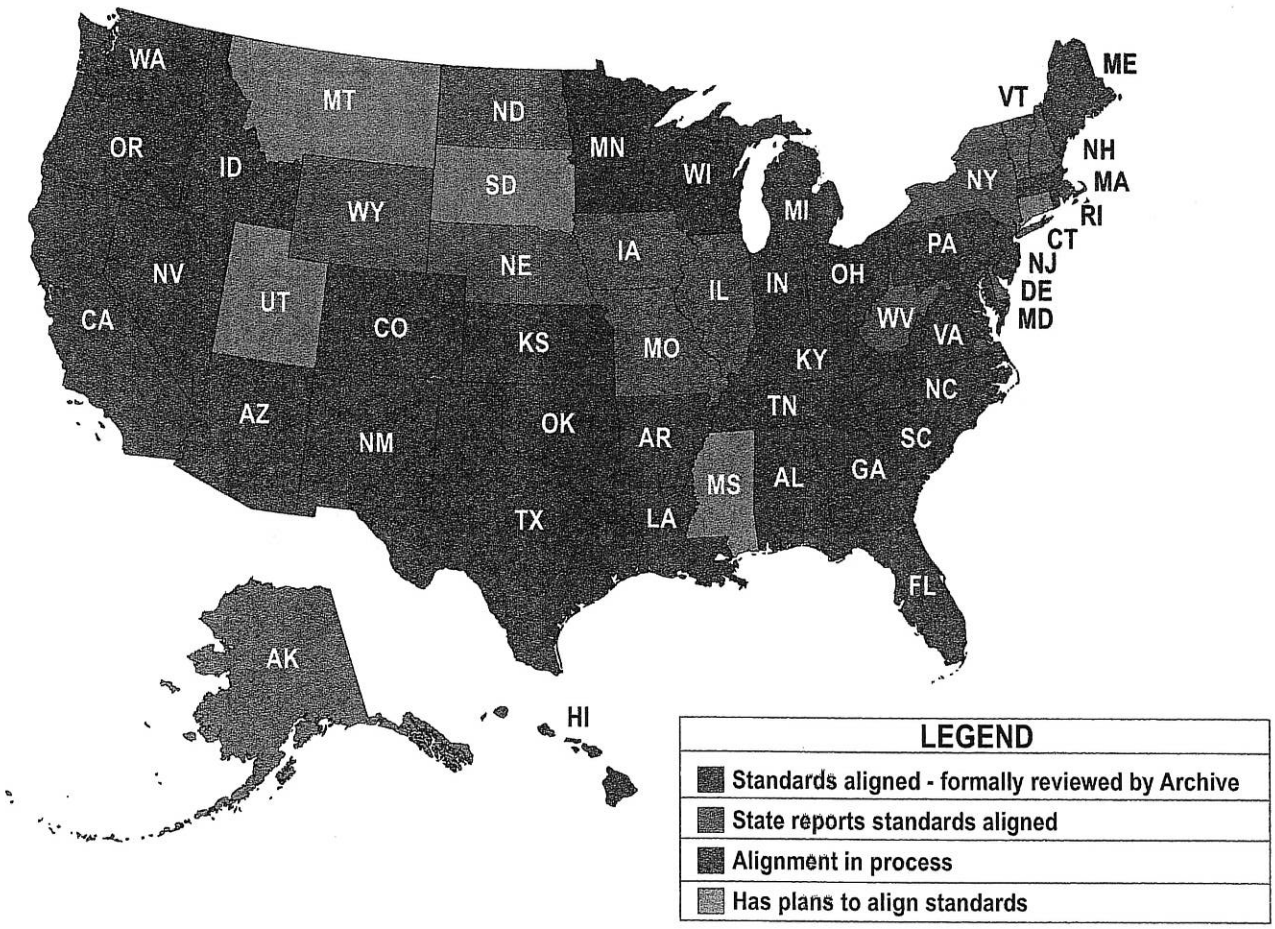
States with no mandatory exit exam:
CO, CT, DE, DC, HI, IL, IA, KS, KY, ME, MI, MO, MT, NE, NH, ND, OR, PA, RI, SD, UT, VT, WV, WI, WY
(24 states and DC)

Source: Center on Education Policy, exit exam survey of state departments of education, June 2007.

K-12 Indicators

Kansas is putting in place an integrated K-20 data system and Council, but has not yet made as comprehensive an effort as some states to align K-12 and post-secondary education

States that Align Standards

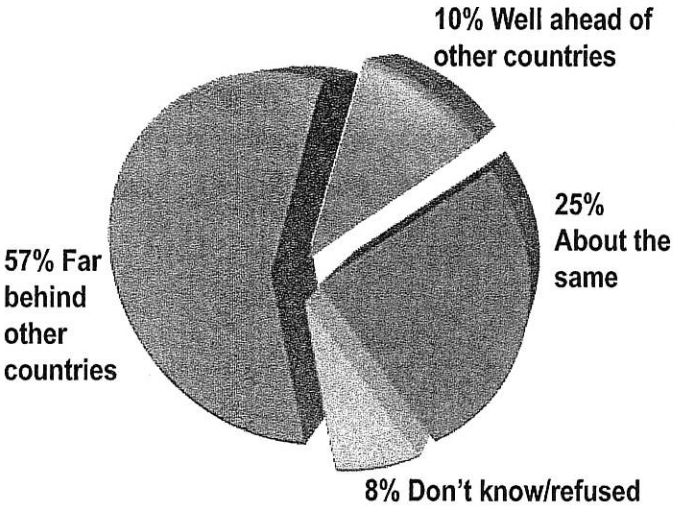


Source: www.achieve.org.

K-12 Indicators

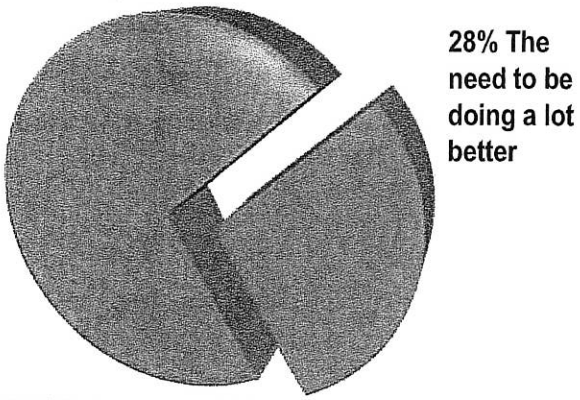
Parents in Kansas recognize the importance of METS, but are much less concerned than employers about the quality of math and science education in local schools

Is the U.S. Competitive in METS?



Most parents recognize that the United States is behind other countries in math, science and technology education.

How Does METS Education in Kansas Rate?



But unlike local leaders, they are confident that local schools are doing a good job preparing students for the future.

The Bottom Line

Despite Kansas' high achievement in math and science, a significant minority achievement gap persists and half the state's graduates are not ready for college-level work in these disciplines

Kansas has an opportunity to collaborate productively with other states in meeting METS challenges

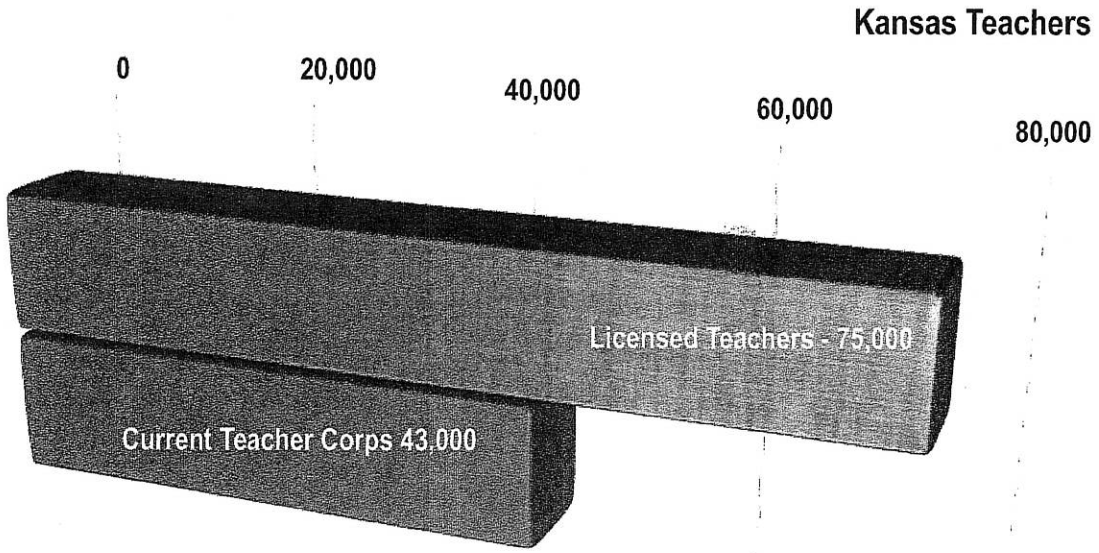
Source: "Important, But Not for Me; Kansas and Missouri Students and Parents Talk about Math, Science and Technology Education." Public Agenda 2007.

Section IV: K-12 Math-Science Teacher Corps

Decades of research indicate that teachers play a critical role in math and science education. Although the teaching profession has had historic appeal in Kansas, a number of factors have converged in recent years to put the math and science teacher corps under increasing pressure. These include the high-stakes testing and accountability provisions of No Child Left Behind, the influx of English language learners, the aging of the current teacher workforce, the lag in teacher salaries relative to other professions, and the aggressive recruitment practices of school districts outside the state. This section of the data book highlights some of the key forces at work.

K-12 Math-Science Teacher Corps

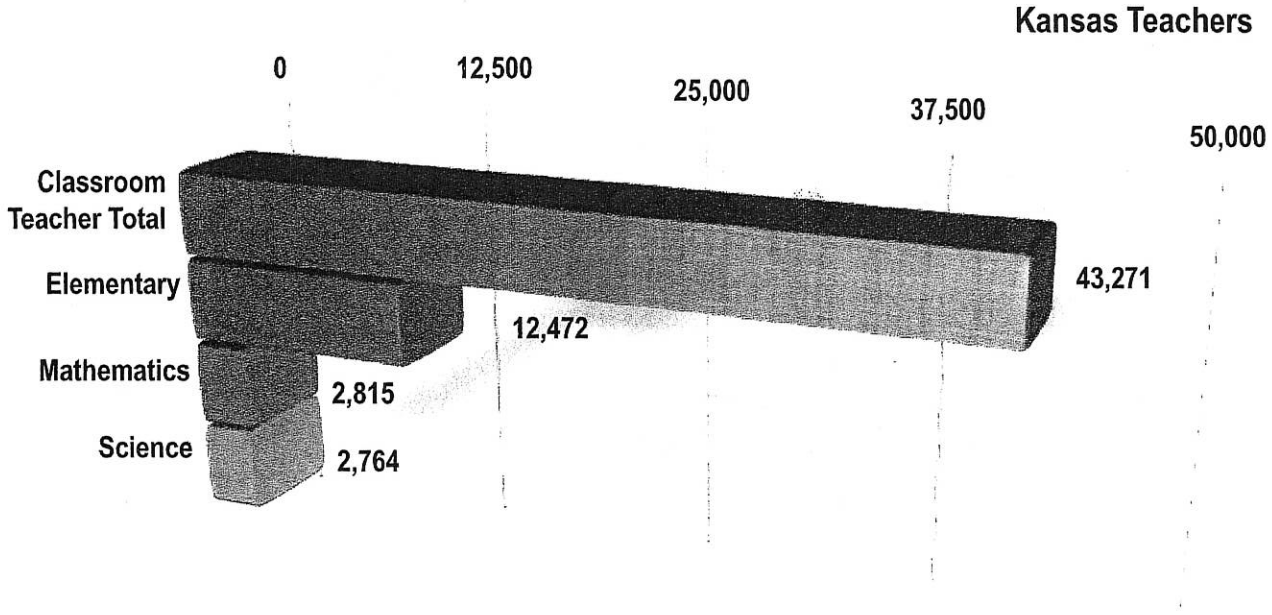
The number of Kansans holding valid teacher credentials is almost double the number that actually teach



Source: KS State Department of Education.

K-12 Math-Science Teacher Corps

The classroom teacher corps includes about 12,500 elementary school and 4500 secondary teachers of math and science



Source: KS State Department of Education.

K-12 Math-Science Teacher Corps

The demand for teachers has been steady in recent years

Kansas Teaching Corps	
Year	**Total Licensed Personnel**
2001	43,738
2002	44.066
2003	44,296
2004	43,897
2005	43,918
2006	41,882
2007	43,271

Source: Kansas State Department of Education.

K-12 Math-Science Teacher Corps

Returning teachers account for almost 90% of the teacher corps year over year

Statewide Teacher Turnover Information 1990-00 to 2003-04			
Year	Teachers Leaving Kansas Public Schools		
	Non-Retirees	Retirees	Total
1990-00	2,444 7.3%	590 1.8%	3,034 9.1%
2000-01	2,583 7.6%	673 2.0%	3,257 9.6%
2001-02	2,356 6.9%	649 1.9%	3,005 8.9%
2002-03	2,083 6.2%	638 1.9%	2,721 8.1%
2003-04	2,061 6.2%	744 2.2%	2,806 8.4%
Five-Year Average	2,306 6.9%	659 2.0%	2,965 8.8%

Note: may not add up due to rounding.

Source: LPA Analysis of data provided by the Kansas Department of Education and Kansas Public Employees Retirement System.

K-12 Math-Science Teacher Corps

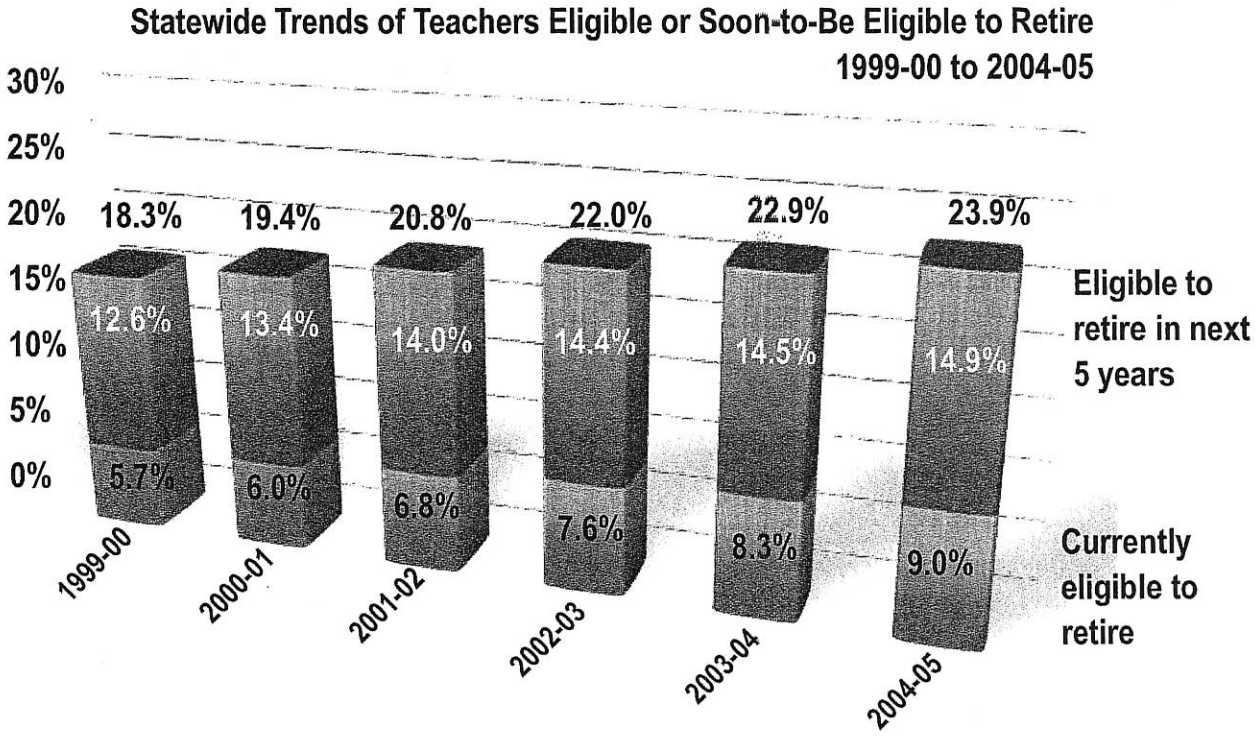
Turnover rates are highest in high-poverty areas

Statewide Teacher Turnover Information by type of district (2003-04)			
	Teachers Leaving Kansas Public Schools		
	Non-Retirees	Retirees	Total
High Poverty	561 7.0%	234 2.9%	795 9.9%
Rural	351 5.8%	136 2.3%	487 8.1%
Other	1,149 6.0%	375 2.0%	1,524 8.0%
Overall	2,061 6.2%	744 2.2%	2,806 8.4%

Source: LPA Analysis of data provided by the Kansas Department of Education and Kansas Public Employees Retirement System.

K-12 Math-Science Teacher Corps

Almost one-quarter of the teacher corps will become retirement eligible within five years



Source: LPA Analysis of data provided by the Kansas Department of Education.

K-12 Math-Science Teacher Corps

The traditional pre-service track produces far more licensed math and science teachers than alternative licensure

Track 1: Traditional Pre-Service*

- Hold a bachelor's degree from an accredited college or university
- Complete a state-approved teacher preparation program
- Pass a subject or grade level content assessment
- Pass a pedagogy assessment
- Receive conditional two-year license
- Receive professional license

Track 2: Alternative Licensure**

- Hold a bachelor's degree from an accredited college or university in the content area to be taught or a degree with equivalent coursework
- Collaborate with a mentor teacher, the school district, and a teacher preparation institution
- Receive a three-year restricted license to teach full-time in an area of demonstrated content knowledge
- Complete professional teaching skills coursework (usually online)
- Receive conditional two-year license
- Receive professional license

* Track 1 completion, 2005-06: 75 math and 50 science

** Track 2 completion, 2005-06: 7 math and 11 science

Source: Kansas Department of Education.

K-12 Math-Science Teacher Corps

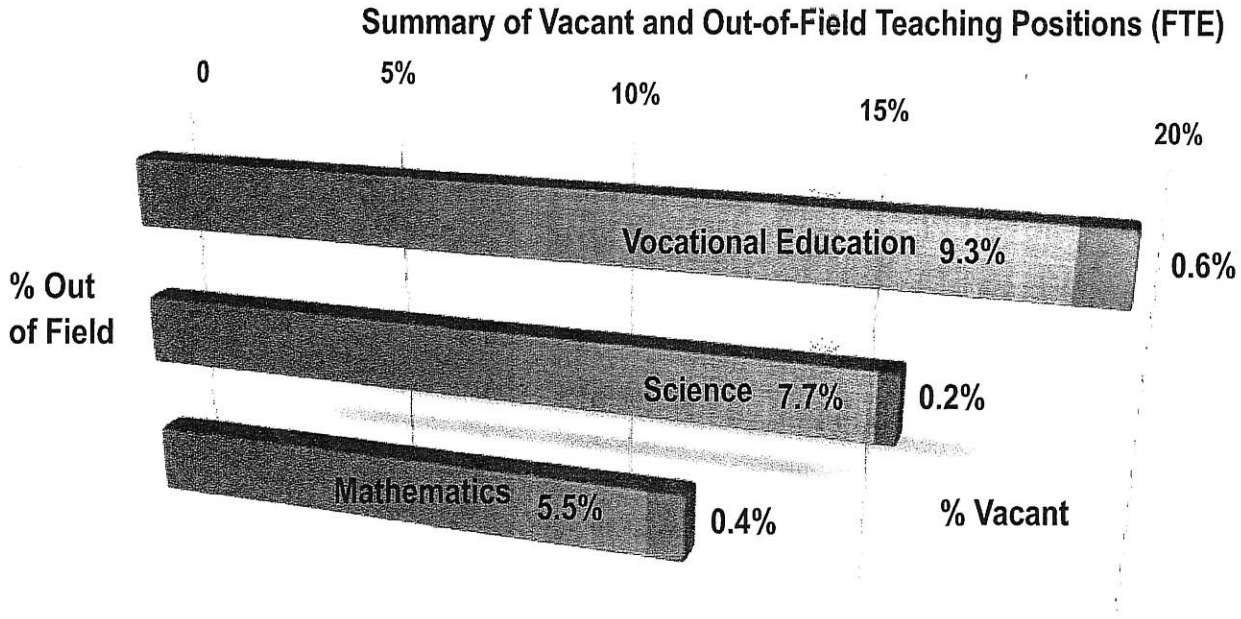
Although more than 90% of the teacher corps meet the "highly qualified" standard, lesser percentages of math and science teachers meet that requirement

2007 Licensed Personnel Report NCLB - Highly Qualified by Class					
		Fully Licensed		NCLB Highly Qualified	
	Total	Number	Percent	Number	Percent
Elementary	20,278	19,704	97.2	19,704	97.2
Fine Arts	15,536	14,434	92.9	13,974	89.9
Foreign Language	3,856	3,274	84.9	3,216	83.4
History/Govt.	9,755	9,113	93.4	8,832	90.5
Language Arts	16,755	15,423	92.1	14,286	85.3
Mathematics	13,578	12,203	89.9	11,653	85.8
Science	11,497	9,943	86.5	9,578	83.3
ESL/Bilingual	1,444	1,158	80.2	1,158	80.2
Special Ed.	6,808	5,395	79.3	5,370	78.9
Total Assignments	99,507	90,650	91.1	87,771	88.2

Source: Kansas State Department of Education.

K-12 Math-Science Teacher Corps

The shortage of qualified teachers in math, science, and vocational education forces districts to rely on less-qualified out-of-field teaching personnel

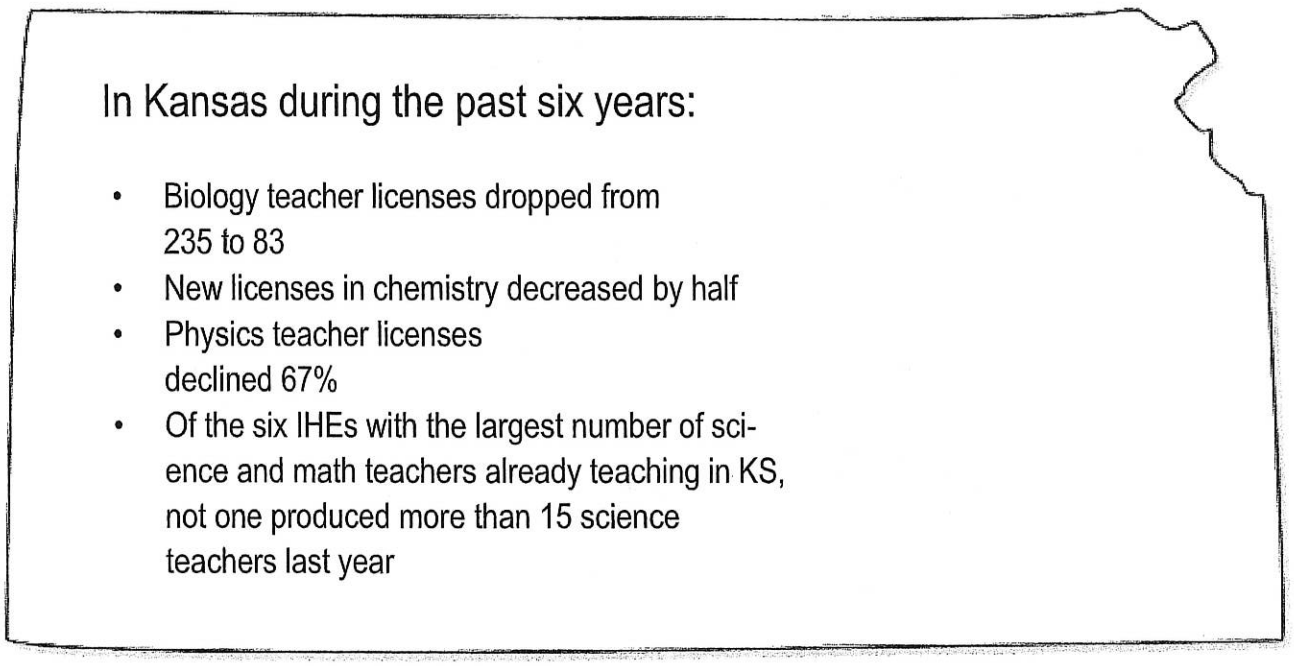


Note: This includes teachers assigned to teach family and consumer science, industrial arts, and vocational education.

Source: Legislative Division of Post Audit State of Kansas: School District Performance Audit Report, April 2007.

K-12 Math-Science Teacher Corps

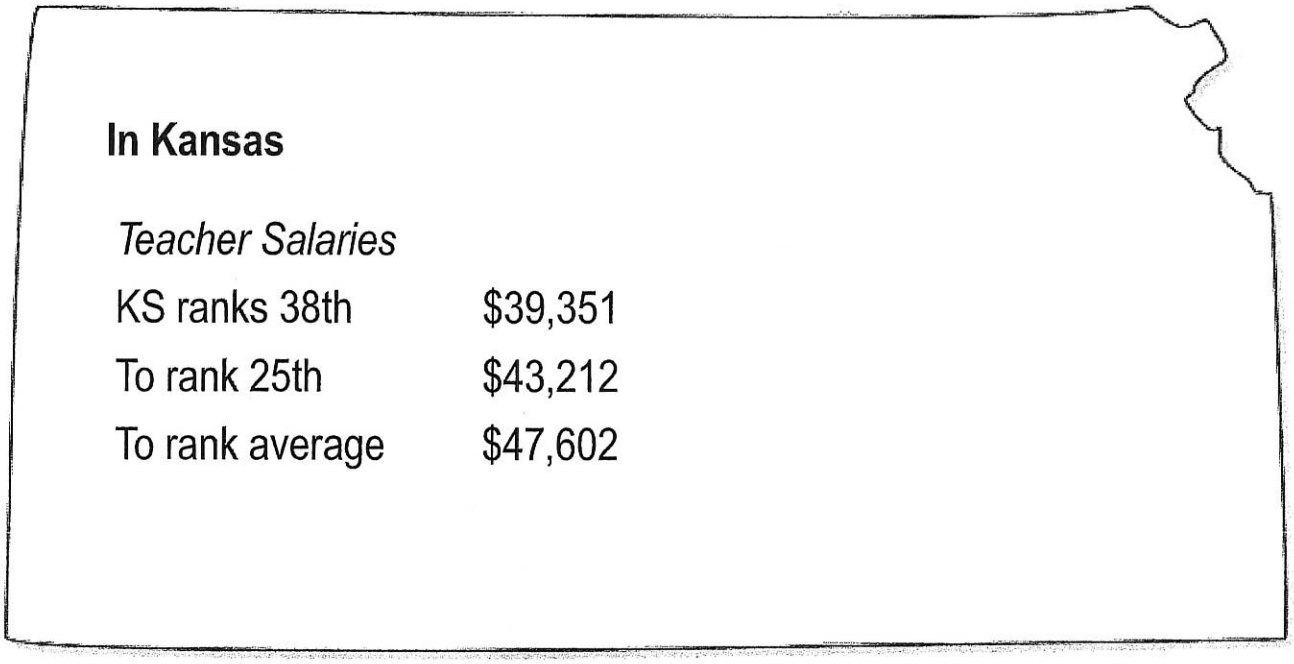
The number of newly credentialed science teachers has declined sharply in recent years



Source: Kansas State Department of Education.

K-12 Math-Science Teacher Corps

Teachers in Kansas are paid less than the national average



In Kansas

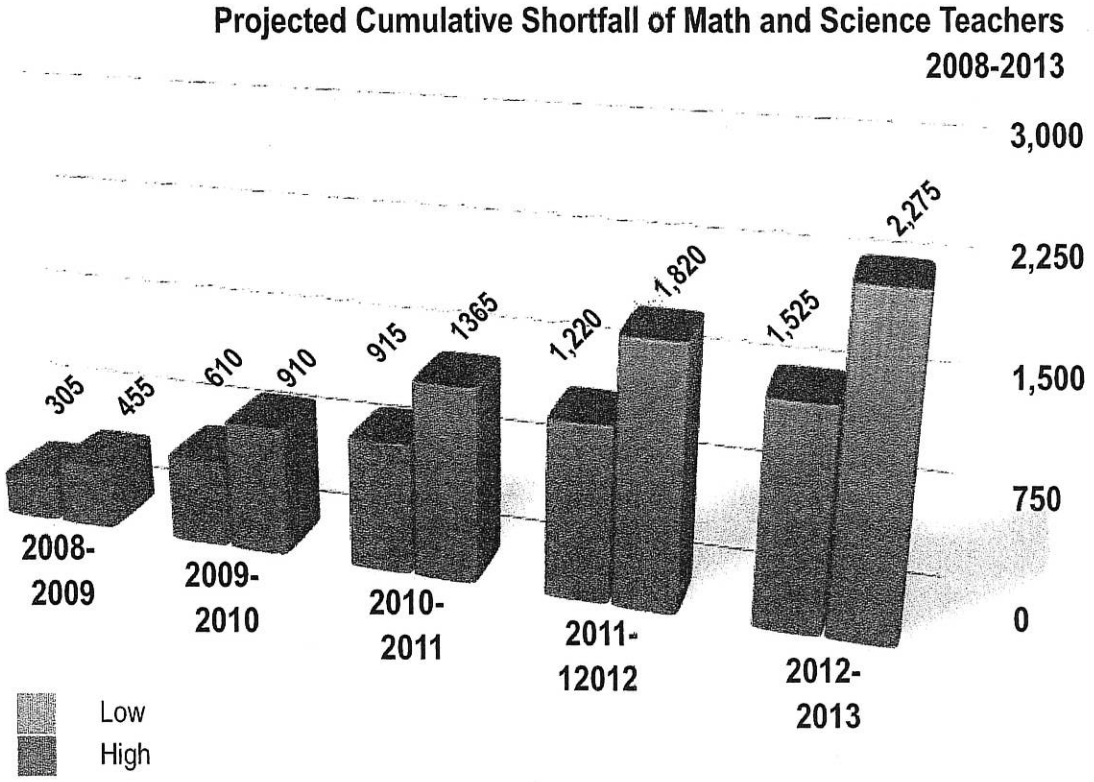
Teacher Salaries

KS ranks 38th	$39,351
To rank 25th	$43,212
To rank average	$47,602

Source: Kansas Department of Education.

K-12 Math-Science Teacher Corps

The Department of Eduation estimates a shortfall of at least 1,500 math and science teachers over the next five years if current trends continue*



* The projections in this chart are based on the low and high estimates of K-12 math and science teacher vacancies for 2008-09 provided by districts to the Kansas Department of Education.

The Bottom Line

Kansas has reached a crisis point in producing and retaining K-12 math and science teachers

Source: (for graph) Kansas Department of Education.

Section V: Post-Secondary Indicators

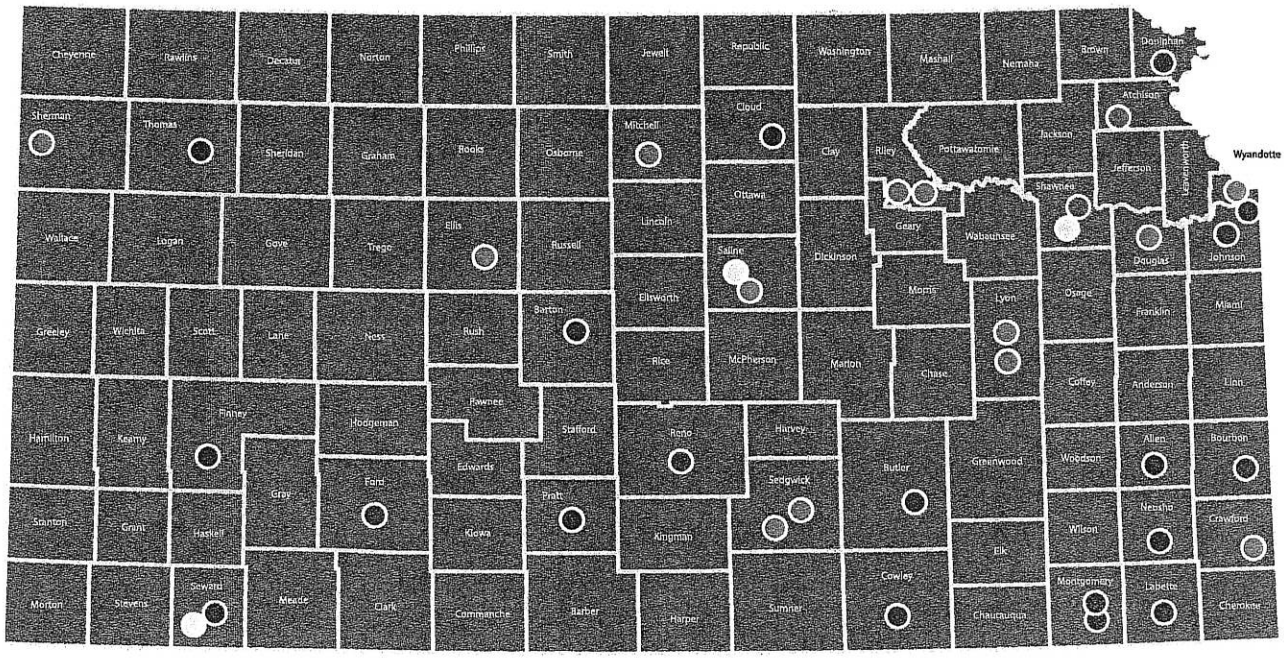
Institutions of higher education in Kansas provide the bridge between the K-12 system and the METS workplace. They develop both the human and intellectual capital that drives the economy of the state. The higher education enterprise includes 36 public institutions serving a student population of about 200,000. One of the essential roles of these institutions is to ensure that all graduates are sufficiently fluent in math, science, and technology to meet the demands of today's workplace. Another is to produce a specialized talent pool with quality and depth to support Kansas' prosperity. In addition, the state's three research universities have the mission of generating knowledge that can be translated into high-value products and services. The indicators in this section put into perspective the capacity of Kansas' institutions of higher education to produce METS talent.

Post-Secondary Indicators

Thirty-six public post-secondary institutions contribute to building the state's capacity in technical fields

State Universities
Municipal University
Community Colleges
Technical Colleges
Technical Schools

- University
- Municipal University
- Community College
- Community College/Area ATS
- Technical College
- Technical Schools



Source: Kansas Board of Regents.

Post-Secondary Indicators

Kansas state investment per full-time student in higher education is less than most states

Kansas Investment Per Student			
	State	**Approp. per FTE**	**Percentile Rank**
High	Alaska	$12,413	100.0
	Nebraska	$5,801	59.1
	Missouri	$5,793	57.1
	Arkansas	$5,769	53.0
	Kansas	**$5,448**	**38.7**
	Oklahoma	$5,110	32.6
Low	Colorado	$2,827	0.0
	Average	*$5,540*	

Source: Kansas Board of Regents.

Post-Secondary Indicators

The Board of Regents provides a structure for integrated coordination of post-secondary education

Kansas Board of Regents			
Governed Institutions	**Coordinated Institutions**		
Emporia State Univ.	Washburn Univ.	Community Colleges	Technical Institutions
Fort Hays State Univ.		Allen Cty CC	Flint Hills TC
Kansas State Univ.		Barton Cty CC	Manhattan Area TC
University of Kansas		Butler Cty CC	N. Central Area TC
Pittsburg State Univ.		Cloud Cty CC	NE KS Area TC
Wichita State Univ.		Coffeyville CC	NW KS Area TC
		Colby CC	Wichita Area TC
		Dodge City CC	
		Fort Scott CC	Kansas City Area TS
		Garden City CC	Kaw Area TS
		Highland CC	Salina Area TS
		Hutchinson CC	SW Area TS
		Independence CC	
		Johnson Cty CC	TC = Technical College
		Kansas City KS CC	
		Labette CC	TS = Technical School
		Neosha CC	
		Pratt CC	
		Seward CC	

Source: Kansas Board of Regents.

Post-Secondary Indicators

Together, two and four-year institutions serve a large and diverse student population

Fall 2006 Enrollment in Secondary Education	
Public 4-year	96,659
Public 2-year and less*	76,614
Independent 4-year	23,894
Independent 2-year and less	984
	197,464
* includes community colleges, technical colleges, and technical schools; IPEDS fall 2008 data used for technical schools	
** includes Haskell University (federal institution)	

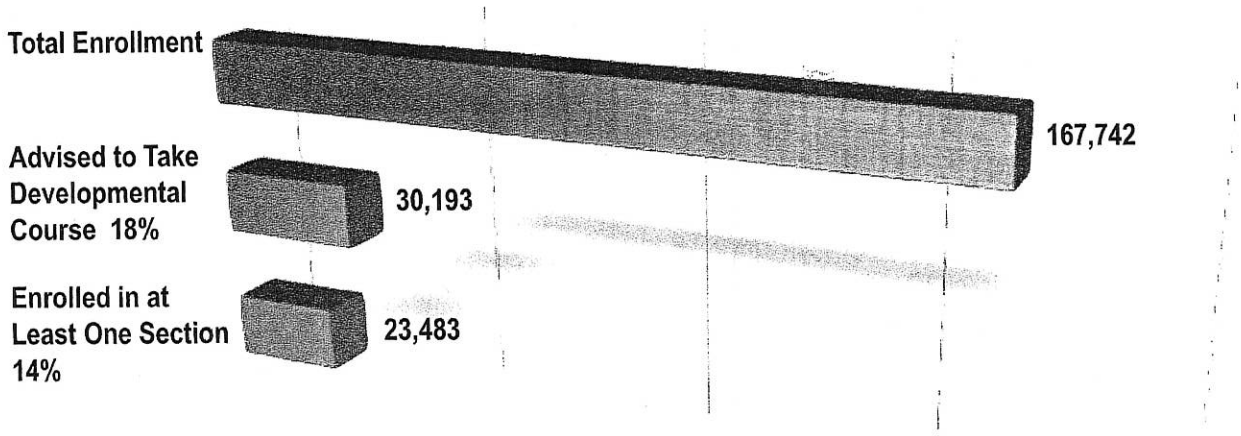
Average Age of Enrolled by Institution Sector	
State University	23 years old
Community College	28 years old

Enrollment by Race/Ethnicity and Institution Sector (%)		
	Universities	Comm. Colleges
White	75	77
African-American	3	7
Hispanic	3	5
Unknown	8	6
Other	11	4
	100	**100**

Source: Kansas Board of Regents.

Post-Secondary Indicators

Post-secondary institutions provide developmental math education for a large number of under-prepared students



Source: Kansas Board of Regents.

Post-Secondary Indicators

Two-year institutions respond to needs for general and technical education as well as local workforce requirements

Kansas Board of Regents					
Associate Degrees Awarded - Specific Majors					
	2002	2003	2004	2005	2006
Total Associate Degrees	5,558	6,074	6,494	6,534	6,429
General Studies Majors	1,509	2,198	3,142	3,189	3,232
Science Majors	259	237	156	185	145
Engineering Majors	122	102	70	56	53
Mathematics Majors	6	10	3	4	9

Note: Institutions have reported a decrease in STEM-related Associate Degrees over the five-year period. In 2003-2004 a reporting change occurred where Community Colleges started to report STEM Majors in the broader Major of General Studies. However, one cannot conclude that the large increase in General Studies Majors in 2004 and later can be attributed to the change in reporting STEM Majors, because the General Studies Major includes other Majors or Areas of Study (Psychology, History, English, etc.) at the Associate Degree level.

Source: U.S. Department of Education, IPEDS Completion Surveys.

Post-Secondary Indicators

Large number of students change from one Kansas post-secondary institution to another

Transfer Pathways into Four-Year Institutions					
Number of Students Enrolled in Fall 2003 at One Institution, who then Enrolled in a Different Institution, by Institution Sector					
	Fall 2004 Institutions				
Fall 2003 Institutions	Universities	Community Colleges	Technical Colleges	Technical Schools	**Grand Total**
Universities Total	1,385	1,743	66	14	**3,208**
Community Colleges Total	6,631	1,665	233	67	**8,596**
Technical Colleges Total	51	206	2	0	**259**
Technical Schools Total	80	87	3	0	**170**
Grand Total	**8,147**	**3,701**	**304**	**81**	**12,233**

Source: Kansas Board of Regents.

Post-Secondary Indicators

The state's major institutions of higher education play a distributed role in the preparation of K-12 math and science teachers

Traditional Program Completers				
Institution		**2004**	**2005**	**2006**
Emporia State University	math	5	5	13
	science	11	5	4
Fort Hays State University	math	14	1	3
	science	8	5	0
Kansas State University	math	16	15	13
	science	8	10	10
Pittsburg State University	math	6	9	10
	science	6	10	6
University of Kansas	math	12	12	13
	science	6	12	12
Washburn University	math	2	6	2
	science	2	2	1
Wichita State University	math	4	4	5
	science	2	4	5

Source: HEA Title II.

Post-Secondary Indicators

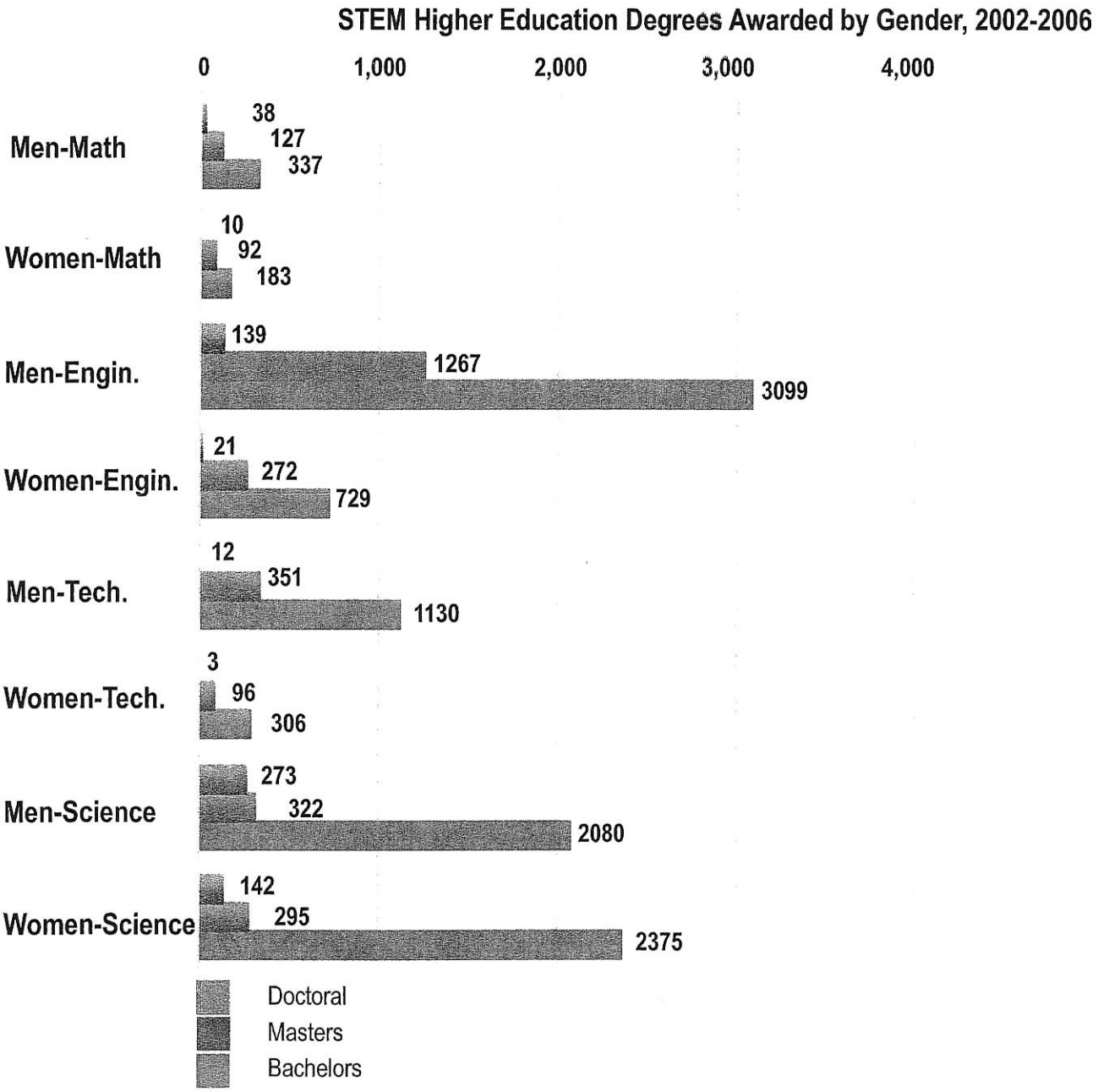
The state's production of baccalaureate and advanced degrees in technical field has remained flat in recent years in spite of rising overall enrollment

Kansas Board of Regents						
Degrees Awarded in METS Categories Statewide Totals, Academic Years 2002-2006						
Institution	**Degree Level**	**2002**	**2003**	**2004**	**2005**	**2006**
Emporia State University	Bachelor's	68	98	90	63	66
	Master's	6	15	11	8	11
	Total	*74*	*113*	*101*	*71*	*77*
Fort Hays State University	Bachelor's	103	92	76	51	56
	Master's	10	11	9	13	8
	Total	*113*	*103*	*85*	*64*	*64*
Kansas State University	Bachelor's	610	822	771	794	798
	Master's	117	167	179	203	188
	Doctoral	56	58	62	61	67
	Total	*783*	*1,047*	*1,012*	*1,058*	*1,053*
Pittsburg State University	Bachelor's	62	90	86	87	87
	Master's	3	17	13	9	10
	Total	*65*	*107*	*99*	*96*	*97*
University of Kansas Main Campus	Bachelor's	615	676	683	676	664
	Master's	165	181	196	168	174
	Doctoral	39	45	27	21	32
	Total	*819*	*902*	*906*	*865*	*870*
University of Kansas Medical Center	Bachelor's	0	16	2	2	3
	Master's	0	4	11	10	14
	Total	*0*	*20*	*13*	*12*	*17*
Washburn University	Bachelor's	66	43	39	32	45
	Total	*66*	*43*	*39*	*32*	*45*
Wichita State University	Bachelor's	298	331	307	329	261
	Master's	92	158	232	216	173
	Doctoral	22	7	7	11	6
	Total	*412*	*496*	*546*	*556*	*440*

Source: U.S. Dept. of Education, IPEDS Completions Survey, 2002-2006.

Post-Secondary Indicators

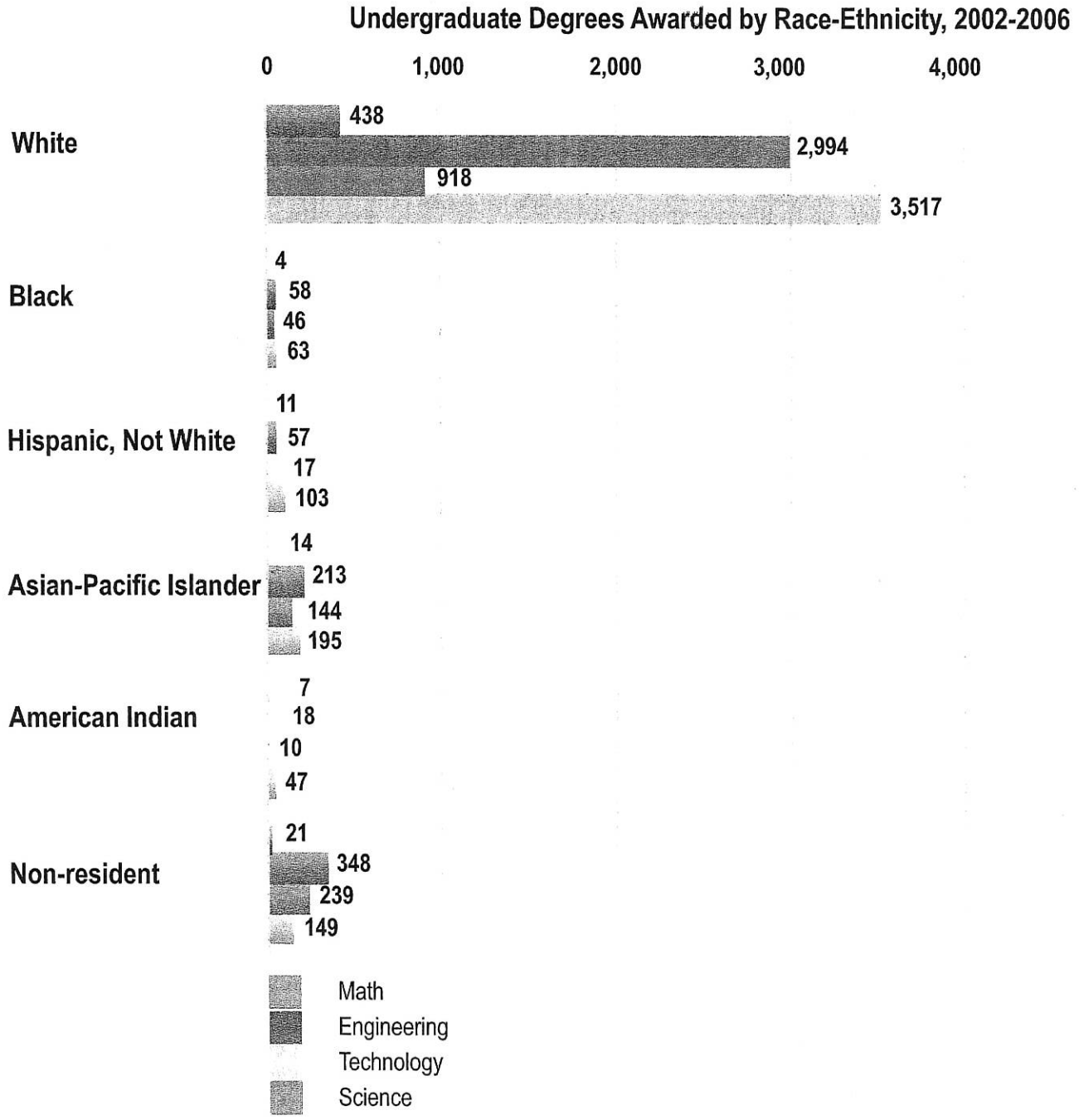
Women now earn more bachelor's degrees in science than men, but remain significantly underrepresented in engineering, technology and mathematics



Source: U.S. Department of Education, IPEDS Completion Survey.

Post-Secondary Indicators

African Americans and Hispanics are strikingly underrepresented in METS degree production



Source: U.S. Department of Education, IPEDS Completion Survey.

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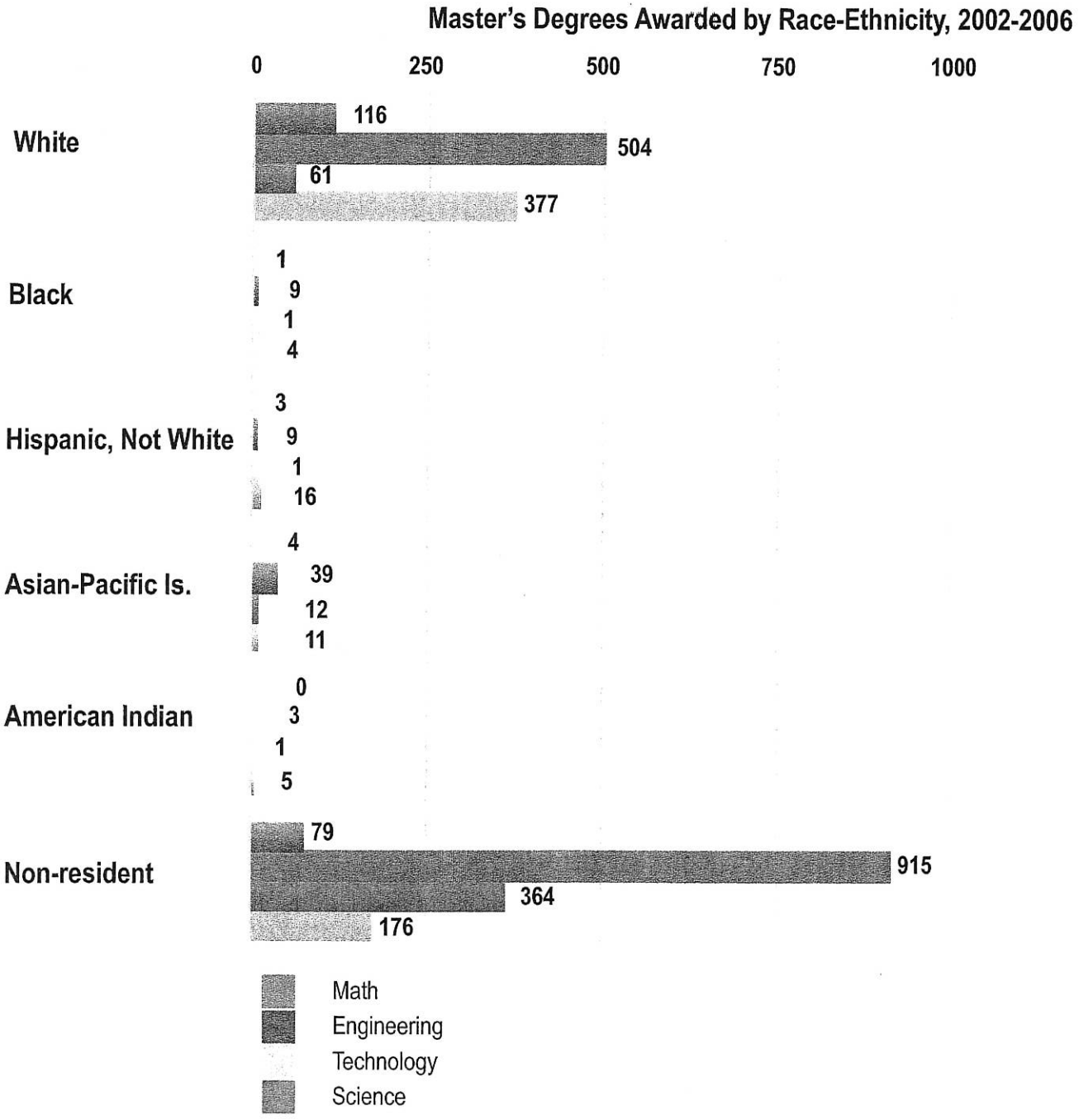
Post-Secondary Indicators

Non-U.S. residents earn a high share of advanced degrees in technical fields



Source: U.S. Department of Education, IPEDS Completion Survey.

Post-Secondary Indicators

The R&D expenditures of the state's three research universities are comparatively low

R&D Expenditures at Universities and Colleges									
ranked by FY 2005 R&D Expenditures, FY 1998-2005, $ in thousands									
Rank	Institution	1998	1999	2000	2001	2002	2003	2004	2005
	All	25,857,149	27,532,203	30,069,991	32,805,014	36,384,500	40,074,699	43,228,773	45,750,413
83	U. KS all campuses	117,115	132,752	148,670	156,467	172,131	173,024	181,192	190,105
112	KS State U	81,233	85,580	91,790	94,030	106,804	112,733	119,306	123,398
192	Wichita State U	13,117	14,555	16,213	16,142	18,842	22,401	29,948	32,726

Research Expenditures per Full-Time Faculty	
Public research, Fall 2005	
Kansas	$70,357
U.S. Average	$88,566

The Bottom Line

Kansas' higher education enterprise is stronger in METS degree production than research and development

Sources: (from top) National Science Foundation/Division of Science Resources Statistics, Kansas Board of Regents.

Appendix I

Math and Science Education Advisory Committee		
Legislators	**Business Leaders**	**Education Community Leader**
Sen. Nick Jordan, chair Rep. Kenny Wilk, co-chair	Mitch Counce, general manager Servi-Tech	Kenneth Clouse, president Northwest Kansas Technical College
Sen. Laura Kelly	Dan Jacobsen, president AT&T Kansas	Edward Hammond, president Ft. Hays State University
Rep. Shirley Palmer	Richard Taylor Plumbers and Pipefitters Local Union 441	Michael Lane, president Emporia State University
Rep. Sheryl Spalding	Paul Weida, vice president Black & Veatch Corp.	Janis Lariviere Center for Science Education University of Kansas
Sen. Ruth Teichman		

Report of the Advisory Committee on Math and Science Education to the 2008 Kansas Legislature

CHAIRPERSON: Senator Nick Jordan

VICE-CHAIRPERSON: Representative Kenny Wilk

RANKING MINORITY MEMBER: Senator Laura Kelly

OTHER LEGISLATIVE MEMBERS: Senator Ruth Teichman; and Representatives Shirley Palmer, Sheryl Spalding, and Kenny Wilk

OTHER MEMBERS: Mitch Counce, Dr. Edward H. Hammond, Paul Weida, Janis Lariviere, Richard Taylor, Kenneth Clouse, Dan Jacobsen, and Dr. Michael R. Lane

STUDY TOPICS

- Math and Science Education

January 2008

Math and Science Education Advisory Committee

Report to the 2008 Legislature
Road Map to Success

Conclusions and Recommendations

Although Kansas leads the world in production agriculture and airplane design and manufacturing, the economy of the state is more diverse and more service-oriented than many may realize. The sectors that are most likely to generate significant numbers of high-wage jobs are knowledge based. Most of these high-growth sectors also are intensely competitive. In order to create and maintain competitive advantage, Kansas must produce a deeper pool of technically skilled workers, while at the same time building capacity in frontier research and product development in selected fields.

Improving Kansas' capacity in mathematics, engineering, technology, and science (METS) is vital if Kansas is to remain nationally as well as internationally competitive. Improving this capacity will require increasing awareness of the issue among students and parents, improving the salary and benefits of the state's teachers, aligning classroom learning with the requirements of the marketplace, and keeping the state at the cutting edge of innovation in math and science teacher preparation and education.

In acknowledgment of this, the Math and Science Education Advisory Committee, composed of legislative, education, and business leaders from across the State, developed the recommendations described below.

Public Awareness Strategies

- Encourage the Governor and legislators to speak publicly and frequently about the critical shortage of math and science majors and the impact on Kansas.
- Develop public awareness initiatives that consider students of all ages beginning with elementary school, including the following:
  - Produce marketing initiatives that highlight the benefits of science and math careers for students, partnering with METS industries whenever possible to increase the awareness of the need for math and science in all levels of students' career goals.
  - Develop a public campaign that stresses the importance of math and science to the general public.
  - Coordinate and develop the Kansas Math and Science Awards Program to celebrate and reward outstanding students for METS achievements.
- Expand after school and summer program opportunities for elementary through high school students to nurture skills, interests and appreciation for science and mathematics.

- Support the development of the Kansas Academy for Math and Sciences at Fort Hays State University.

Teacher Preparation Strategies

- Support new innovative pathways to math and science teacher licensure, such as the UKanTeach Program, at the University of Kansas.

- Encourage better partnerships between higher education METS departments and the schools of education in the preparation of teachers.

- Establish a joint masters program for teachers offered collaboratively by Regents' universities through on-line delivery methods for preparation and professional development.

- Support new, innovative and cooperative programs to produce METS teachers between universities and community colleges, such as the "2 + 2 program" which Emporia State University cooperatively operates with Butler County and Kansas City, Kansas, Community Colleges.

Teacher Recruitment and Retention Strategies

- Provide METS teachers special incentives, partnerships, and competitive compensation, using vehicles such as the UpLink program which connects educators with businesses; teacher housing as provided in some rural western Kansas school districts; and the tax credit program which provides tax credits to businesses hiring teachers during the summer.

- Support a set of coordinated regional centers for METS at institutions of higher education that would provide on-going professional development.

- Support the development of a master teacher program to provide mentoring support and professional development opportunities for METS teachers. Create efficient pathways for second career teacher candidates.

- Develop strategies that allow "retired teachers" in METS disciplines to return to the classroom with no reduction of retirement payments.

- Support summer institutes that provide opportunities to update the skills of mathematics and science teachers; examples of such institutes include the Emporia State University Bioscience Institute for Kansas high school teachers.

Alignment Strategies

- Strengthen and align preschool through career recommended curricula in METS areas, including career emphasis activities.

- Expand the academic competition and award opportunities that promote research in the classroom at the secondary level. Advance the METS learning timeline while exposing

students to real world METS applications. Encourage algebra in the 8th grade and calculus in 12th grade. Begin to move toward a 4 X 4 required secondary curriculum – four years of science and four years of mathematics required for every student.

Coordination Activities

- Create a statewide METS Education Innovation Council made up of appointments from the Kansas Board of Regents, State Board of Education, and the business community. The Secretary of the Kansas Department of Commerce would be the Council's convener.

Proposed Legislation: This Committee is not authorized to introduce legislation.

Background

Upon the request of Senator Nick Jordan and Representative Kenny Wilk, the Legislative Coordinating Council (LCC) created the Math and Science Education Advisory Committee as a 2007 Interim Committee. Membership of the Committee included six legislators, four business leaders, and four education community leaders with all appointments made by legislative leadership. The Committee held its first meeting on September 26, 2007. The Committee met monthly through early January 2008. Results of the Committee's meetings included two products: a data book entitled *The Talent Imperative: Building Kansas' Capacity in Mathematics, Engineering, Technology, and Science* and recommendations designed to improve the mathematics, engineering, technology, and science efforts of the State.

Committee Activities

Testimony

Over the course of five months, the Committee heard testimony from a variety of educators and program directors involved in providing innovative METS programming across the State. Foundational information on current METS programming in the State was presented at the Committee's first meeting by Dr. Alexa Posny, Commissioner, Kansas Department of Education, and Reginald L. Robinson, President and CEO of the Kansas Board of Regents. Other presenters discussed METS programs:

- Jewell Scott, Executive Director, The Civic Council of Greater Kansas City;
- Dr. Patricia All, Superintendent, Olathe School District;
- Verneda Edwards, Executive Director of Curriculum and Instruction, Blue Valley School District;
- Denise Wren, Assistant Superintendent for High Schools, Wichita School District;
- Lori Doyle, Principal, Wichita West High School, Wichita School District;
- Dr. Janis Lariviere, Director, UKan Teach Math and Science Teacher Preparation Program;
- Brigadier General Deborah Rose, STARBASE Program;
- Nicole Riegel and Dr. Keith Gary, Kansas Area Life Sciences Institute, Inc.;
- Laura Norris, Executive Vice President, Youth Friends in Greater Kansas City;
- Joan Friend, Superintendent, Unified School District 494, Syracuse;
- Joe T. Davis and Laura Loyacono, Project Lead the Way, Kansas City; and
- Dr. Zulma Toro-Ramos and Lary Whitman, College of Engineering, Wichita State University.

Committee meeting minutes will provide greater detail regarding each presenter's

testimony. Meeting minutes can be reviewed in the Office of Legislative Administrative Services.

Development of a Data Book

The data presented in this book are designed to illuminate two basic questions: First, why does building capacity in mathematics, engineering, technology, and science (METS) matter to the nation as a whole and especially to the State of Kansas? Second, where does Kansas stand in regard to METS? The development of the data book was made possible by a grant from the Ewing Marion Kauffman Foundation to Building Engineering and Science Talent (BEST), an independent, San Diego-based non-profit organization that specializes in education and workforce development in technical fields. BEST assembled a data book for the State of Missouri in 2006. Mr. John Yochelson of BEST worked closely with the Committee and others, including the Kansas Board of Regents, Kansas Department of Education, Kansas Department of Commerce, and Kansas, Inc. in compiling the data book.

KANSAS BOARD OF REGENTS

1000 SW JACKSON • SUITE 520 • TOPEKA, KS 66612-1368

ATTACHMENT E
Task Force on Engineering Success
for the Future of Kansas
March 9, 2009

JOINT COMMITTEE ON ECONOMIC DEVELOPMENT
September 19, 2008

Shortage of Engineers: Impact on the Kansas Economy

Dr. Gary Alexander
Vice President for Academic Affairs

Madam Chair and members of the Committee, thank you for the opportunity to appear before you this morning. I am pleased to join the Deans of Kansas' three Schools of Engineering in discussing strategies for responding to the state's shortage of engineers.

This is not, of course, simply a problem for Kansas, as the United States in general has fewer students choosing to pursue degrees in science and engineering than do other parts of the world. For example, while engineering students comprise about twelve percent of undergraduates in most of Europe, twenty percent in Singapore, and more than forty percent in China, they represent only about six percent of undergraduates in the United States. Likewise, Kansas' engineering schools need the resources to produce larger number of graduates if we are to address the engineering shortage in our state. Deans Bell, English and Toro-Ramos will discuss their respective institutional responses to the shortage, drawing on a "white paper" they prepared last spring. This document was created at the request of Senate President Steve Morris, who was perhaps the first state policymaker to publicly recognize the engineering shortage. Senator Morris has had a keen interest in this issue and the Board is certainly appreciative of his support and helpful guidance as we work to address the shortage. After the Deans conclude their presentation, they will be followed by a panel that will provide an industry perspective on the issue.

The Board of Regents, in consultation with the Deans, invited a group of industry representatives to meet in Topeka for the purpose of discussing strategic responses to the engineering shortage. This working group, comprised of 18 individuals representing private companies throughout Kansas, held a wide-ranging discussion of the reasons behind the shortage and of possible steps that might be taken to alleviate it. Some of the key issues emerging from the discussion included: (1) the need for strengthening the pipeline that develops potential engineers, in particular, improving the teaching of mathematics and science in the early grades and middle school; (2) the importance of developing strategies to retain a greater number of those students enrolled in engineering programs through to graduation; (3) the feasibility and significance of strengthening the partnership between schools of engineering and community colleges in developing integrated programs for producing more engineers; (4) the importance of seeking funding from multiple sources to support engineering initiatives; and (5) the importance of identifying the high-need engineering disciplines in Kansas and clearly aligning academic programs with them.

If we are to respond adequately to the engineering shortage, it is also important to consider at least two other related concerns, namely, the need to: (1) increase the numbers of teachers qualified to teach mathematics and science in the early grades and middle school; and (2) align the mathematics and science requirements for graduation from high school with the knowledge and skills necessary to succeed in college. In other words, the shortage of engineers is interlaced with the shortage of math and science teachers in our K-12 educational system.

The working group recommended development of a long-term strategic plan growing out of the Deans' white paper. Once this draft plan is complete, the working group will reconvene to discuss its contents and consider strategies for its implementation. I anticipate that a final plan will be produced within the next two months, and, once finalized, we would welcome the opportunity to present the plan to this Committee.

The Schools of Engineering are committed to developing and implementing a strategic plan in collaboration with both each other and their industry partners. Doing this will require both staff and resources, but if successful the project will contribute to the state's economy by producing engineers who benefit the state, on the one hand, as wage-earning, tax-paying citizens, and, on the other, through their contributions to the success of their corporate employers.

Again, thank you for the opportunity to visit with you about this important issue. I would be happy to stand for any questions that you may have.

More Engineers For Kansas

More Engineers for Kansas

The importance of engineers to the Kansas economy and how to address the shortage

Presented by engineering deans of Kansas State University, the University of Kansas and Wichita State University

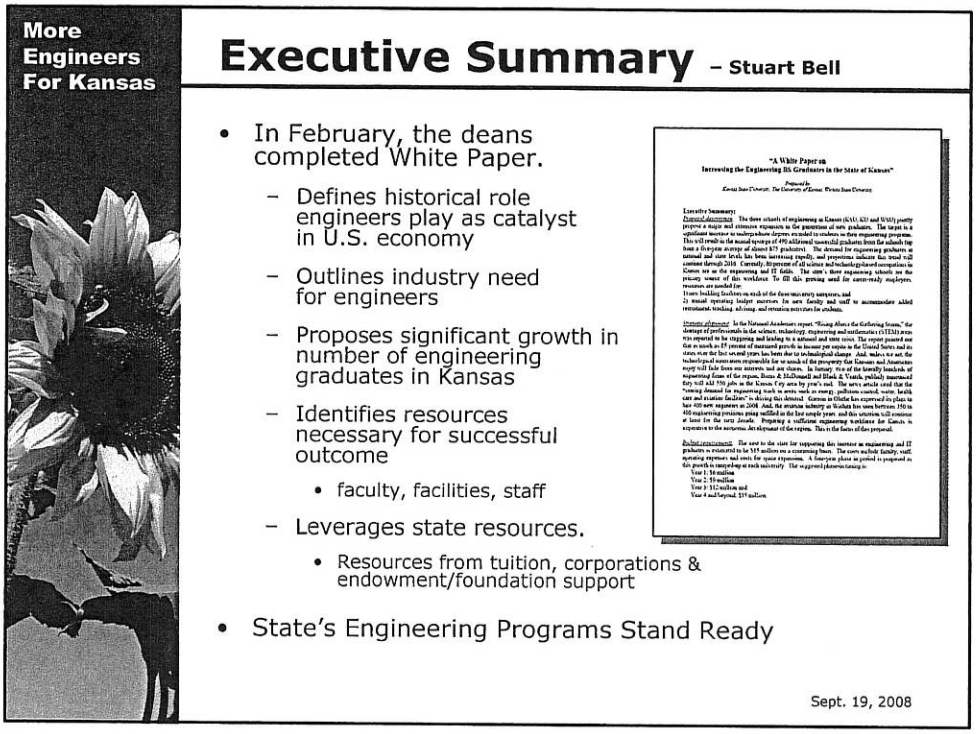
Sept. 19, 2008

More Engineers For Kansas

Executive Summary – Stuart Bell

- Goal is to help Kansas' economic development and stability
- Demand by industry for engineering graduates is high
  - More graduates needed
- Last January, Sen. Morris asked deans from three Kansas engineering schools (WSU, KSU, KU) to develop a plan to produce more engineers.

Sept. 19, 2008



Executive Summary – Stuart Bell

- In February, the deans completed White Paper.
  - Defines historical role engineers play as catalyst in U.S. economy
  - Outlines industry need for engineers
  - Proposes significant growth in number of engineering graduates in Kansas
  - Identifies resources necessary for successful outcome
    - faculty, facilities, staff
  - Leverages state resources.
    - Resources from tuition, corporations & endowment/foundation support

"A White Paper on
Increasing the Engineering BS Graduates in the State of Kansas"

Prepared by
Kansas State University, The University of Kansas, Wichita State University

Executive Summary:

Proposal Abstract: The three schools of engineering in Kansas (KSU, KU and WSU) jointly propose a major and extensive expansion in the production of new graduates. The target is a significant increase in undergraduate degrees awarded to students in their engineering programs. This will result in the annual upsurge of 490 additional successful graduates from the schools (up from a five-year average of almost 875 graduates). The demand for engineering graduates at national and state levels has been increasing rapidly, and projections indicate this trend will continue through 2016. Currently, 80 percent of all science and technology-based occupations in Kansas are in the engineering and IT fields. The state's three engineering schools are the primary source of this workforce. To fill this growing need for career-ready employees, resources are needed for:

1) new building facilities on each of the three state university campuses, and
2) annual operating budget increases for new faculty and staff to accommodate added recruitment, teaching, advising, and retention activities for students.

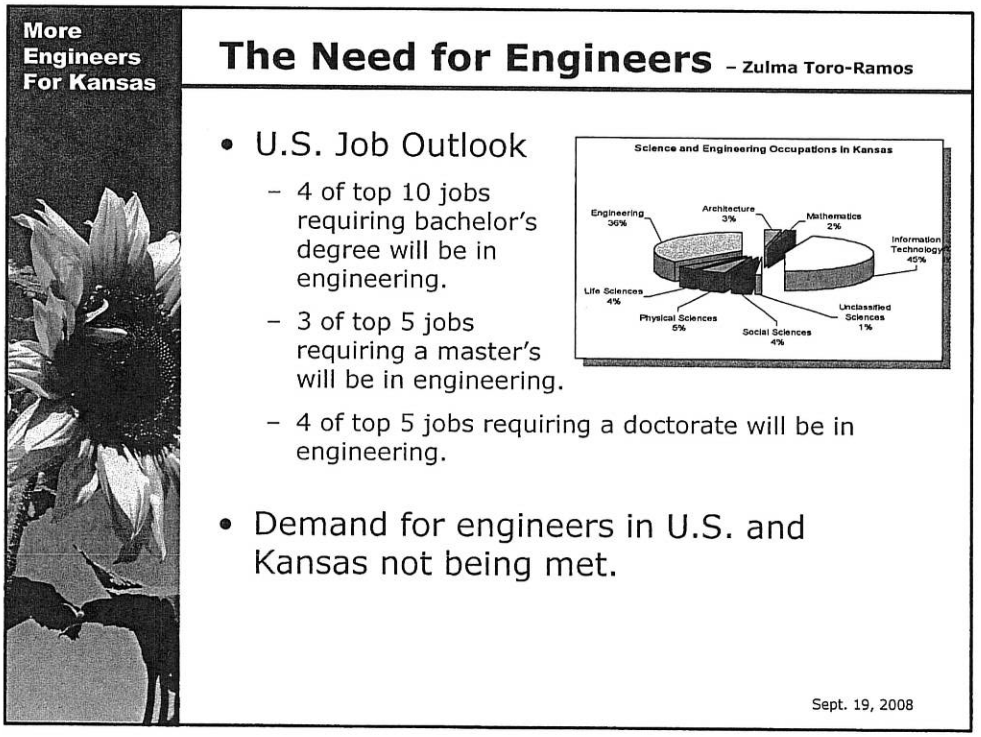
Statement of Interest: In the National Academies report, "Rising Above the Gathering Storm," the shortage of professionals in the science, technology, engineering and mathematics (STEM) areas was reported to be stagnating and leading to a national and state crisis. The report pointed out that as much as 85 percent of sustained growth in income per capita in the United States and its states over the last several years has been due to technological change. And, unless we act, the technological innovators responsible for so much of the prosperity that Kansans and Americans enjoy will fade from our memories and our shores. In January, two of the heavily hitched of engineering firms of the region, Burns & McDonnell and Black & Veatch, publicly announced they will add 550 jobs in the Kansas City area by year's end. The news article noted that the "growing demand for engineering work in areas such as energy, pollution control, water, health care and aviation facilities" is driving this demand. Garmin in Olathe has expressed its plans to hire 400 new engineers in 2008. And, the aviation industry in Wichita has seen between 350 to 400 engineering positions going unfilled in the last couple years and this situation will continue at least for the next decade. Preparing a sufficient engineering workforce for Kansas is imperative to the enterprise. An alternate of the region. This is the focus of this proposal.

Budget requirement: The cost to the state for supporting this increase in engineering and IT graduates is estimated to be $55 million on a continuing basis. The costs include faculty, staff, operating expenses and costs for space expansion. A four-year phase in period is proposed as the growth in enrollment is matched with university. The suggested phase-in timing is:

Year 1: $4 million
Year 2: $9 million
Year 3: $12 million and
Year 4 and beyond: $55 million

- State's Engineering Programs Stand Ready

Sept. 19, 2008



The Need for Engineers – Zulma Toro-Ramos

- U.S. Job Outlook
  - 4 of top 10 jobs requiring bachelor's degree will be in engineering.
  - 3 of top 5 jobs requiring a master's will be in engineering.
  - 4 of top 5 jobs requiring a doctorate will be in engineering.

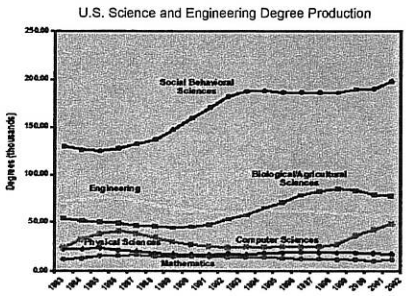
- Demand for engineers in U.S. and Kansas not being met.

Sept. 19, 2008

More Engineers For Kansas

The Need for Engineers – Zulma Toro-Ramos

- Production in Kansas of BS degrees (including CS majors) from 3 schools has averaged ~875 degrees annually over last 5 years.



- Number of new engineering and CS graduates nationwide has been flat while demand has increased.

Sept. 19, 2008

More Engineers For Kansas

Program Goals – Zulma Toro-Ramos

- Grow BS graduates by minimum of 500 students

- Focus on retention as well as recruitment
  - Ensure a greater percentage of those who start in engineering complete the degree
  - Maximize growth potential by focusing on current students
- Set a recruitment goal of 40% increase in freshmen enrollment
  - Increase over a 5-year period

Sept. 19, 2008

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More Engineers For Kansas

Proposed Plan – John English

- Resources
  - Faculty Positions
    - Kansas schools are near peer averages for faculty/student ratios
      - 40% increase in student body and improved retention requires more faculty
    - Preserve quality along with growth
  - New Spaces
    - 40% increase in enrollment will require more space
    - Schools currently stretched to capacity
    - More teaching classrooms and laboratories needed
  - Staff
    - Additional staff needed for retention, recruitment and outreach
    - Collaborative efforts in K-12 outreach

Sept. 19, 2008

More Engineers For Kansas

Proposed Plan – John English

- Resource Leveraging
  - State's investment leveraged through corporate support for programs
  - Increased tuition revenue
  - Endowment/Foundation support of faculty and programs

Year →	Year 1	Year 2	Year 3	Year 4 & beyond
State Support	$6,000,000	$9,000,000	$12,000,000	$15,000,000

Sept. 19, 2008

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K-State Comments
John R. English, Dean of Engineering (785 477 1117)
September 19, 2008, Joint Committee on Economic Development

Introduce the COE at K-State University

Vision: *The Kansas State University College of Engineering will be a highly ranked college providing quality education within a research environment that develops engineering leaders to benefit society*: **education within a research environment is key**

Themes:

1. *Recruit and retain diverse, high-quality academic achievers from both inside and outside Kansas to produce graduates who will take the lead in generating technological solutions for and new knowledge about tomorrow's challenges.* **Diverse student body**
2. *Provide outstanding and diverse faculty and technological facilities so students receive quality teaching and advising, enabling them to become problem solvers, leaders, and critical thinkers highly sought after by universities, industry, and the government.* **Focuses on faculty**
3. *Establish focused, high-impact, nationally recognized research programs and build a prominent faculty that will enhance the college's national and international reputation.* **National prominence**
4. *Establish lifelong connections with alumni and capitalize on this network, corporate partnerships, and related research/scholarship within the college to strengthen the education experience, research/scholarship quality, and financial support of the college.* **Connections**
5. *Prepare students and faculty for the changing global environment to create a culture of diversity, creativity, innovation, and entrepreneurship.* **Global perspectives**
6. *Disseminate new knowledge to a global society and the citizens of Kansas to meet the land-grant mission.* **Disseminate**

The College at a glance

8 Departments, 11 u/g programs
Student enrollments: 3000 (2926 for F2008) undergraduate students, 500 graduate students
Graduations: 416 – 440 ugs over the past 5 years
Industry support:
- Advisory boards: curriculum input, strategic planning
- Scholarships: recruit and retain
- Research support: undergraduate and graduate students, pressing the frontiers
- Infrastructure: equipment to facilities
- Faculty/student interactions: research to internships

Such relationships give us (KSU, KU, WSU) a competitive edge
We (KSU,KU,WSU) "experience" their cry for more engineers: we have a crisis

Rising above the Gathering Storm

Not only in KS; this is a national crisis
STEM areas are critical:
- Increase the pipeline: middle school through graduate school, must be addressed
- Maintain the pipeline
- Yielding increased graduations

3-99

Career opportunities

Pinging of students by discipline

Increased 5-20 fold for each discipline in the last five years

Our students:

Desired by KS companies

Kansas roots, great people skills, team skills, work ethic, problem solvers, technologically up to date upon graduation

80 % have some type of industrial experience

41 – 47 % of our graduates stay in KS over the past 5 yrs

BSXE graduates found in all industries

26 top employers of K-State engineering graduates (2006-2007):

11.5% Aerospace
57.7% Construction/consulting
3.9% Healthcare
11.5% Oil/gas
11.5% Electronics
3.9% Manufacturing

Our communities of excellence:

These communities bridge academic pillars of excellence and are based upon synergistic communities

Sustainable energy: bioenergy, wind energy, solar energy, nuclear energy

Big 12 Engineering Consortium

Sensors and materials: radiation detection to animal monitoring to human health care

Water resources: systems perspective integrated with tremendous focus in agriculture

Generate graduates to key dimensions of the Kansas economy

Growth in graduates is destined to build economic prosperity for the state

Our Need

Expand number of graduates: improve our society's technological competence

Requires:

Resources for people

Resources for scholarships

Resources for buildings

ATTACHMENT H
Task Force on Engineering ...cess
for the Future of Kans...
March 9, 2009

KU School of Engineering

THE UNIVERSITY OF KANSAS
School of Engineering

Background: The University of Kansas' first graduating class in 1873 included a civil engineer, Murray Harris. KU's Board of Regents formally established the School of Engineering with two departments in 1891. Ever since, the school has worked to serve Kansas by providing exceptionally qualified graduates to companies and agencies throughout the state, as well as graduates who have started new companies in Kansas.

Our graduates have had and continue to have a strong influence on Kansas and its economy.

Major Kansas Impact

1. The founders of Black & Veatch were both KU engineering, as have been several of its subsequent leaders.
2. Founder and CEO of Perceptive Software.
3. Founder of Murfin Drilling Co.
4. President and CEO of ITC Holdings, parent company of ITC Great Plains in Topeka
5. CEO of Bartlett & West
6. CEO of Landplan Engineering
7. President of Harris Construction
8. Executive Vice President of Henderson Engineers

Major Global & National Impact

1. Executive director for Royal Dutch Shell. Linda Zarda Cook, a native of Shawnee, Kan., also is routinely named one of the world's 50 most powerful women by Forbes
2. President and CEO of Jacobs Engineering, the No. 2 design firm in the nation
3. Current CEO of Ford Motor Company and past president of Boeing Commercial Airplanes
4. Current president of SABRE holdings (parent company to Travelocity) and past president of Travelocity
5. CEO and Chairman of TranSystems (two locations in Kansas)
6. President of HNTB
7. Past CEO of Burns and McDonnell
8. Six of past CEOs of the Phillips Petroleum Co.
9. Past president and CEO of Standard Oil of Ohio (now BP)
10. Past CEO of Chrysler and DaimlerChyrsler

Engineering graduates have literally been building, fueling and moving the world; beginning right here in Kansas.

Enrollment: The 20th day was yesterday and we are still double-checking our numbers. At present, our engineering enrollment appears to be at a 20-year high. We have just under 2,400 students in the school and they are very bright students. Over the last two years, about 1 in 20 of our incoming freshman class has been National Merit students – the brightest our state has to offer. And we have roughly doubled the diversity in ethnicity of the incoming freshman class over the last five years.

Handout: As included on the handout, we are six united departments, offering 10 undergraduate degree programs and 16 graduate degree fields. We serve Kansas through our research and outreach programs. To mention just a few, these include: a focus on better recovery of oil from our aging petroleum reservoirs; developing bio-fuels and bio-chemicals; serving the IT industry needs of Kansas companies; and working with companies focused on design and construction, transportation planning and technology development.

Future: The School stands ready to expand our programs and help the state as it looks to strengthen opportunities for economic development by providing excellent graduates and by serving the needs of companies through our visionary research and service programs.

KU SCHOOL OF ENGINEERING

KU SCHOOL OF ENGINEERING
The University of Kansas

Dean Stuart R. Bell
Eaton Hall, Room 1
(785) 864-3881
www.engr.ku.edu • kuengr@ku.edu

Fall 2008 Enrollment*

1,695 undergraduate students
699 graduate students
2,394 total

Departments

Aerospace Engineering
Chemical & Petroleum Engineering
Civil, Environmental & Architectural Engineering
Electrical Engineering & Computer Science
Engineering Management
Mechanical Engineering

Distinctions

KU is the only university in Kansas with faculty in the National Academy of Engineering:

- Stanley Rolfe, Albert P. Learned distinguished professor of civil, environmental and architectural engineering
- G. Paul Willhite, Ross H. Forney distinguished professor of chemical and petroleum engineering
- Richard Moore, professor emeritus of electrical engineering
- Ross McKinney, professor emeritus of civil engineering

The top five reasons our students say they chose the KU School of Engineering to earn their degree:

1. Strong program in their major
2. Quality of engineering facilities
3. Academic reputation of KU
4. Academic reputation of KU School of Engineering
5. Scholarships/Affordability

About 95 percent of courses are taught by engineering and computer science professors — the same people producing the latest developments in research and technology.

* Preliminary estimates; final 20th day enrollment figures currently being tallied.

Undergraduate degrees offered (all are accredited by ABET)

Aerospace engineering
Architectural engineering (a five-year program)
Chemical engineering
Civil engineering
Computer engineering
Computer science
Electrical engineering
Engineering physics (jointly administered with the KU Department of Physics & Astronomy)
Mechanical engineering
Petroleum engineering (the only program in the state)

Additional undergraduate degree concentrations available
Chemical Engineering
- Biomedical concentration
- Environmental concentration
- Premedical concentration
- Petroleum concentration

Civil Engineering
- Environmental engineering

Engineering Physics
- Aerospace systems
- Chemical systems
- Digital electronic systems
- Electromechanical control systems

Mechanical Engineering
- Biomechanics concentration

Graduate degree fields offered

Aerospace engineering
Architectural engineering
Bioengineering
Chemical engineering
Civil engineering
Computer engineering
Computer science
Construction management
Electrical engineering
Engineering management
Environmental engineering
Environmental science
Information technology
Mechanical engineering
Petroleum engineering
Water resources science

Engineering Research Centers, Groups and Initiatives

Center for Environmentally Beneficial Catalysis
- Catalyst Design and Preparation
- Media and Catalyst Supports
- Experimental Design and Advanced Measurements
- Molecular and Process Modeling Optimization

NSF Science and Technology Center for Remote Sensing of Ice Sheets

Information and Telecommunication Technology Center
- Bioinformatics & Computational Life Sciences Lab
- Computer Systems Design Lab
- e-Learning Design Lab
- Intelligent Systems Lab
- Networking and Wireless Systems Lab
- Photonics Technology Lab
- Radar Systems & Remote Sensing Lab

Transportation Research Institute
- Environmental Engineering & Science Lab
- Flight Research Lab
- Infrastructure Research Institute
- KU Transportation Center
- Structural Engineering & Materials Lab

Bioengineering Research Center

Biofluid Dynamics Lab

Biomedical Engineering Research Center

Computational Mechanics Lab

Biomechanics Research Lab
- Experimental Joint Biomechanics Lab
- Biodynamics Research Lab
- Orthopedic Tissue Biomechanics Lab
- Human Motion Control Lab

Heat Transfer Laser Lab

Intelligent Systems & Automation Lab

Kansas Association for Networked Supercomputer Applications

Kansas Neurological Institute (KEGA)

KU Energy Council

Internal Combustion Engine Lab

Kurata Thermodynamics Lab Resource Center

Tertiary Oil Recovery Project

KU SCHOOL OF ENGINEERING
The University of Kansas

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Wichita State University College of Engineering: An Overview

Joint Committee on Economic Development

Zulma Toro-Ramos, Dean

September 19, 2008

WICHITA STATE UNIVERSITY

College Vision

The College of Engineering at Wichita State University will be recognized nationally and internationally for its: experience-based undergraduate and graduate degree programs; collaborative efforts with industry; and research programs to support the economic development and global competitiveness of the Wichita metropolitan area, the state of Kansas, and the nation.

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College Mission

The College of Engineering at Wichita State University is committed to:

- Prepare graduates who will engage effectively and responsibly in the practice of the engineering profession in a global economy and in pursuing advanced engineering education.
- Conduct applied and basic research to support and contribute to the social and economic well-being of citizens and organizations in the Wichita metropolitan area, the state of Kansas and beyond.
- Cultivate the spirit of entrepreneurship and the connection between engineering and business that encourages technology commercialization.
- Improve continuously the engineering pedagogical methods employed in delivering its academic programs.

College Mission *(cont.)*

The College of Engineering at Wichita State University is committed to:

- Foster and value diversity of ideas and people through early student recruitment, outreach programs, and the recruitment and development of faculty role-models.
- Encourage scholarship in all its dimensions.
- Evolve thoughtfully in response to the needs of industry and the changing world.

College of Engineering Contribution to WSU

11% of the BS enrollment

24% of the MS enrollment

25% of the PhD enrollment

College Origins

1928- The sixth Aeronautical Engineering Program in the nation is opened by the University of Wichita with cooperation and support of eight local aircraft companies

1930 – First five students graduated with BS in Aeronautical Engineering

College Departments and Academic Programs

Aerospace Engineering
- BS, MS, PhD

Electrical Engineering and Computer Science
- BS, MS, PhD EE
- BS Computer E
- BS, MS CS

Industrial and Manufacturing Engineering
- BS, MS, PhD IE
- BS Manufacturing E
- MS EM

Mechanical Engineering
- BS, MS, PhD

College Distinctive Characteristics

Scholarship Programs

Cooperative Education Program
- 275 placements during AY 2006-07

Cisco Computer Networking Laboratory

GEEKS Program

Engineer 2020 Program

ABET Accredited Manufacturing and Industrial Engineering Programs

College and NIAR laboratory facilities

College role in the economy of the region
- 34% of Wichita area industry engineers are WSU alumns

Ranked third in money spent on aerospace research and development

Distinguished alumns

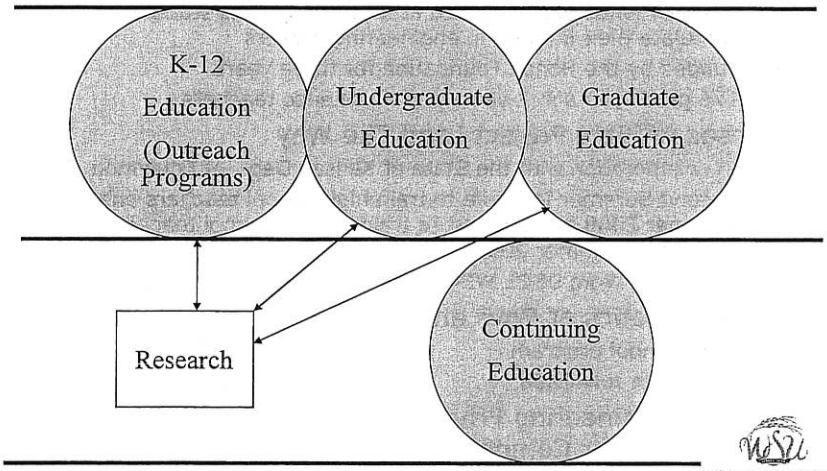
College Faculty

As of AY 2008-09

54 T/TT Faculty Members

9.25% Female

College Areas of Involvement



Outreach Programs

Kansas Boosting Engineering, Science and Technology (Kansas BEST)

- A sport-like contest in which high school students design and build a remote-controlled robot
- Managed by members of the Dean's Circle for the last 8 years
- Funded annually through company donations
- 1,496 participants in the last 3 years; 25% girls

Summer Programs

- Middle School for girls
- Middle School for boys and girls
- High School camp for boys and girls

WSU Lego Mindstorms Challenge

- Annual event targeted at 4th to 8th grades students
- Joint effort by CoE and College of Education
- 760 participants in the last 4 years; 36% girls

Outreach Programs

Switched-on-Saturday (SOS)

- Once a month class targeted at 5th to 8th grades students to stimulate their interest in engineering careers
- Funded by the Honda Foundation for three years
- 176 participants in 2 years and 47 science teachers

Kansas Affiliate Project Lead The Way

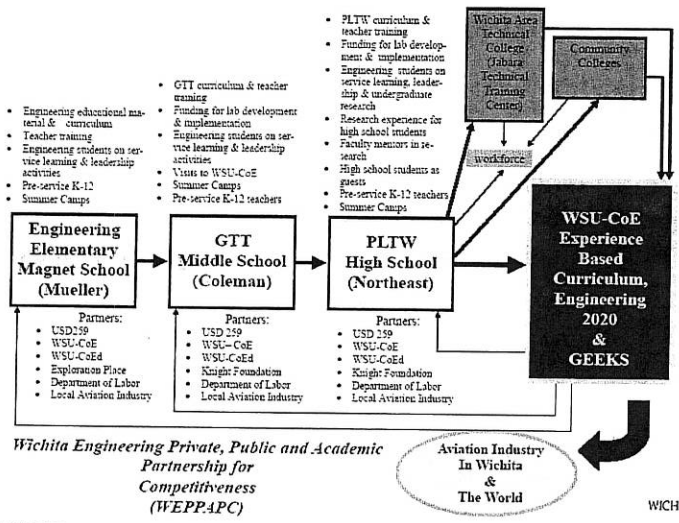
- In collaboration with the State of Kansas Dept. of Education
- Second Summer Institute to train high school teachers offered in Summer 2008 and the first to train middle school teachers to be offered in Summer 2009
- $ 280,000 from USDL WIRED Grant and $2M from Knight Foundation

LEGO Robotics at Boys and Girls Club

- After school program
- Started in July 2008

Wichita Engineering Private, Public and Academic Partnership for Competitiveness (WEPPAPC)

WEPPAPC



WICHITA STATE UNIVERSITY

Undergraduate Education

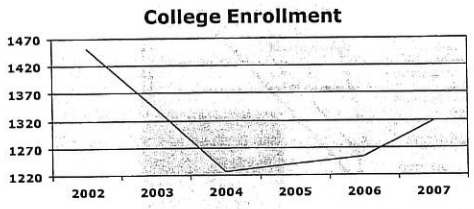
Student's Profile

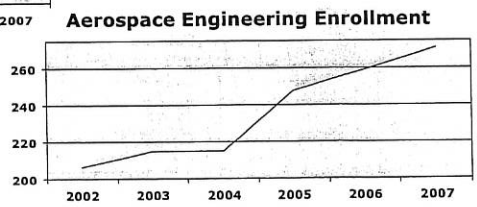
- 61% of student body is undergraduate
- 32% are part-time students
- 81% are domestic
- 72% works at least 10 hours per week
- 11% of our BS graduates only attended WSU

WICHITA STATE UNIVERSITY

Undergraduate Education

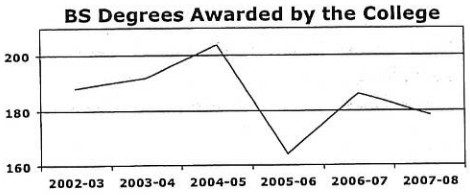
Fall Enrollment (Headcount)

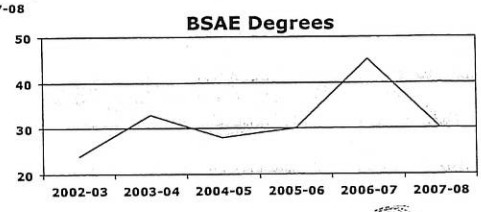




Undergraduate Education

Degrees Awarded





6 Year Average

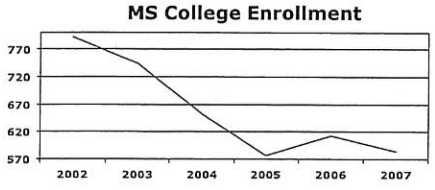
Graduate Education

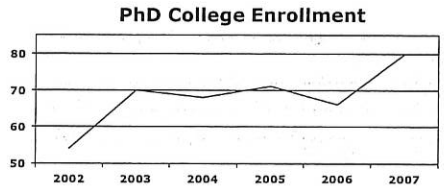
Student's Profile

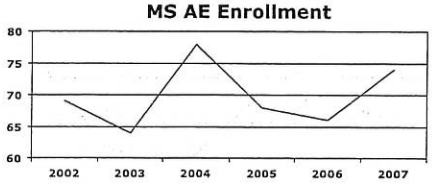
Measures	MS	PhD
% College's Headcount	34.9%	4.4%
% Part-Time Students	50.0%	47.0%
% International Students	70.0%	76.6%

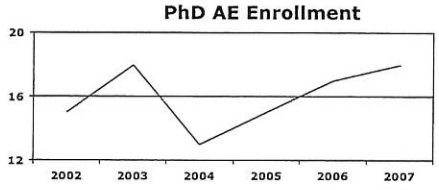
Graduate Education

Enrollment (Headcount)





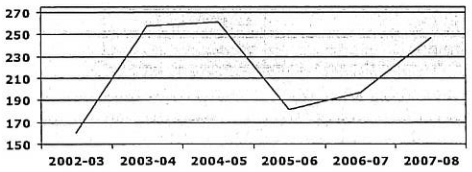




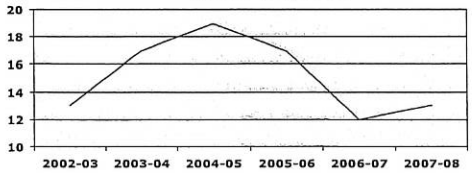
Graduate Education

Degrees Awarded

MS Degrees Awarded by the College



MSAE Degrees

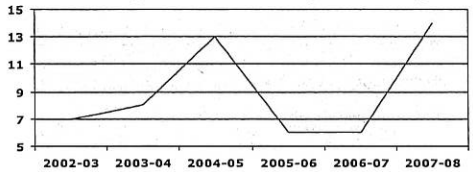


6 Year Average

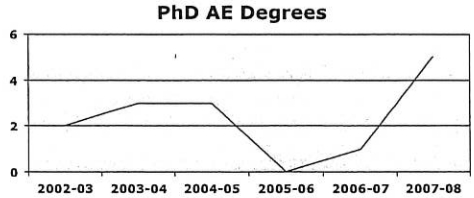
Graduate Education

Degrees Awarded

PhD Degrees Awarded by the College



PhD AE Degrees



6 Year Average

College Strategic Research Thrusts

Sustainable Engineered Systems

Composite Materials

Nanotechnology

Information Technology
- Wireless Communications and Networks
- Data Storage
- Information Security

Bio-Engineering

Aircraft Icing

Computational Fluid Dynamics

Engineering Education

Research

The College produces on average $4.8M in research funding per year or 24% of the WSU research funding.

The Department of Aerospace Engineering produces on average $2.6M or 55% of the College research funding.

CONVERSATION WITH . . . FRANK KEY, 10B

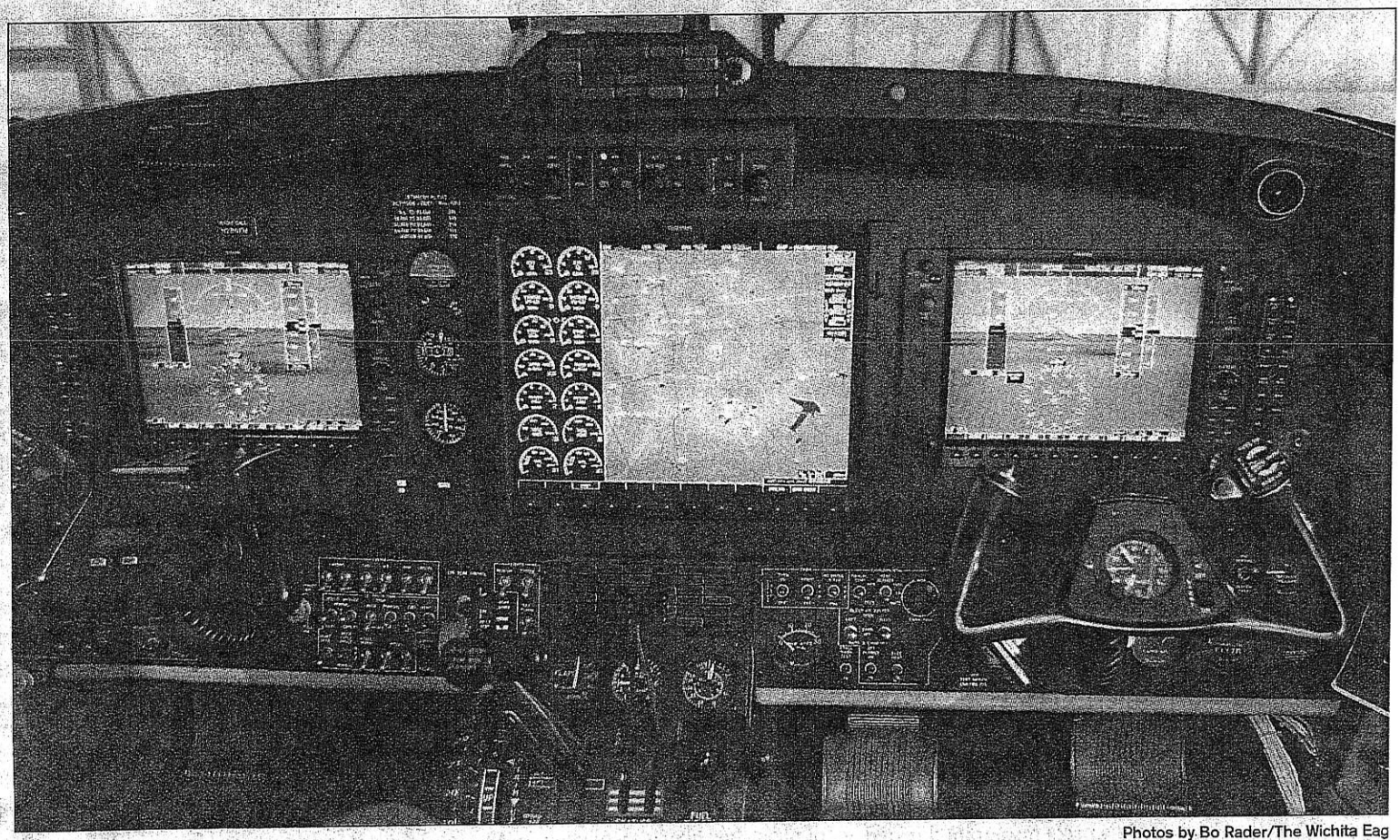
BUSINESS

Now you know.

9

SUNI
JULY 20, 2

GARMIN GROWTH DOUBLES, TRIPLES



Photos by Bo Rader/The Wichita Eag

The cockpit of a King Air has been fitted with new Garmin instruments. The company's "glass cockpit" integrates all the primary flight, navigation, communication, terrain, traffic, weather and engine instrumentation onto large-format displays in the cockpit.

FINDING ROUTE TO SUCCESS

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TOP: The Garmin hangar houses all sorts of planes used for testing and certification of products.
ABOVE: Pat Hopkins inspects a circuit board in the Garmin manufacturing plant in Olathe. Workers inspect, test and complete the units in-house, and then fill orders and ship products.

Co-founded by a wise g… maker of navigation systems h… been profitable ever since it opened

BY MOLLY McMILLIN
The Wichita Eagle

OLATHE — Garmin, the builder of navigation devices, has grown quickly since it was co-founded by a Wichita State University graduate in 1989.

The company is especially familiar in Wichita, where Cessna Aircraft and Hawker Beechcraft use its integrated, high-technology avionics suites on several models of aircraft. Cessna is Garmin's largest aviation customer.

John Doman, Cessna's vice president for worldwide propeller aircraft sales, calls Garmin's G1000 glass cockpit revolutionary for general aviation.

"It takes just so much of the anxiety out of flying an airplane," Doman said.

The G1000 replaced older, round gauges in aircraft and integrated all the primary flight, navigation, communication, terrain, traffic, weather and engine instrumentation onto large-format displays in the cockpit.

The device is a "watershed point in terms of the aircraft and how they're looked upon," Doman said. "Either you have old airplanes that have round dials, or you've got new-generation glass cockpits."

Cessna uses Garmin's avionics in the SkyCatcher — its new light sport aircraft — in its piston aircraft, in Caravan turboprops and in its entry-level business jet, the Citation Mustang.

The products give buyers a reason trade up to aircraft incorporating the technology, Doman said. Last year, Cessna took orders for 272 Caravans in part because it began offering the

Please see **GARMIN**, Page

Now you know
GARMIN

Founded: 1989

Major officials: Min Kao, chairman and chief executive

Employees: 9,000, including 2,500 in Olathe

What it does: Develops aviation, consumer and marine technologies using the global positioning system

Major aviation competitors: Honeywell, Avidyne, Rockwell Collins

Headquarters: Olathe

Incorporated: Cayman Islands

Web site: www.garmin.com

NEWS 2 USE

GARMIN

.n Page 9B

with the G1000, he said.

The company

Garmin was founded in 1989 by Gary Burrell, a WSU electrical engineering graduate, and Min Kao, a native of Taiwan. (Thus the name Gar-Min.)

The two were executives at the former King Radio in Olathe. They left the company and went into business together, convinced the future of navigation would be linked to GPS technology, which uses a series of satellites to track location, speed, position, distance and movement.

Garmin has been profitable every year since it opened. In 2000, it was incorporated in the Cayman Islands as a holding company to facilitate a public offering of its stock in the U.S.

Last year, all four business segments — aviation, auto, marine and fitness products — had either double or triple revenue growth.

It sold 12 million units in 2007 and recorded revenue of $3.18 billion, a 79 percent increase from the year before.

"Our success comes from innovation and bringing new products to market," said Garmin vice president for marketing Gary Kelley.

Garmin employs 9,000 people — including 2,500 in Olathe — nearly double its worldwide work force of 4,750 in 2006.

Garmin's automotive and mobile segment is its largest ...siness. Last year, it expand- into the rental car market, ...pplying GPS units to rental car companies.

Garmin's aviation segment is its second-largest business, bringing in 13 percent of its revenue.

At its 980,000-square-foot headquarters on 42 acres in Olathe, workers do research and development, engineering, administration, product support, marketing, communications, aviation manufacturing, certification and customer support.

Inside its massive warehouse — big enough to hold three Boeing 747s — workers are aided by a series of conveyer belts to fill orders and ship products.

The company completed a 231,000-square-foot expansion to its warehouse this year. It's now adding an extension for more engineering offices.

Not far from the warehouse is a manufacturing area where automated production lines build circuit boards for the G1000 units. Workers inspect, test and complete the units in-house.

Upstairs, engineering offices are next to a series of workbenches. That way, engineers come up with a design, "then come out of the office to see if it's going to work," said Garmin spokeswoman Jessica Myers.

New ideas for aviation

The windows in Garmin's spacious hangar in New Century Aircenter near Olathe are obscured by frosted glass.

That helps keep proprietary work Garmin does customizing products for customers a secret.

When it's working on a confidential project, the company converts an office into a "war room" and shuts off a corner of the hangar.

"Nobody can get in," said Tom Carr, Garmin's manager of flight operations and its chief test pilot.

The hangar houses a variety of aircraft from Hawker Beechcraft, Cessna, Mooney, Cirrus, Diamond and others used for testing and certification of products.

A Beech Baron, for example, is used to test a variety of products at different altitudes and speeds. The right side of the panel pops out, and "we can install any display system we make," Carr said.

A Citation CJ2 was bought for autopilot development for Cessna's Citation Mustang and other planes.

The hangar is also where the company is testing its newest cockpit technology: synthetic vision.

"It's the hottest new technology to come along," said Cessna's Doman.

In a simulator in an upstairs office, Carr demonstrates how the new technology gives pilots a 3-D color depiction of terrain, obstacles and traffic on the G1000 flight display.

The avionics panel replicates what pilots would see outside the cockpit on a clear day. That helps them fly in poorer weather.

If a plane gets too close to an obstacle like a mountain, tower or radio antenna, the obstacle turns red on the display and an audio cue tells the pilot to change course.

"It knows time to impact," Carr said.

The technology lets pilots program in where they want to go and computer-generated guidance symbols highlight the route the pilot should take. It's like a big video game.

One market Garmin hasn't reached is products for business jets larger than a light jet. The next step is "to expand up," said Myers, although company officials wouldn't elaborate.

For Garmin to grow, it must continue to develop new capabilities.

"We'll continue to innovate and grow in the marketplace," Kelley said.

Reach Molly McMillin at 316-269-6708 or mmcmillin@wichitaeagle.com.

Now you know
WHAT IS GPS?

The global positioning system is a navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense.

Although originally intended for military purposes, the government made it available for civilian use in the 1980s.

The satellites orbit the Earth twice a day and transmit signals to Earth. The GPS receiver works by comparing the time a signal was transmitted by a satellite with the time it was received.

The time difference tells the receiver how far away the satellite is. GPS uses the information to calculate the user's exact location. The receivers are accurate to within 10 to 30 feet.

Source: Garmin

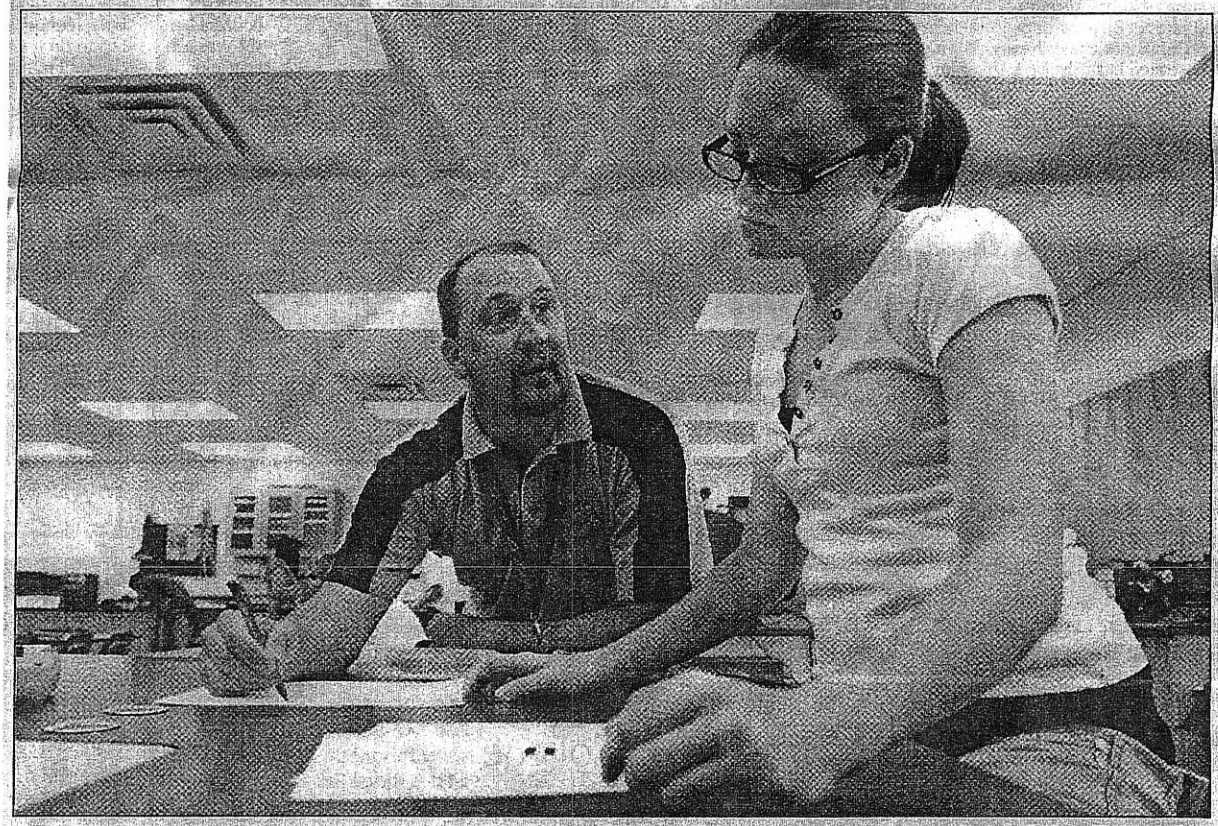
Bo Rader/The Wichita Eagle

Gary Kelley is vice president for marketing at Garmin, which employs 2,500 people in Olathe and 9,000 worldwide. "Our success comes from innovation and bringing new products to market," Kelley said.

PROGRAM SEEKS MILLIONS TO GET KIDS INTO SCIENCE

ENGINEERING FUTURE WORKERS

Eric Hollingsworth and Marlo Griffith work on a project last week. They're in a pre-engineering class at West High School.



Photos by Bo Rader/The Wichita Eagle

Jim Pugh, who teaches a pre-engineering class at West High School, works with Marlo Griffith on a project. The class is part of Project Lead the Way, a program that is aimed at attracting students to engineering. Supporters hope to expand it.

To keep industry, Wichita needs to build up a skilled work force

BY ROY WENZL
The Wichita Eagle

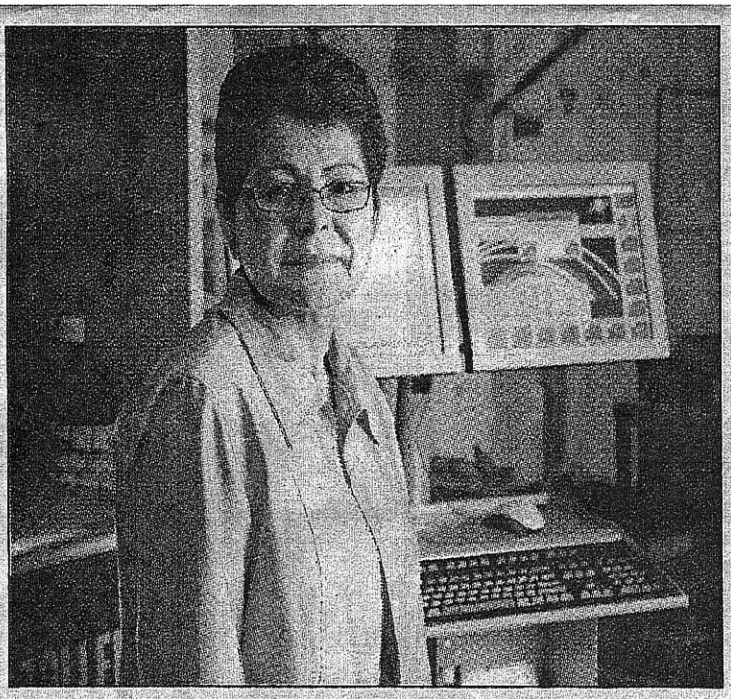
An unprecedented effort is under way among aircraft companies, the Kansas Legislature and Wichita State University to expand the teaching of pre-engineering and other science courses in Wichita public schools — and to build a bigger pipeline of kids seeking engineering and skilled-labor jobs.

They hope to start next fall, training and inspiring a new generation of engineers. They plan to start at Mueller Elementary School, Coleman Middle School and Northeast Magnet High School, later working in multiple schools.

WSU has applied for a $2 million grant, to be voted on next Sunday by the Knight Foundation's national board, to greatly expand pre-engineering courses in Wichita public schools.

The university applied because state leaders are worried that some of Kansas' biggest companies might soon leave or outsource work

Please see **ENGINEERING**, Page **6A**



Zulma Toro-Ramos, dean of the College of Engineering at Wichita State University, says the engineer shortage is a national problem.

"The shortage is so severe that when I show up at career fairs and talk to company representatives I become almost uncomfortable. They are so desperate for engineers. We're not meeting their needs."

Stuart Bell, KU's dean of engineering

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ENGINEERING

From Page 1A

because they can't find engineers in Wichita.

"Everyone knows the national economy isn't doing well, and that if we don't solve some of the problems here, we could lose what we have," said Pete Gustaf, president of Wichita Area Technical College, who has been included in the planning.

Aircraft companies need to fill 400 to 500 additional engineering jobs and thousands of skilled-labor jobs, said Zulma Toro-Ramos, dean of the College of Engineering at WSU. Company executives told her that schools need to better prepare students for those jobs.

Toro-Ramos is coordinating an effort to expand Project Lead the Way, a program already in place in Wichita schools that offer pre-engineering courses on topics such as engineering design, computer integrated manufacturing, and civil engineering and architecture.

Toro-Ramos wants to get into multiple schools in Wichita, then expand to Derby and other school districts.

Some students recruited for the program might not ultimately go into engineering but would be well prepared to apply for the technical education training WATC offers.

"The point of all this is not only to develop engineers but to maintain the standard of living here in Wichita," Toro-Ramos said. "You maintain the standard of living when you maintain the industry here, and the work force."

There is already a $260,000 grant in place from the U.S. Department of Labor, and a proposal for another $100,000 from the National Science Foundation, all to be used for training and equipment to expand the program.

The new effort will go forward in some way even if WSU doesn't get the Knight grant, Toro-Ramos said. She and WSU's education college plan to bring high school students to campus to work with faculty in the research labs and to train more K-12 teachers to prepare children for careers in technology and engineering.

A statewide problem

Kansas Senate President Stephen Morris said he and other legislators are concerned about what might happen if Wichita's aircraft companies, or engineer-reliant Kansas City-area companies like Black & Veatch, Garmin and Burns & McDonnell, leave Kansas or outsource.

Those companies are at least 1,500 engineers short, said Morris, R-Hugoton. "Part of the reason our state is not growing as fast as other states is because of this shortage," Morris said.

The shortage has lasted for years, but took on urgency when the national economy weakened with the subprime mortgage crisis, said Reggie Robinson, president and chief executive of the Kansas Board of Regents.

He's been pressing universities to do much more to help K-12 schools address the problem. In recent months, engineering school deans including Toro-Ramos and the deans at Kansas State University and the University of Kansas made plans to aggressively recruit, train and mentor youngsters in public schools.

"The shortage is so severe that when I show up at career fairs and talk to company representatives I become almost uncomfortable," said Stuart Bell, KU's dean of engineering. "They are so desperate for engineers. We're not meeting their needs."

Toro-Ramos said WSU hopes to establish new or enhanced engineering-based science centers in many schools, starting with Mueller, Coleman and Northeast.

There would be five courses taught at each school; WSU would help train teachers and help find money for equipment. The new classes would be in addition to Project Lead the Way programs at West and Northwest high schools and would expand the program at Northeast.

Help from WATC

When Morris started talking with the engineering deans, he said he asked them to find whatever way they could to help public schools and to collaborate with technical schools like Wichita Area Technical College.

Gustaf agreed to help.

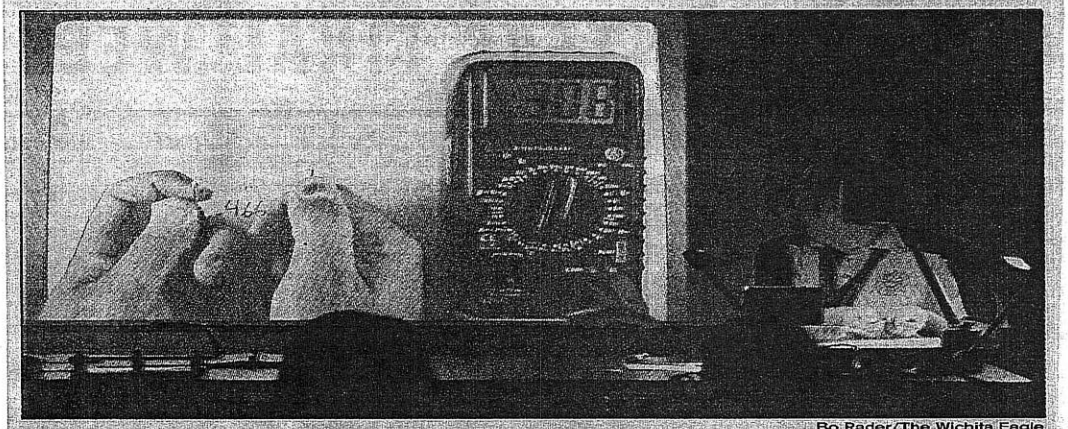
Technical education, whether for engineering or skilled labor, is expensive. Equipment costs a lot because technological improvements make it obsolete in two to three years.

Wichita public schools haven't had the resources to keep up. But WATC could help by allowing schoolchildren to use its state-of-the-art training equipment once its new $54 million training center opens near Jabara Airport in 2010.

Just months ago, Gustaf was saying in The Eagle and in speeches that the public schools seemed unable or unwilling to adapt to how work force needs have tilted toward skilled labor.

And the public schools were saying that technical education was a good idea, but that they had no money to develop it further.

Wichita State, at least publicly, didn't seem to be saying much, though it had collaborated with public schools for three years on Project Lead the Way at West.



Bo Rader/The Wichita Eagle

Jim Pugh, a teacher at West High School, uses an overhead projector to show his students how to test a resistor. Pugh teaches five pre-engineering classes.

"The point of all this is not only to develop engineers but to maintain the standard of living here in Wichita. You maintain the standard of living when you maintain the industry here, and the work force."
Zulma Toro-Ramos,
dean of the College of Engineering at WSU

A prestige issue

The engineer shortage is a national problem, Toro-Ramos said. Not nearly enough young Americans want to become engineers.

Engineering in this country is not considered a prestige job like law, she said.

"Our contribution to society is not clear. Everything engineers do is for the betterment of humanity," Toro-Ramos said.

"We design airplanes that don't crash, bridges and buildings that don't fall down, we design reliable cars, cell phones and computers that make work easier and more dependable. Even the chair you are sitting in was designed by an engineer."

Of the 1,100 undergraduates at WSU seeking a bachelor's degree in engineering, Toro-Ramos said, 25 percent are foreign-born. Of the 600 graduate students seeking an engineering degree at WSU, 75 percent are foreign-born, mostly from India, China and Malaysia.

Jill Docking, a Wichita stockbroker and member of the Board of Regents, attended the WSU engineering school graduation last spring, and was startled to see how many students came from Asia. She knew American kids seemed reluctant to become engineers. Here was the evidence.

"Where are all these graduates going?" she remembered asking Toro-Ramos.

Home, Toro-Ramos said. Outside the U.S.

Help from industry

Private industry needs to help schools, Morris said, by providing money for everything from training to buildings.

He wants to boost business' ability to make money, "but because of the current economic picture, the state can't do it all," he said.

The help would be welcome, school district leaders said.

The district needs a lot of help, but it has never been unwilling to provide technical education, said Jim Means, the Wichita district's director of secondary career and technical education.

Last year, the district taught 9,000 of its 12,000 high school students at least one course in secondary career or technical education, he said.

Expanding has always been limited by resources, he said.

"People may have finally concluded that it's in their interests to help us," said school board member Connie Dietz. "Guess where most of the new aircraft workers are going to come from? From Wichita schools."

"This effort has huge potential," Means said. "But it's very expensive. If WSU gets that Knight grant, that will be huge."

At West High on Thursday, Jim Pugh taught a Project Lead the Way pre-engineering class, showing 11 students how to use a digital multimeter, which measures current in a circuit. The students appeared upbeat and alert. When asked how many wanted to be engineers, all 11 raised their hands.

"We like challenges," said Khalfani Issa, a junior.

"This isn't hard to learn when you like what you are learning," said Layton Butler, also a junior.

It will lead to great jobs with good pay, he said.

He knows about jobs with low pay, he said — he earns $6.55 an hour working at McDonald's.

Reach Roy Wenzl at 316-268-6219 or rwenzl@wichitaeagle.com.

3-120

WSU RECEIVES $2 MILLION

Jaime Oppenheimer/The Wichita Eagle

Zulma Toro-Ramos, dean of WSU's College of Engineering, shakes hands with Kurt Soshinske, assistant professor of mechanical engineering.

Grant will help combat shortage of engineers

BY ROY WENZL
The Wichita Eagle

Wichita State University received a $2 million grant on Sunday that will allow it to expand the teaching of pre-engineering and other skilled-labor classes in Wichita public schools.

Public school officials had said before the grant was awarded that getting it would be a dramatic development for Wichita's economy and for the education of its young people. Officials said the grant would expand the teaching of pre-engineering and technical education in schools at a time when there is a huge skilled-labor shortage in Wichita.

"The opportunity for us to transform the lives of so many youngsters is unique," said Zulma Toro-Ramos, WSU's dean of the school of engineering. "We have developed something that will impact a lot of children and schools and industry, and we will keep looking for more money to expand to other school districts."

She said the effort will involve hundreds of children, and every middle and high school in Wichita. Eventually she will try to reach all middle and high schools in Sedgwick County.

Please see **ENGINEERS**, Page **3A**

ENGINEERS

From Page 1A

The grant from the John S. and James L. Knight Foundation will finance an effort by aircraft companies, the Kansas Legislature and WSU to build a bigger pipeline of kids seeking engineering and skilled-labor jobs in a city where there is a severe shortage of applicants for both.

"This is just great, and we're very pumped about it," said Denise Wren, assistant superintendent for Wichita schools. "We're planning meetings with WSU's engineering dean about this, and we could not be more excited."

They hope to start next fall, Toro-Ramos said. The money will be used over five years to greatly expand Project Lead the Way, a national program promoting the teaching of pre-engineering courses in public schools. That program has existed in at least one school (West High) for six years, but will likely expand to every middle and high school in Wichita.

The foundation's board of trustees voted on Sunday to give the grant. WSU will use the money for equipment and to train K-12 teachers how to teach pre-engineering courses, Toro-Ramos said.

Anne Corriston, a Wichitan who is a program director for the foundation, helped Toro-Ramos and other WSU educators write the proposal that won the grant. Corriston told trustees meeting to vote in Washington D.C. on Sunday that the vision she had conceived with Toro-Ramos is to address the shortage of engineers by "growing our own, but also to better prepare students to use technology to solve problems and ultimately, become better citizens."

She urged the trustees to approve the grant in part because she told them Toro-Ramos was a "a passionate and visionary advocate" who could transform education and an entire local economy if she got this kind of help.

Corriston in the last year helped bring other work-force-related Knight Foundation grants to Wichita. In the last year, she worked to obtain a $450,000 grant for the Workforce Alliance of South-Central Kansas, and a $1.5 million grant to help the local Boys & Girls Club teach work-force classes.

Toro-Ramos came to WSU three years ago and immediately began meeting with aircraft and other industry leaders, asking them what they wanted from WSU. They told her they need to fill 400 to 500 additional engineering jobs and thousands of skilled-labor jobs in Wichita, she said.

Toro-Ramos said WSU plans to start at Mueller Elementary School, Coleman Middle School and Northeast Magnet High School, later adding more schools.

WSU applied because state political and industry leaders worry that some of Kansas' biggest companies might soon leave or outsource work because they can't find engineers.

Toro-Ramos wants to get into multiple schools in Wichita, then expand to Derby and other school districts.

Technical education like this, because of the equipment needed — and the way that equipment quickly becomes outdated in today's world — is expensive. Wren said school planners will have to worry about how to finance this effort once the grant runs out.

But Toro-Ramos on Sunday pledged that she will work to find money.

"In five years we can come up with a mechanism to make it sustainable, to make it permanent," she said. "I don't have any doubt. We'll ask industry for help and I think the federal and state governments will come on board as well."

Reach Roy Wenzl at 316-268-6219 or rwenzl@wichitaeagle.com.

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ATTACHMENT J
Task Force on Engineering Success
for the Future of Kansas
March 9, 2009

September 17, 2008

To: Joint Committee on Economic Development

From: Kathie Sparks, Principal Analyst

Re: Oklahoma Conference Committee Substitute for Engrossed House Bill No. 3239 (Tax Credits for Hiring Engineers)

Per the charge of the Legislative Coordinating Council, the following memoramdum will examine 2008 Oklahoma House Bill No. 3239 enacted in July 2008. The bill provides three new tax credits for the aerospace industry in Oklahoma. A copy of the bill is enclosed.

The act provides the following:

- Definitions (Section 1 of the bill):
  - A "qualified employee" is defined as a person employed by or contracting with a qualified employer who has been awarded an undergraduate or graduate degree from a qualified program and who was not employed in the aerospace sector in Oklahoma immediately preceding the qualified employment;
  - A "qualified employer" is defined as a business whose principal business activity involves the aerospace sector; and
  - A "qualified program" is defined as a program that has been accredited by the Engineering Accreditation Commission of the Accreditation Board of Engineering and Technology and that awards an undergraduate or graduate degree.

- A maximum 50 percent tax credit to a qualified employer in the aerospace industry against tuition reimbursed to a qualified employee who has been awarded an undergraduate or graduate degree within one year of commencing employment with the employer. (Section 2 of the bill)
  - The tuition reimbursed to a qualified employee for the first through fourth years of employment cannot exceed 50 percent of the average annual amount paid by a qualified employee for enrollment and instruction in a public institution in Oklahoma and the credit cannot be used to reduce the tax liability of the qualified employer to less than zero.

- A tax credit for the employer against compensation paid to a qualified employee as follows (Section 3):
    - Ten percent of the compensation paid for the first through the fifth years of employment if the qualified employee graduated from an institution located in Oklahoma;
    - Five percent of the compensation paid for the first through the fifth years of employment if the qualified employee graduated from an institution located outside of Oklahoma; and
    - The maximum amount of the credit per employee is $12,500 and the credit cannot reduce the employer's tax liability to less than zero.

- A tax credit for the qualified employee of up to $5,000 per year for a period of five years. The credit may be carried forward for each of the five years. The credit claim may not be used to reduce the tax liability of the taxpayer to less than zero (Section 4).
- Technical changes to the Aerospace Development Act of 2008 (Section 5).
- Tax credits effective January 1, 2009 (Section 6).
- Technical changes to current law which become effective November 1, 2008 (Section 7).

Enclosure

KS/mkl

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STATE OF OKLAHOMA

2nd Session of the 51st Legislature (2008)

CONFERENCE COMMITTEE
SUBSTITUTE
FOR ENGROSSED
HOUSE BILL NO. 3239

By: McNiel, Banz, Jackson, Pittman, Shannon, Dorman, Shumate and Proctor of the House

and

Corn, Johnson (Constance) and Sparks of the Senate

CONFERENCE COMMITTEE SUBSTITUTE

An Act relating to aerospace; defining terms; providing for tax credit for certain tuition reimbursements; limiting amount of credit; prohibiting use of credit to reduce tax liability below a certain amount; providing maximum number of years to claim tax credit; providing tax credit for compensation to certain employees; providing maximum annual amount of credit; prohibiting use of credit to reduce tax liability below a certain amount; providing maximum number of taxable years for which credit can be claimed; providing tax credit for certain employees; providing maximum amount of credit; imposing maximum number of taxable years for which credit claimed; prohibiting use of credit to reduce tax liability below a certain amount; authorizing carryover for certain number of years; amending Section 1, Chapter 263, O.S.L. 2006 (74 O.S. Supp. 2007, Section 5060.3a), as amended by Section 1 of Enrolled House Bill No. 3098 of the 2nd Session of the 51st Oklahoma Legislature and as renumbered by Section 2 of Enrolled House Bill No. 3098 of the 2nd Session of the 51st Oklahoma Legislature, which relates to the Aerospace Development Act of 2008; authorizing the Oklahoma Aeronautics Commission to employ certain program processes and to contract with

certain qualified entities; providing for codification; and providing effective dates.

BE IT ENACTED BY THE PEOPLE OF THE STATE OF OKLAHOMA:

SECTION 1. NEW LAW A new section of law to be codified in the Oklahoma Statutes as Section 2357.301 of Title 68, unless there is created a duplication in numbering, reads as follows:

As used in Sections 1 through 4 of this act:

1. "Aerospace sector" means a private or public organization engaged in the manufacture of aerospace or defense hardware or software, aerospace maintenance, aerospace repair and overhaul, supply of parts to the aerospace industry, provision of services and support relating to the aerospace industry, research and development of aerospace technology and systems, and the education and training of aerospace personnel;

2. "Compensation" means payments in the form of contract labor for which the payor is required to provide a Form 1099 to the person paid, wages subject to withholding tax paid to a part-time employee or full-time employee, or salary or other remuneration. Compensation shall not include employer-provided retirement, medical or health-care benefits, reimbursement for travel, meals, lodging or any other expense;

3. "Institution" means an institution within The Oklahoma State System of Higher Education or any other public or private college or university that is accredited by a national accrediting body;

4. "Qualified employer" means a sole proprietor, general partnership, limited partnership, limited liability company, corporation, other legally recognized business entity, or public entity whose principal business activity involves the aerospace sector;

5. "Qualified employee" means any person employed by or contracting with a qualified employer on or after January 1, 2009, who has been awarded an undergraduate or graduate degree from a qualified program by an institution, and who was not employed in the aerospace sector in this state immediately preceding employment or contracting with a qualified employer;

6. "Qualified program" means a program that has been accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET) and that awards an undergraduate or graduate degree; and

7. "Tuition" means the average annual amount paid by a qualified employee for enrollment and instruction in a qualified program. Tuition shall not include the cost of books, fees or room and board.

E. No credit authorized pursuant to this section shall be claimed after the fifth year of employment.

SECTION 4. NEW LAW A new section of law to be codified in the Oklahoma Statutes as Section 2357.304 of Title 68, unless there is created a duplication in numbering, reads as follows:

A. For taxable years beginning after December 31, 2008, a qualified employee shall be allowed a credit against the tax imposed pursuant to Section 2355 of Title 68 of the Oklahoma Statutes of up to Five Thousand Dollars ($5,000.00) per year for a period of time not to exceed five (5) years.

B. The credit authorized by this section shall not be used to reduce the tax liability of the taxpayer to less than zero (0).

C. Any credit claimed, but not used, may be carried over, in order, to each of the five (5) subsequent taxable years.

SECTION 5. AMENDATORY Section 1, Chapter 263, O.S.L. 2006 (74 O.S. Supp. 2007, Section 5060.3a), as amended by Section 1 of Enrolled House Bill No. 3098 of the 2nd Session of the 51st Oklahoma Legislature and as renumbered by Section 2 of Enrolled House Bill No. 3098 of the 2nd Session of the 51st Oklahoma Legislature, is amended to read as follows:

Section 1. A. This act shall be known and may be cited as the "Aerospace Development Act of 2008".

B. There is hereby created within the Oklahoma Aeronautics Commission, the Center for Aerospace Supplier Quality (CASQ), and

the Oklahoma Aerospace Institute (OAI) whose purpose shall be to create a partnership of service providers to more effectively respond to the needs of the aerospace industry in the areas of education and training, research, and economic development. The CASQ and OAI will focus available resources to promote cooperation and collaboration among businesses, manufacturers, military installations, commercial aviation, educational institutions, nonprofit research institutions, and state government for the purpose of strengthening the economy of the State of Oklahoma. Contingent upon the availability of funds, ~~OCAST~~ the Oklahoma Aeronautics Commission may employ established program processes or may contract with other qualified entities to operate the CASQ and the OAI.

C. The CASQ is designed to serve as a conduit between Oklahoma's military installations and aerospace industry to promote quick response to opportunities that will:

1. Increase Department of Defense contracts with Oklahoma aerospace companies and contracts between Oklahoma aerospace companies and prime contractors in the aerospace and defense industries;

2. Create and retain more high-wage, high-skill jobs;

3. Strengthen collaborations between businesses and aerospace interests;

4. Reduce the flow of federal defense contract dollars to out-of-state businesses;

5. Expand the aerospace industry in Oklahoma;

6. Provide engineering and technical assistance;

7. Provide more manufacturing sources for Oklahoma military installations and the aerospace industry; and

8. Reduce costs and increase competitiveness for Oklahoma military installations and the aerospace industry.

D. In order to streamline the use of resources with the goal of eliminating duplication of efforts, the OAI shall act as a clearinghouse of information and activities concerning the aerospace industry. The OAI will provide a focal point to coordinate the plans and activities of state agencies, task forces, departments, boards, commissions, and other entities that have responsibilities or duties regarding the aerospace industry with the goal of eliminating duplication of effort.

E. The OAI shall create a partnership of education and training providers to meet the specific needs of the aerospace industry to build a credentialed work force for the future. Participating educational institutions shall act cooperatively to create complementary activities.

F. The OAI shall include a center for applied research and will primarily undertake applied research, development and technology transfer that have long-term potential for commercial development.

The center shall build upon institutional strengths and conduct activity in areas of research in which the participating research institutions and businesses have achieved or have true promise of attaining a standard of excellence in applied research and development.

G. The OAI shall support and foster the growth of the aerospace industry. The OAI shall acquire aerospace executive expertise and provide consulting services to the aerospace industry, government agencies and organizations across the State of Oklahoma in order to strengthen the policy framework, economic development initiatives and activities of the state.

H. The OAI may accept funding that includes, but is not limited to:

1. Monetary contributions;

2. Contractual arrangements;

3. In-kind services;

4. Federal- and state-appropriated dollars;

5. Private and public foundation grants; and

6. Fee-for-service products.

SECTION 6. Sections 1 through 4 of this act shall become effective January 1, 2009.

SECTION 7. Section 5 of this act shall become effective November 1, 2008.

51-2-11420 MMP 05/20/08

KANSAS
DEPARTMENT OF REVENUE

Testimony to the Joint Committee on Economic Development

Richard Cram

September 19, 2008

2008 Oklahoma House Bill 3239—Aerospace Engineer Tax Credits

Senator Karin Brownlee, Chair, and Members of the Committee:

Background

The 2008 Oklahoma Legislature enacted House Bill 3239, which creates 3 new tax credits associated with hiring recent aerospace engineer graduates by Oklahoma employers in the aerospace sector, effective for tax years beginning after December 31, 2008.

A qualified employer in the aerospace sector hiring or contracting with after January 1, 2009 an engineer (qualified employee) who has graduated within one year of the hiring or contracting is entitled to a non-refundable income tax credit for 50% of the annual tuition reimbursement paid by the employer to the engineer during the first 4 years of employment. The credit cannot exceed 50% of the average annual amount of tuition paid by the engineer for enrollment at a public institution in Oklahoma. Thus, it appears that the engineer must have attended an Oklahoma engineering program in order for the tuition reimbursement credit to apply.

The engineer (qualified employee) must have graduated from an accredited engineering program with a graduate or undergraduate degree, and must not have been previously employed in the aerospace sector in Oklahoma immediately preceding employment or contracting with the qualified employer.

A qualified employer in the aerospace sector may also claim a non-refundable tax credit for either 10% of the annual compensation paid during the first 5 years of employment to the newly-hired engineer, if the engineer graduated from an Oklahoma program, or 5% of such annual compensation, if the engineer graduated from an out-of-state accredited engineering program. For purposes of the credit, compensation does not include retirement or medical benefits, or reimbursement for travel, meals, lodging or other expenses. This credit cannot exceed $12,500 per qualified employee per year.

The newly hired engineer (qualified employee) is also eligible to claim a non-refundable income tax credit of $5,000 per year for five years. This credit can be carried forward for up to 5 years. The engineer must continue to be employed by the qualified employer in order to claim the credit.

Fiscal for HR 3239 Estimate if Enacted in Kansas

If Oklahoma House Bill 3239 were to be enacted in Kansas, the Department's fiscal estimate of the revenue loss from the ~~State General Fund~~ is shown below, based on the following assumptions:

1) approximately 1000 newly graduated engineers would be hired annually by the aerospace sector in Kansas;
2) the average salary for newly graduated and hired engineers (including undergraduate and graduate degrees) is $81,000 in 2009, and would increase annually at the rate of 5%;
3) in order to maximize tax credits, aerospace employers would hire graduates of Kansas engineering programs;
4) average annual tuition costs for resident engineering students for 2008 is $6509 at Kansas engineering programs (averaging KU, KSU and WSU tuition rates) and average annual tuition costs for non-resident engineering students for 2008 is $15,633.33, those tuition costs increasing at a rate of 8%/yr., with 60% of the students being residents and 40% being non-residents; and
5) for purposes of calculating the credit for 10% of compensation paid to a qualified employee, it is assumed that any tuition reimbursement amount is not included in that compensation amount, since the employer can also claim a credit for 50% of the tuition reimbursement paid to that employee.

Tuition Reimbursement Non-refundable Credit ($ in millions)

FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
3.380,000	7	11	15.25	20.2

10% of Compensation Non-refundable Credit ($ in millions)

FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
5.4	11.35	17.85	25	32.85

$5000/Qualified Employee Non-refundable/5-yr Carryforward Credit ($ in millions)

FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
2.700,000	5.95	9.75	14.25	19.15

Total ($ in millions)

FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
11.580,000	24.300,000	38.600,000	54.500,000	72.200,000

For fiscal years after FY 2014, the fiscal impact would level off approximately to the FY 2014 amount and increase proportionately to salary and tuition growth rates.

The administrative costs for implementing the proposal would be significant. Programming would be required to implement 3 new tax credits. An administrative cost estimate is being prepared and will be provided as soon as it is available.

September 5, 2008

Stuart R. Bell, Dean
School of Engineering
Eaton Hall, Room 1
The University of Kansas

Stuart:
Included below is the University of Kansas data in response to the five questions (e-mail 8/25/08, Subject re: Assistant Department of Revenue with fiscal note - Oklahoma Tax Credit for hiring aeronautical engineers) directed to the three engineering deans. ASEE data was used in questions #1 and #2. Data from the KU Office of Student Financial Aid was used in question #3. KU's Engineering Career Center's data was used in questions #4 and #5.

1. **University of Kansas, School of Engineering Degrees granted by Fiscal Years 2003-2008**

Year	B.S.	M.S.	Ph.D.
FY2003	268	168	12
FY2004	290	182	13
FY2005	255	160	11
FY2006	241	161	12
FY2007	219	119	16
FY2008	253	149	19

2. **University of Kansas, Aerospace Engineering Degrees granted by Fiscal Years 2003-2008**

Year	B.S.	M.S.	Ph.D.
FY2003	16	6	2
FY2004	19	5	1
FY2005	12	13	3
FY2006	11	6	2
FY2007	26	3	3
FY2008	19	12	2

3. **2008-2009 University of Kansas, School of Engineering Academic Year Estimated Cost of Attendance**

Tuition:

Standard Tuition

Kansas Resident: $206.50/credit hour, 2 semesters @ 15 hours/sem = $6,195.
Out-of-State: $542.40/credit hour, 2 semesters @ 15 hours/sem = $16,272.

2007 Tuition Compact

Kansas Resident: $213.00/credit hour, 2 semesters @ 15 hours/sem = $6,390.
Out-of-State: $560.00/credit hour, 2 semesters @ 15 hours/sem = $16,800.

2008 Tuition Compact
Kansas Resident: $229.27/credit hour, 2 semesters @ 15 hours/sem = $6,878.
Out-of-State: $602.07/credit hour, 2 semesters @ 15 hours/sem = $18,062.

Campus Fees: $847 (12 hours or more)

Engineering Course Fees: Students enrolled in a School of Engineering course pay a $36.50 per credit hour course fee.

Books and Supplies: $800

Housing: $6,592

Personal Expenses and Transportation: $4,130

In summary, for tuition, campus fees and course fees, a resident engineering student enrolled in 15 credit hours/semester will pay **$7,589.50/academic year**. An out-of-state engineering student will pay **$17,666.50/academic year**. The Engineering Course Fee was applied to ½ of the courses since approximately ½ of an engineering student's course are within the School of Engineering.

4. **Percent of University of Kansas, School of Engineering B.S. degree graduates hired by Kansas Companies/Entities – based on those reporting a location for their offers.**

FY2003	**Unavailable**
FY2004	**42 out of 63 self-reporting (67%)**
FY2005	**46 out of 84 self-reporting (55%)**
FY2006	**54 out of 92 self-reporting (59%)**
FY2007	**65 out of 106 self-reporting (61%)**
FY2008	**81 out of 111 self-reporting (73%)**

5. **Percent of University of Kansas, Aerospace Engineering B.S. degree graduates hired by Kansas Companies/Entities – based on those reporting a location for their offers.**

FY2003	**Unavailable**
FY2004	**1 out of 1 self-reporting (100%)**
FY2005	**1 out of 5 self-reporting (20%)**
FY2006	**3 out of 6 self-reporting (50%)**
FY2007	**4 out of 10 self-reporting (40%)**
FY2008	**4 out of 6 self-reporting (67%)**

Submitted by
Robert M. Sorem, Associate Dean for Undergraduate Studies

Graduate Data provided by
Amanda Ostreko, Coordinator of Graduate and Research Programs

August 27, 2008 (revised 9-8-08)

John R. English, Dean
College of Engineering
1046 Rathbone Hall
UNIVERSITY

John:
Included below are the K-State data in response to the five questions (e-mail 8/25/08, Subject re: Assistant Department of Revenue with fiscal note - Oklahoma Tax Credit for hiring aeronautical engineers) directed to the three engineering deans. **ASEE data** were used in question #1. **K-State's Career and Employment Services' data** were used in question #5.

1. Kansas State University—College of Engineering Degrees granted by Fiscal Years 2003-2008

	B.S.	M.S.	Ph.D.
FY2003	416	134	11
FY2004	410	139	21
FY2005	440	144	20
FY2006	421	127	16
FY2007	436	107	14
FY2008*	434	?	?

***Complete report available in January 2009**

2. NA

3. 2008-2009 Kansas State University—College of Engineering Academic Year Fees/Tuition/Books and Supplies/Miscellaneous Fees

Fees and Tuition:

Kansas Resident: $198.47 per credit hour, 14 credits/sem = $5,557/academic year.
Out-of-State: $541.95 per credit hour, 14 credits/sem = $15,175/academic year.

Privilege fee (Health, student newspaper, recreation complex, plus other items): $673 (12 hours or more)

Engineering fees: Students enrolled in a College of Engineering course pay a $19 per credit hour equipment fee and a $20 per credit hour course fee.

Books and Supplies: Estimated, $900 to $1100

Miscellaneous (Personal expenses): Estimated, $1600 to $3600

In summary, excluding housing, books, supplies and personal expenses, and assuming an average of 8 credits/semester of engineering courses, a resident engineering student enrolled in 14 credit hours/semester will pay **$6854/academic year**. An out-of-state engineering student will pay **$16472/academic year**.

4. Percent of Kansas State University—College of Engineering B.S. degree graduates hired by Kansas Companies/Entities

The data relate **only** to graduates who reported their employment status; thus, there may be graduates employed by Kansas Companies/Entities who did not self report.

FY2003	**141 out of 300 self-reporting (47%)**
FY2004	**146 out of 328 self-reporting (45%)**
FY2005	**155 out of 376 self-reporting (41%)**
FY2006	**138 out of 329 self-reporting (42%)**
FY2007	**149 out of 350 self-reporting (43%)**
FY2008	**Report available in January 2009**

5. NA

Revised report (9-8-08)
Submitted by
Richard R. Gallagher
Associate Dean for Academics and Administration

Wichita State University

College of Engineering

Number of Graduates, Post-Graduation Employment, and Tuition Costs

Question 1 and 4: Degrees in Engineering--All Disciplines and Percentage of Graduates Staying In Kansas

				Bachelor's Degree Recipients Only***	
Year	B.S. Degree	M.S. Degree	Ph.D.	Responding	% working or graduate school in Kansas
2002-03	188	160	7	Data not available	
2003-04*	192	258	8	68	62
2004-05	204	261	13	59	56
2005-06	164	182	6	67	60
2006-07	186	197	6	56	52
2007-08**	178	247	14	39	36

*Follow-up information for May 2004 bachelor's graduates only

**Follow-up information for fall 2007 bachelor's graduates only

Question 2 and 5: Degrees in Aerospace Engineering Only and Percentage of Graduates Staying In Kansas

Year	B.S. Degree	M.S. Degree	Ph.D.		
2002-03	24	13	2	Data no available	
2003-04*	33	17	3	21	17
2004-05	28	19	3	17	14
2005-06	30	17	0	23	21
2006-07	45	12	1	18	16
2007-08**	30	13	5	3	2

*Follow-up information for May 2004 bachelor's graduates only

**Follow-up information for fall 2007 bachelor's graduates only

***All WSU undergraduate students are surveyed shortly before graduation each semester with two additional attempts to non-respondents following graduation. Although response rates vary from year to year, the response rate averages 30-35% up information on graduate students is not collected formally.

Question 3: Tuition Rates (Academic Year Tuition Only)

Resident Undergraduate Student: 15 hours at $138.15 per hour equals $2,072.25 per semester or $4,144.50 for the academic year.

Non-Resident Student: 15 hours at $394.05 per hour equals $5,190.75 per semester or $11,821.50 for the academic year.

Other Costs:

Student Fees: $26.60 per credit hour equals $399.00 for 15 hours per semester or $798.00 for the academic year.

Facilities Use Fee: $3.60 per credit hour equals $54.00 for 15 hours per semester or $108.00 for the academic year.

University Registration Fee: $17.00 per semester or $34.00 for the academic year.

	Engineering Equipment Fee: Additional $14.00 per credit hour for engineering courses only.					