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## Maine Innovation Index, 2004

Maine Department of Economic and Community Development

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# MAINE INNOVATION INDEX 2004

A Publication of:



Prepared by:



June 2004



STATE OF MAINE  
DEPARTMENT OF ECONOMIC  
AND COMMUNITY DEVELOPMENT



JOHN ELIAS BALDACCI  
GOVERNOR

JACK CASHMAN  
COMMISSIONER

It is with tremendous pleasure that the Department of Economic and Community Development presents the *Maine Innovation Index 2004*. This report measures a broad range of indicators relevant to the technology-based economy, and highlights Maine's strengths and challenges.

The *Index 2004* shows that Maine has:

- Significantly increased our Research and Development (R&D) Capacity, surpassing the national average for R&D in the not-for-profit and federal funding indicators, fueled by a 30 fold increase in R&D investments over the past 10 years;
- Increased key areas of its Innovation Capacity, receiving more than \$2.5 million in federal grants and over \$14 million in venture capital to Maine companies, increasing its ranking among other states;
- Experienced significant growth in Employment Capacity, increasing the number of people employed in technology-intensive industries by 9.5% in just one year--more than triple the national average for this type of job growth;
- Improved important components of Education Capacity, including surpassing the national average by awarding more than three engineering or science degrees for every 1000 residents;
- Continued to increase our Connectivity Capacity, where Maine households have more computers than the average household nationally.

This report reflects the success of the investments the State has made in R&D, education and technology-based economic development over the last decade, and shows some areas that warrant additional attention. As these investments begin to pay off, Maine needs to stay on course to effect the long-lasting improvement that these indicators suggest is possible.

Governor Baldacci's economic development plan retains the strong commitment required to further develop Maine's innovation index. The newly created Office of Innovation will provide the focus and strategic direction Maine needs to improve its innovation index by growing the promising areas that build on Maine's strengths. Investments in innovation, technology and Maine's entrepreneurial creativity will help make Maine a magnet for creative people and the businesses they grow.

With the strong leadership of Governor Baldacci and the Maine State Legislature, Maine is building a platform for the 21st Century, so that everyone, no matter who, no matter where, has the opportunity to succeed in Maine.

Sincerely,

Jack Cashman  
Commissioner

# TABLE OF CONTENTS

	Page
<b>Introduction and Summary.....</b>	<b>i</b>
<b>Research and Development Capacity</b>	
<b>Overview.....</b>	<b>1</b>
<b>1 - Total R&amp;D Performance.....</b>	<b>2</b>
<b>2 - Industry R&amp;D Performance.....</b>	<b>5</b>
<b>3 - Academic R&amp;D Performance.....</b>	<b>8</b>
<b>4 - Not-for-Profit Laboratory R&amp;D Performance.....</b>	<b>11</b>
<b>5 - Federal R&amp;D Obligations.....</b>	<b>14</b>
<b>6 - State R&amp;D Investments.....</b>	<b>17</b>
<b>7 - Research Equipment Expenditures at Academic Institutions.....</b>	<b>18</b>
<b>Innovation Capacity</b>	
<b>Overview.....</b>	<b>20</b>
<b>8 - SBIR/STTR Funding.....</b>	<b>21</b>
<b>9 - Venture Capital Investments.....</b>	<b>24</b>
<b>10 - Patents Issued.....</b>	<b>28</b>
<b>Employment Capacity</b>	
<b>Overview.....</b>	<b>30</b>
<b>11 - High Technology Employment.....</b>	<b>31</b>
<b>12 - Net High Technology Business Formations         per 10,000 Business Establishments.....</b>	<b>33</b>
<b>13 - Ph.D. Scientists and Engineers in the Labor Force.....</b>	<b>35</b>
<b>Education Capacity</b>	
<b>Overview.....</b>	<b>37</b>
<b>14 - Education Attainment.....</b>	<b>39</b>
<b>15 - Science and Engineering Degrees Awarded.....</b>	<b>43</b>
<b>16 - Higher Education Enrollment among Young People.....</b>	<b>47</b>
<b>17 - Math and Science Skills of High School Students.....</b>	<b>49</b>
<b>18 - Math Gender Equity among High School Students.....</b>	<b>53</b>

<b>19 - Percent of High Schools Offering Advanced Placement</b>	
<b>Courses.....</b>	<b>56</b>
<b>20 - Ability to Pay for College.....</b>	<b>59</b>
<b>Connectivity Capacity</b>	
<b>Overview.....</b>	<b>64</b>
<b>21 - Internet Connectivity.....</b>	<b>65</b>
<b>22 - Household Connectivity.....</b>	<b>67</b>
<b>23 - High Speed Internet Access.....</b>	<b>69</b>
<b>24 - Classroom Connectivity.....</b>	<b>71</b>
<b>Endnotes.....</b>	<b>74</b>

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**About PolicyOne Research –**

*PolicyOne Research of Portland, Maine is owned by Jim Damicis and A. Mavourneen Thompson. Damicis and Thompson each have over 15 years’ experience in public policy research and analysis. PolicyOne leverages the principals’ broad experience in core research and analysis techniques to provide clients with a full range of services within the areas of economic and community development, education policy, science and technology policy, program and service evaluation, state and local fiscal analysis, demographic analysis, survey design and analysis, and research and analysis to support advocacy.*

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# *Introduction & Summary*

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*Maine's Innovation Index 2004* is a compilation of 24 indicators measuring Maine's economic capacity and progress toward competing in an innovation-driven economy. The indicators are organized into five categories representing key components of an innovation-based economy:

- **Research and Development Capacity**
- **Innovation Capacity**
- **Employment Capacity**
- **Education Capacity**
- **Connectivity Capacity**

**Research and Development Capacity** - Research forms the basis for the successful development of new products, processes and services. The section on research and development (R&D) capacity provides measures of the dollar amount of R&D performance in the state as a percent of gross state product and per worker. The measures capture performance (as measured by spending) by the various types of entities engaged in R&D, including industry, academic institutions, and not-for-profit laboratories. Additionally, R&D contributions by the federal government and the state are considered within the R&D capacity section.

**Innovation Capacity** - Innovation describes the continuous process of generating and applying new ideas that lead to commercialization of new products, processes and services. The innovation capacity section of this report assesses Maine's potential for generating innovation by measuring key outputs, such as patents issued.

**Employment Capacity** - The depth and breadth of Maine's highly skilled workforce is perhaps the most important indicator of our ability to grow and sustain an innovation-driven economy. For Maine to remain competitive in today's marketplace we need to assure that technology and research-intensive businesses and institutions have a thick labor market of skilled and highly educated workers.

**Education Capacity** - Maine's economic future will depend heavily on the quality of today's education systems. Since knowledge is the raw material of innovation, our education systems must produce students capable of organizing and analyzing information, communicating effectively, and operating in both collaborative and independent settings. As a state, our success relies on our ability to increase access to a quality education system for all Maine residents.

**Connectivity Capacity** - The development and deployment of information technology (IT) has profoundly impacted the way we access and use information and is defining the way we learn, work, play, and communicate. The section on connectivity capacity measures Maine's ability to provide IT infrastructure to enable businesses, educators, students and citizens to easily access information. Connectivity capacity indicators include Internet host sites, household Internet connectivity and K-12 students per Internet connected classroom computer.

# *Introduction & Summary*

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Within each capacity area there are two types of indicators. The first measures the relative strength of the “raw materials” essential to the growth of Maine’s innovation economy. Examples include: R&D spending, education attainment, venture capital investments, and Internet connectivity - all necessary inputs that serve as the foundation for innovation-based economic growth. The second type of indicator assesses the performance of Maine’s innovation-driven economic growth by measuring key outputs and products. Examples include: patents issued, technology-business formations, and technology employment. These indicators tell us how Maine’s innovation economy is performing and the degree to which inputs are leading to desired outputs and outcomes. In addition to the 24 key innovation indicators, related sub-indicators are presented that further describe Maine’s performance in growing and sustaining the innovation economy.

In order to assess Maine’s performance on the indicators relative to other states and regions, the data for Maine is compared with data for relevant comparison, or reference groups. The reference groups are the U.S. as a whole, the New England states, and the states that are included in the Experimental Program to Stimulate Competitive Research (EPSCoR).<sup>1</sup> The comparison with the U.S. provides the benchmark most commonly used by similar studies that measure a state’s performance. The comparison with the New England states allows for an assessment of how well Maine is doing relative to the state’s geographic neighbors with whom Maine competes for innovation resources and industry. The comparison with EPSCoR states provides the most analytically sound benchmark because it compares Maine to states that are similar in terms of their historical performance on R&D indicators. Most of the EPSCoR states are rural and lack a high concentration of industry and related innovation resources.

Table 1 presents a summary of Maine’s performance for the 24 primary innovation indicators. It is important to note that for some of the indicators, data for the reference group comparisons and five-year trends is not available. The indicators presented are not meant to be the sole-source, definitive assessment of whether Maine is succeeding in building and sustaining an innovation economy. Like all states, Maine has indicator areas that represent strengths or assets that will serve as the building blocks for the future economy. It also has areas requiring improvement in order for the state to foster innovation, leading to commercialization and economic growth. In many of these areas Maine has made significant progress in the last five years.

**Existing areas of strength for Maine in building and sustaining an innovation driven economy** - The following are indicators for which Maine’s performance exceeds that of the nation as a whole in the latest year for which data is available:

- 4 - Not-for-Profit Laboratory R&D Performance
- 11 - High Technology Employment Percent Change
- 15 - Science and Engineering Degrees Awarded
- 16 - Higher Education Enrollment among Young People
- 22 - Household Connectivity
- 23 - High Speed Internet Access

# *Introduction & Summary*

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**Areas in which Maine showed improvement during the last five years in building and sustaining an innovation driven economy** - The following are indicators for which Maine experienced a trend of improvement during the last five years:

- 1 - Total R&D Performance
- 2 - Industry R&D Performance
- 3 - Academic R&D Performance
- 4 - Not-for-Profit Laboratory R&D Performance
- 5 - Federal R&D Obligations
- 6 - State R&D Investments
- 7 - Research Equipment Expenditures at Academic Institutions
- 8 - SBIR/STTR Funding
- 9 - Venture Capital Investments
- 10 - Patents Issued
- 14 - Education Attainment
- 16 - Higher Education Enrollment among Young People
- 19 - Percent of High Schools Offering Advanced Placement Courses
- 20 - Ability to Pay for College
- 21 - Internet Connectivity
- 22 - Household Connectivity
- 24 - Classroom Connectivity

**Areas in which Maine outperforms its EPSCoR peers** - Success in economic development does not occur overnight, and Maine, building from a position well behind other states, still has a way to go to successfully compete with the top tier states. However, in several indicators, Maine outperforms its peer states as defined by the EPSCoR program. The following are indicators for which Maine's performance exceeds the EPSCoR states as a whole in the latest year for which data is available:

- 4 - Not-for-Profit Laboratory R&D Performance
- 5 - Federal R&D Obligations
- 8 - SBIR/STTR Funding
- 9 - Venture Capital Investments
- 11 - High Technology Employment
- 12 - Net High Technology Business Formations per 10,000 Business Establishments

**Existing areas requiring improvement for Maine in building and sustaining an innovation driven economy** - The following are indicators for which Maine's performance lags behind the nation as a whole in the latest year for which data is available:

- 1 - Total R&D Performance
- 2 - Industry R&D Performance
- 3 - Academic R&D Performance
- 7 - Research Equipment Expenditures at Academic Institutions



# *Introduction & Summary*

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- 8 - SBIR/STTR Funding
- 9 - Venture Capital Investments
- 10 - Patents Issued
- 12 - Net High Technology Business Formations per 10,000 Business Establishments
- 13 - Ph.D. Scientists and Engineers in the Labor Force
- 14 - Education Attainment
- 19 - Percent of High Schools Offering Advanced Placement Courses
- 20 - Ability to Pay for College
- 21 - Internet Connectivity

<b>Table 1- Maine Innovation Index 2004 – Indicator Performance Summary</b>				
<b>Indicator</b>	<b>1-Year Trend</b>	<b>5-Year Trend</b>	<b>Maine in Comparison to EP-SCoR Most Current Year</b>	<b>Maine in Comparison to U.S. Most Current Year</b>
<b>Research and Development Capacity</b>				
1-Total R&D Performance	↑	↑	↓	↓
2-Industry R&D Performance	↑	↑	↓	↓
3-Academic R&D Performance	↑	↑	↓	↓
4-Not-for-Profit Laboratory R&D Performance	↑	↑	↑	↑
5-Federal R&D Obligations	↑	↑	↑	↔
6-State R&D Investments	↑	↑	N/A	N/A
7-Research Equipment Expenditures at Academic Institutions	↑	↑	↓	↓
<b>Innovation Capacity</b>				
8-SBIR/STTR Funding	↑	↑	↑	↓
9-Venture Capital Investments	↓	↑	↑	↓
10-Patents Issued	↑	↑	↓	↓
<b>Employment Capacity</b>				
11-High Technology Employment - % Change	↑	N/A	↑	↑
12-Net High Technology Business Formations per 10,000 Business Establishments	↓	N/A	↑	↓
13-Ph.D. Scientists and Engineers in the Labor Force	↓	↔	↔	↓
<b>Education Capacity</b>				
14-Education Attainment - % of Population 25 and older with Bachelor's Degree or More	↑	↑	N/A	↓

**Table 1- Maine Innovation Index 2004 – Indicator Performance Summary**

Indicator	1-Year Trend	5-Year Trend	Maine in Comparison to EP-SCoR Most Current Year	Maine in Comparison to U.S. Most Current Year
15-Science and Engineering Degrees Awarded	↑	↓	N/A	↑
16-Higher Education Enrollment among Young People – Chance for College by Age 19	↓	↑	N/A	↑
17a-Math Skills of High School Students 11 <sup>th</sup> Grade MEA Scaled Scores	↔	↔	N/A	N/A
17b-Science Skills of High School Students – 11 <sup>th</sup> Grade MEA Scaled Scores	↔	↔	N/A	N/A
18-Math Gender Equality among High School Students	↔	↔	N/A	N/A
19-Percent of High Schools Offering Advanced Placement Courses	↑	↑	N/A	↓
20-Ability to Pay for College	↑	↑	N/A	↓
<b>Connectivity Capacity</b>				
21-Internet Connectivity	↑	↑	N/A	↓
22-Household Connectivity	↑	↑	N/A	↑
23-High Speed Internet Access	↑	N/A	N/A	N/A
24-Classroom Connectivity	↑	↑	N/A	↔

**Key:**

↑ = Improving Trend or Higher than U.S. Average

↓ = Decreasing or Lower than U.S. Average

↔ = No Change or Equal to U.S. Average

N/A = Not Applicable or Data Not Available

# Research & Development Capacity

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## **INDICATORS:**

**1-Total R&D Performance**

**2-Industry R&D Performance**

**3-Academic R&D Performance**

**4-Not-for-Profit Laboratory R&D Performance**

**5-Federal R&D Obligations**

**6-State R&D Investments**

**7-Research Equipment Expenditures at Academic Institutions**

## Overview

Research and development (R&D) is a driving force in economic growth. It fuels innovation that leads to new industries, new jobs and improved quality of life. R&D activity also attracts and supports a highly educated and skilled workforce.

The overall picture that emerges in Maine from the R&D Capacity indicators is one of growth. Once ranked among the bottom of all states in terms of total R&D levels, Maine has moved closer to the middle of the pack. In 1993 Maine ranked 50<sup>th</sup> among all states in total R&D as a percent of gross state product (GSP). In 2000, the latest year for which data is available, Maine ranked 39<sup>th</sup>.

The most significant development may be the substantial increase in state funding in recent years. The state's investments in R&D have grown from just over \$2 million in 1991 to over \$60 million in 2004. The state of Maine has made a serious commitment to supporting R&D and as the indicators in this index demonstrate, this commitment is beginning to pay off.

Maine has experienced recent improvement in all of its R&D indicators. Maine must maintain its commitment to public investments in R&D. It must also aim to increase the state's share of federal R&D funding and foster an environment that encourages R&D investments by private industry. The indicators in this section measure Maine's progress in achieving these goals.

Most of the R&D performance indicators in this section are expressed as a percentage of GSP. This provides a measure of both the intensity of R&D in the state (How much is occurring?) and the importance of R&D to the economy (What is its impact?). GSP is also the most accurate way of comparing R&D investments in Maine to other states and the nation. Most of the R&D indicators are also expressed on a per worker basis. This allows tracking of performance based on the goals of the state's *30/1000 Initiative* which sets a total R&D target of \$1,000 per worker in an effort to raise per capita income in the state. In order to assess Maine's performance relative to other geographic areas, the R&D indicators in this section are presented in comparison to three reference groups. They are the U.S. as a whole, New England, and states that are part of The Experimental Program to Stimulate Competitive Research (EPSCoR).

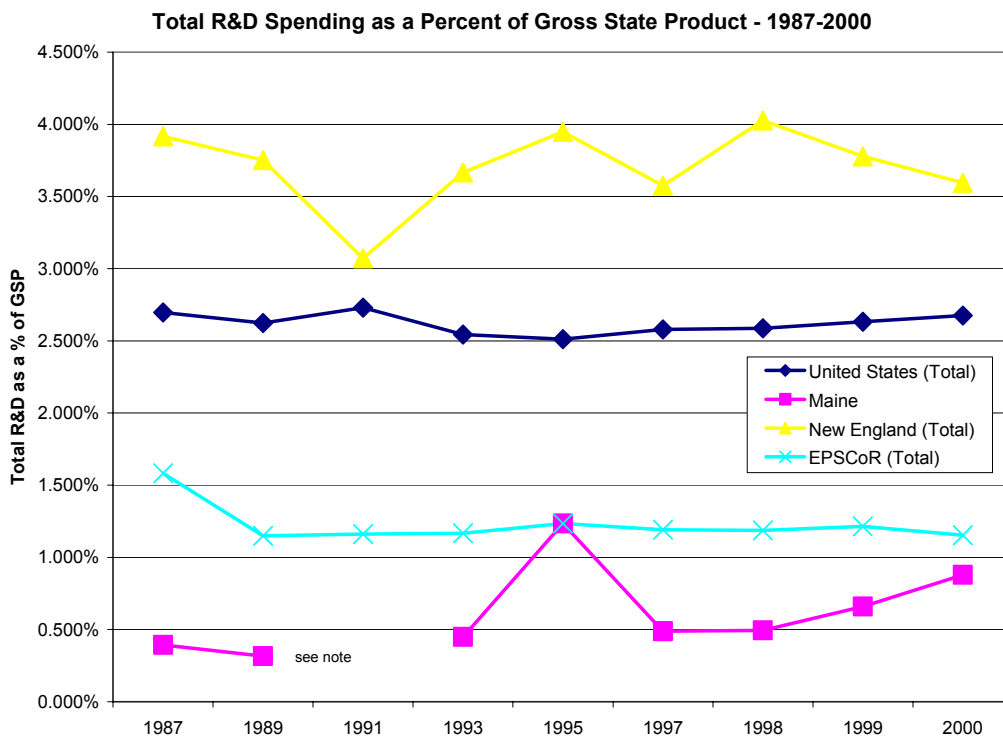
These indicators attempt to present the most complete picture of R&D funding in Maine, but they are limited by the availability of data. For example, nationwide data on state investments in R&D are not available; likewise, figures for R&D spending by not-for-profit laboratories reflect only their federal sources of funding.

# Research & Development Capacity

## 1-Total R&D Performance

### Summary

Since 1989, Maine has made progress in closing the gap in total R&D performance in relation to the reference groups. In 2000, total R&D performance in Maine represented 0.88 percent of gross state product (GSP) compared to 2.68 percent for the U.S., 3.60 percent for New England, and 1.15 percent for the EPSCoR states.

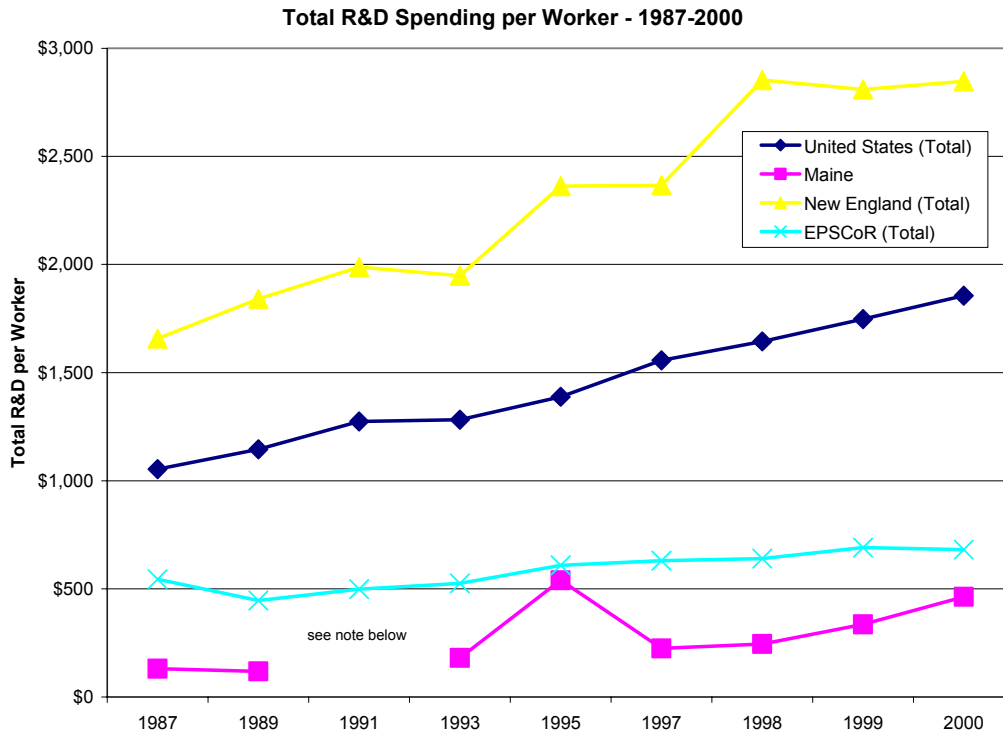


Notes: From 1997 on, chart portrays one-year increments; prior to 1997 data is in two-year increments. 1991 data is not available for Maine because industry R&D data is non-disclosable as reported by the National Science Foundation for that year.

In 1989, total R&D performance in Maine represented 0.315 percent of GSP. Since then Maine has experienced a trend of regular increases in R&D performance. A spike in 1995 occurred when total R&D performance in Maine reached 1.23 percent of GSP. This spike in 1995 was driven by an increase in industry performed R&D, which rose from \$59 million in 1993 to \$286 million in 1995<sup>2</sup>. Overall, the trend of total R&D performance since 1989 has been one of steady increases. This trend has resulted in Maine nearly catching up to its EPSCoR counterparts on this indicator.

In terms of total R&D performance per worker, Maine's equaled \$463 in 2000, up from \$118 per worker in 1989. In 2000, total R&D performed per worker equaled \$1,856 in the U.S. as a whole, \$2,847 in New England, and \$682 for the EPSCoR states.

# Research & Development Capacity



Notes: From 1997 on, chart portrays one-year increments; prior to 1997 data is in two-year increments. 1991 data is not available for Maine because industry R&D data is non-disclosable as reported by the National Science Foundation for that year.

## Why This Is Significant

An innovation economy requires investments in research and development by government, industry, not-for-profit laboratories and academia. This indicator is the most comprehensive measure of R&D capacity in Maine and captures all available sources of data. Expressing R&D expenditures as a percent of gross state product measures both the impact of R&D on the economy and the intensity of R&D that is occurring. R&D per worker provides an indication of the level of R&D as an input to economic activity relative to labor as an input and is consistent with the measurement used by the Maine State Planning Office in its *30/1000 Initiative*. That initiative documented that two factors significantly explain variations in per capita income among states: R&D per worker and the percent of the population 25 years and older with a bachelor's degree or more.

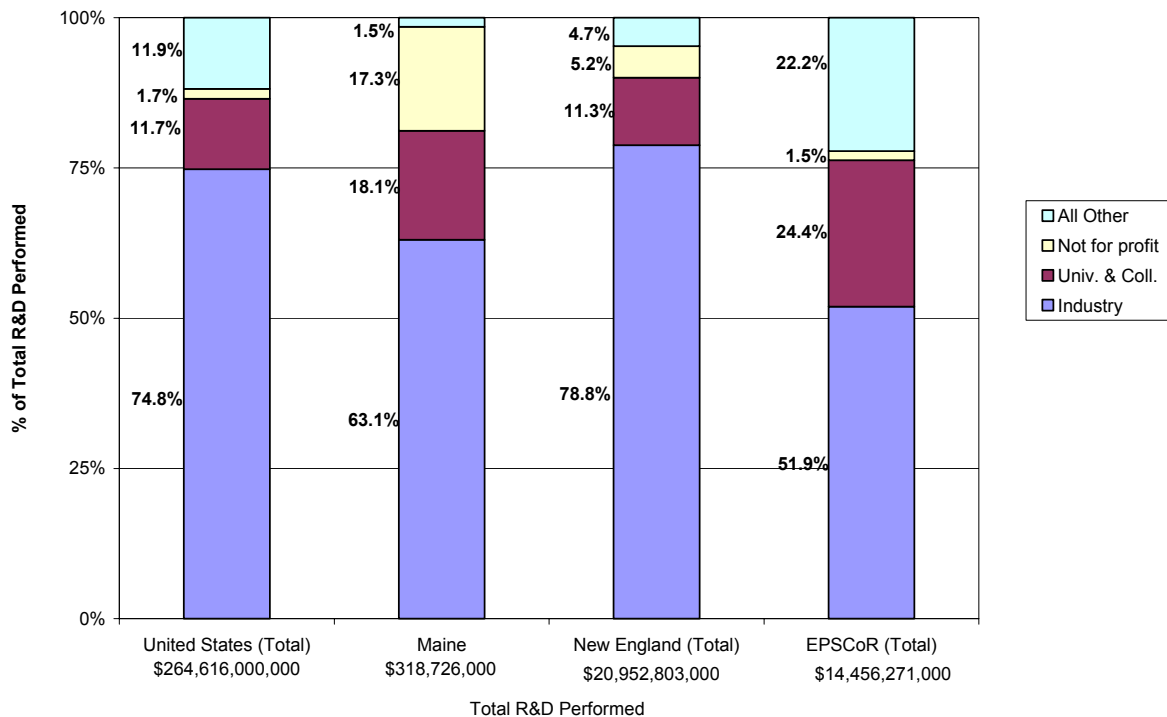
## Related

In 2000, total R&D performed by industry accounted for the largest share of total R&D performance at 63 percent, followed by university and college R&D at 18 percent, and not-for-profit R&D at 17 percent. All other R&D performed accounted for two percent of the total.

In comparison to the reference groups, Maine at 17 percent of total R&D has a much larger share of R&D being performed by the not-for-profit sector. R&D performed by the not-for-profit sector represented 1.7 percent in the U.S. as a whole, 5.2 percent in New England, and 1.5 percent among the EPSCoR states.

# Research & Development Capacity

R&D by Performance Sector - 2000



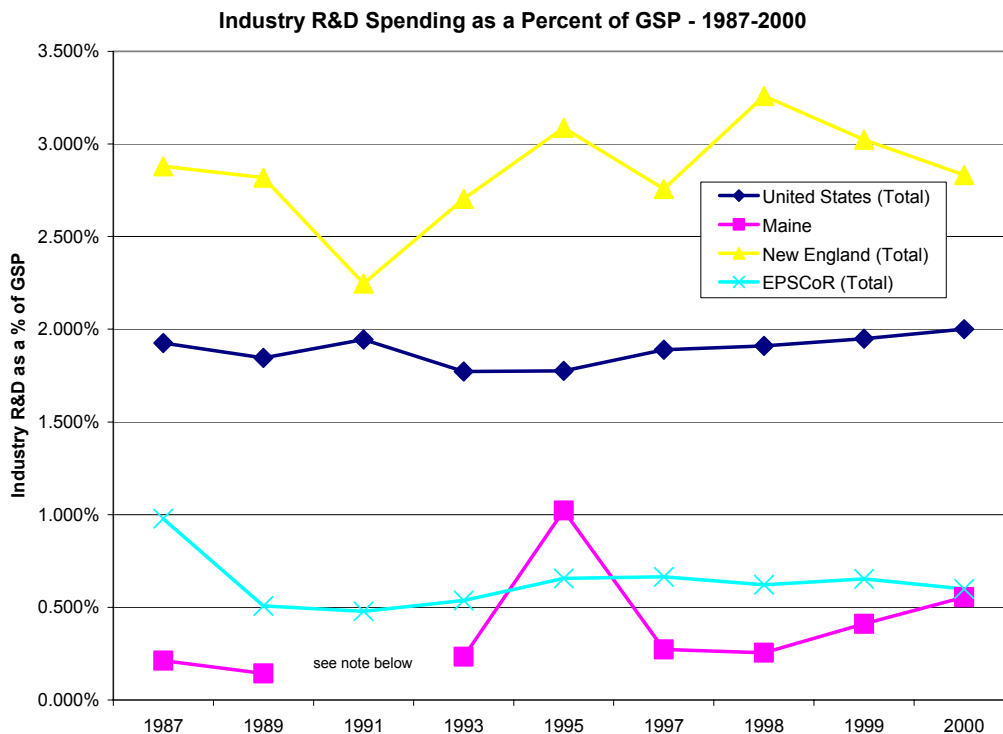
## Sources

Total R&D spending<sup>3</sup> and R&D spending by performer are from *National Patterns of R&D Resources 2002 Data Update*, the National Science Foundation, Division of Science Resources Statistics, <http://www.nsf.gov/sbe/srs/nsf03313/start.htm>. The data is derived from four NSF surveys: *Survey of Industrial R&D*; *Survey of R&D Expenditures at Universities and Colleges*, *Survey of Federal Funds for R&D*, and *Survey of R&D Funding and Performance by Nonprofit Organizations*. Gross State Product is from the Bureau of Economic Analysis, U.S. Department of Commerce, <http://www.bea.doc.gov/bea/regional/gsp/A33>; released May 22, 2003. Worker data is from Civilian Labor Force data, U.S. Department of Labor, Bureau of Labor Statistics, Local Area Unemployment Statistics - <http://www.bls.gov/lau/staadoc.htm>.

## 2-Industry R&D Performance

### Summary

In 2000, industry R&D in Maine represented 0.55 percent of gross state product (GSP). Maine has experienced continual increases since 1987's level of 0.21 percent and is now at a par with other EPSCoR states. However, Maine still lags behind New England and the nation as a whole on this indicator. In 2000, as a percent of GSP, industry performed R&D equaled 2.00 in the U.S., 2.83 percent in New England, and 0.60 percent among all EPSCoR states combined.

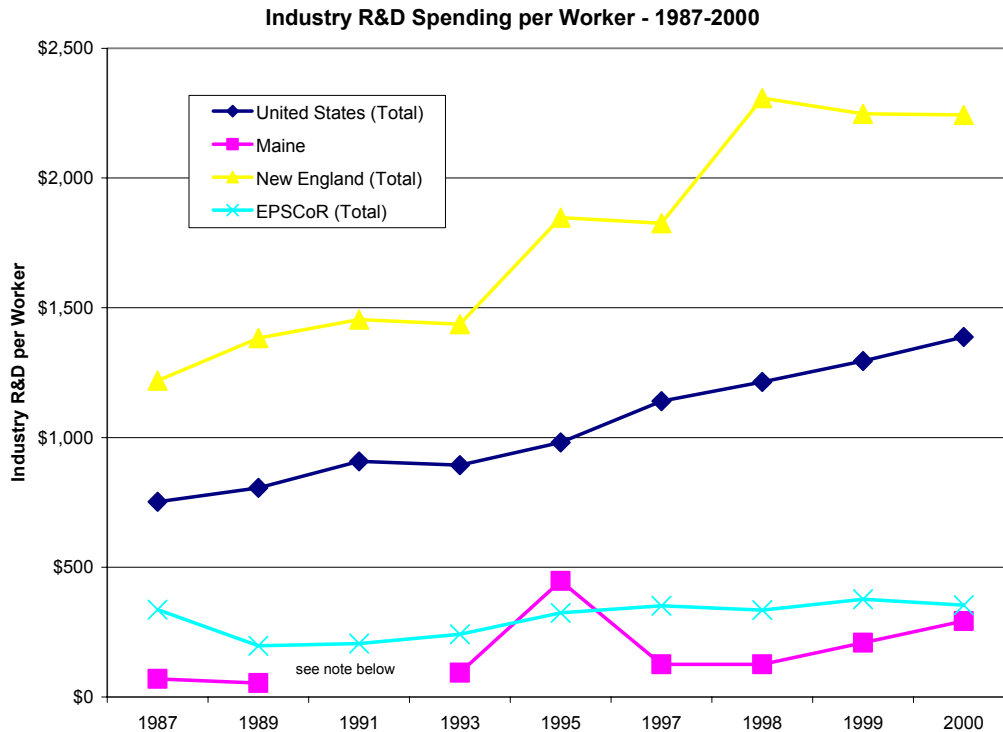


Notes: From 1997 on, chart portrays one-year increments; prior to 1997 data is in two-year increments. 1991 data is not available for Maine because industry R&D data is non-disclosable as reported by the National Science Foundation for that year.

On a per worker basis in 2000, industry-performed R&D represented \$292 per worker in Maine compared to \$1,388 in the U.S., \$2,243 among New England states, and \$354 among EPSCoR states.<sup>4</sup> Maine's progress with industry R&D is highlighted by the fact that between 1997 and 2000, industry R&D in Maine increased 142 percent, from \$83 million to \$201 million. Maine's rate of increase outpaced the reference groups. During this same period industry R&D increased 27 percent in the U.S. as a whole, 27 percent in New England, and four percent among EPSCoR states.



# Research & Development Capacity



Notes: From 1997 on, chart portrays one-year increments; prior to 1997 data is in two-year increments. 1991 data is not available for Maine because industry R&D data is non-disclosable as reported by the National Science Foundation for that year.

## Why This Is Significant

This indicator measures Maine's private sector investments in innovation. Since industry R&D comprises the vast majority of the nation's total R&D investments (75 percent in 2000), R&D by this sector is integral to growing the state's R&D capacity. Industry R&D drives state economic growth by creating high paying jobs for the performance of R&D, increasing productivity, and generating commercialization of new products and services. Industry R&D is particularly important for transforming and growing Maine's economy which has been historically reliant on traditional, natural resource-based industries. R&D can both strengthen these industries as well as create opportunities for new industries in the state.

## Related

In 2000, industry R&D in Maine represented 63.1 percent of total R&D performed compared to 74.8 percent in the nation as a whole, 78.8 percent among New England states combined, and 51.9 percent among EPSCoR states.

## Sources

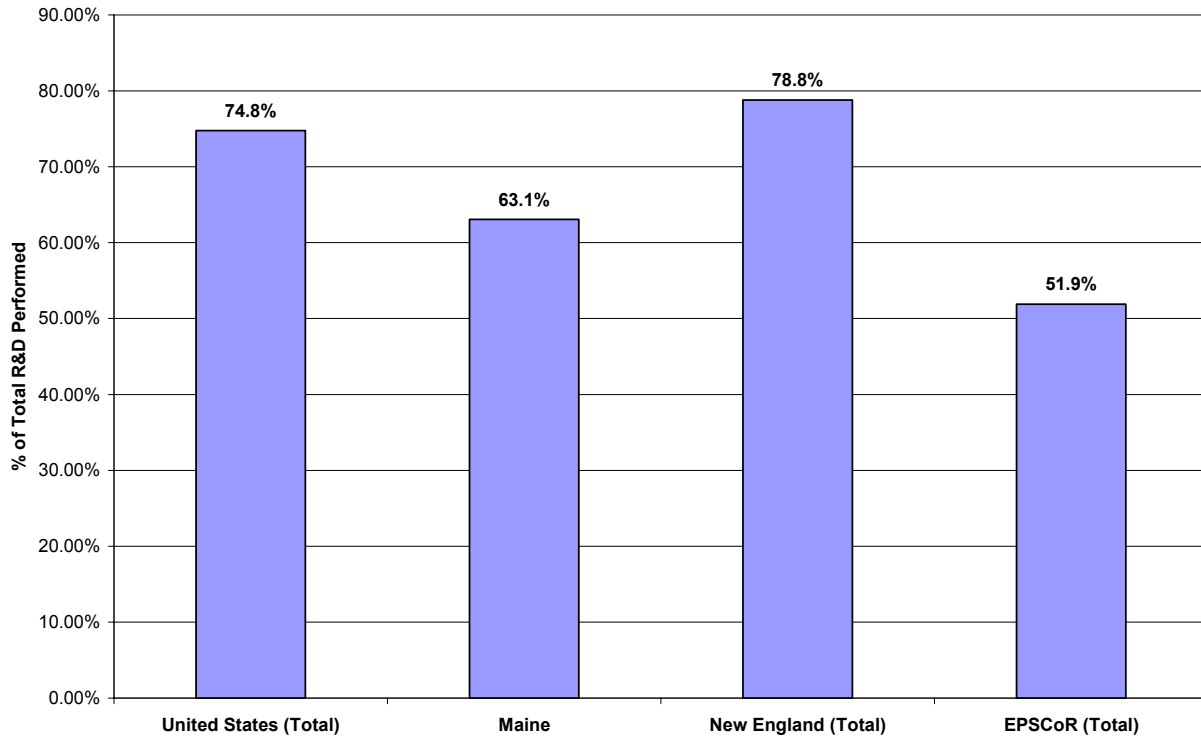
Industry R&D performance<sup>5</sup> is from *National Patterns of R&D Resources 2002 Data Update*, National Science Foundation/Division of Science Resources Statistics and is derived from NSF Survey of Industrial R&D; <http://www.nsf.gov/sbe/srs/nsf03313/start.htm>. Gross State Product is from the Bureau of Economic Analysis, U.S. Department of Commerce, <http://www.bea.doc.gov/bea/regional/gsp/A33>, released May 22, 2003. Worker data is from Ci-

# Research & Development Capacity

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vilian Labor Force data, U.S. Department of Labor, Bureau of Labor Statistics, Local Area Unemployment Statistics - <http://www.bls.gov/lau/staadoc.htm>.

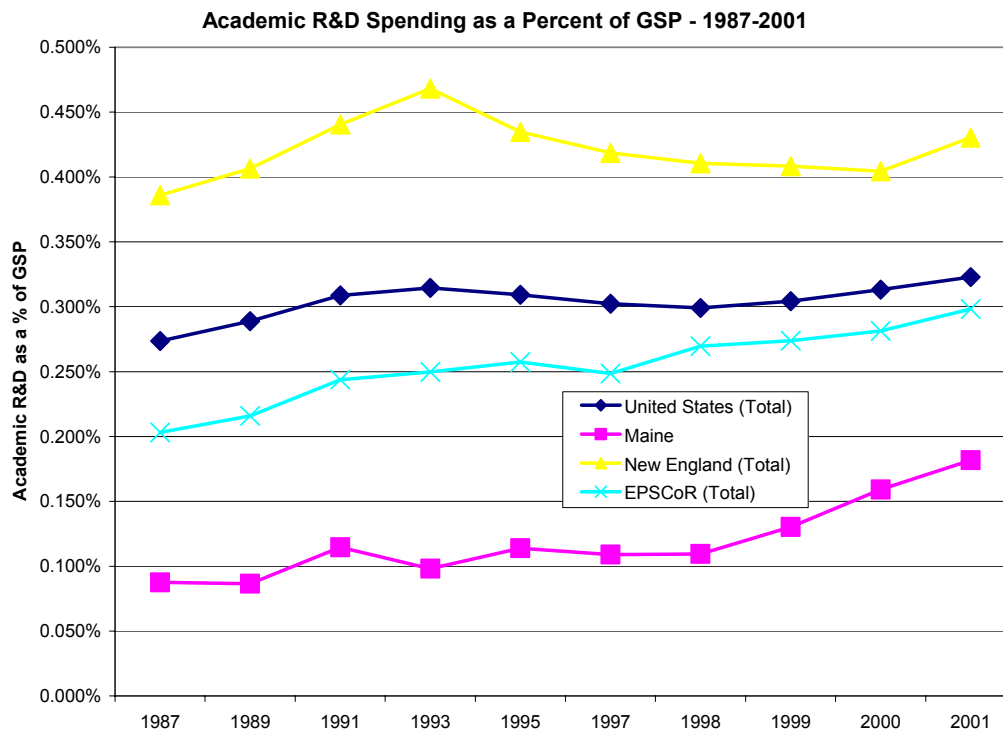
**Industry R&D as a Percent of Total R&D Performed - 2000**



## 3-Academic R&D Performance

### Summary

Maine's growth in academic R&D outpaced the reference groups between 1997 and 2001. During this period academic R&D in Maine increased 105 percent compared to 32 percent in the U.S., 30 percent in New England, and 43 percent among the EPSCoR states. Between 1987 and 1998, R&D performed by Maine's academic institutions remained relatively constant, ranging between a low of 0.087 percent and a high of 0.109 percent as a percentage of gross state product (GSP). Since 1998, Maine experienced steady increases in academic-performed R&D, reaching a level of 0.182 percent in 2001. Maine continues to lag behind the reference groups on this indicator. In 2001, R&D performed at academic institutions represented 0.323 percent of GSP in the U.S. as a whole, 0.430 percent among New England states, and 0.298 percent for all EPSCoR states combined.



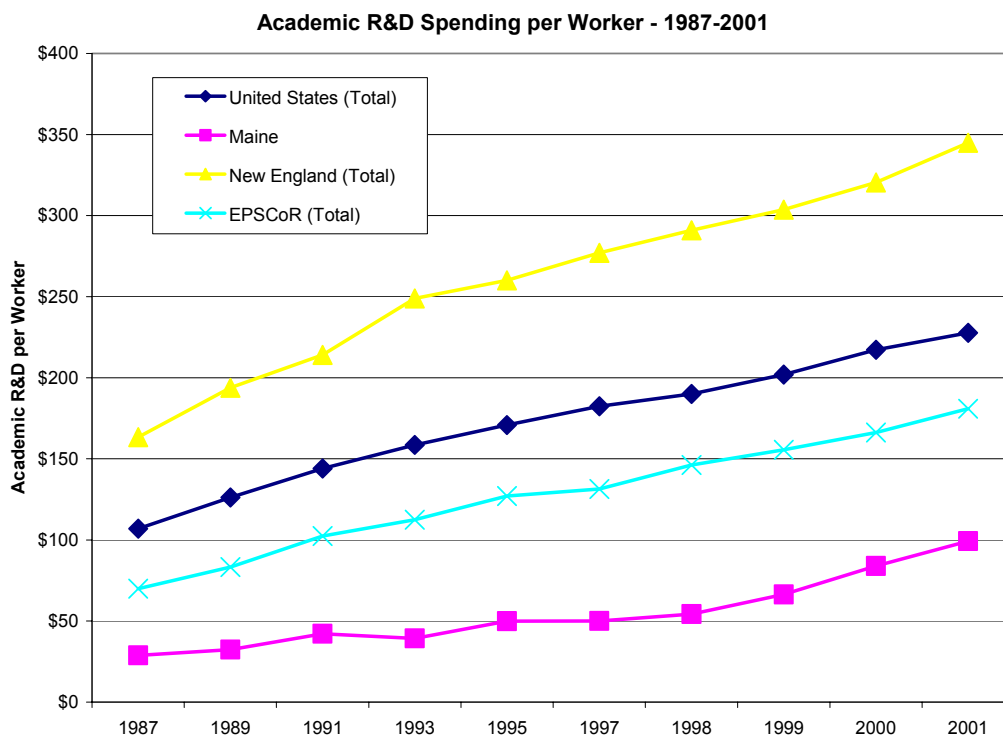
In terms of academic R&D per worker, in 2001, Maine's academic institutions combined performed \$99 worth of R&D per each worker in the state, compared to \$228 for the U.S., \$345 for New England states, and \$181 for EPSCoR states.

### Why This Is Significant

Universities and colleges are a major source of knowledge and innovation. In this knowledge-based economy, businesses increasingly seek to develop partnerships with research-

# Research & Development Capacity

oriented universities and colleges to develop innovative products and identify solutions to business problems. This requires investments in R&D at universities and colleges. This indicator reflects the capacity of Maine universities and colleges to conduct R&D, generate problem-solving innovations and contribute to knowledge-based economic development.



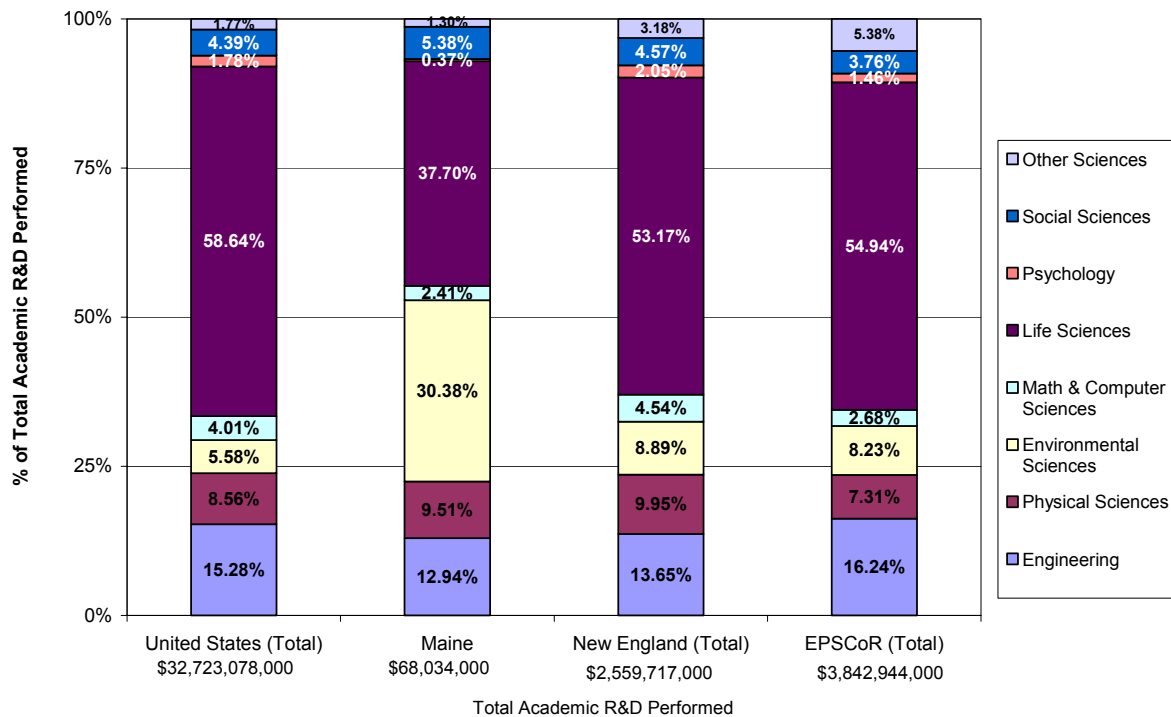
## Related

In 2001, 37.7 percent of all R&D performed by academic institutions in Maine was within the life sciences field.<sup>6</sup> This was the largest field of study for academic-performed R&D in Maine. Environmental sciences followed at 30.4 percent. These two areas – life and environmental sciences – accounted for more than 68.0 percent of academic-performed R&D in Maine in 2001. Percentages for other fields of study for academic-performed R&D in Maine in 2001 included engineering at 12.9 percent, physical sciences at 9.5 percent, social sciences at 5.4 percent, and math and computer sciences at 2.4 percent. All other fields combined accounted for less than 2.0 percent.

In comparison to the reference group, in 2001 Maine had a greater concentration of academic performed R&D in the fields of environmental and social sciences and a lower concentration in the fields of life sciences, engineering, and math and computer sciences. Most notably, while 30.4 percent of Maine's academic-performed R&D in 2001 was in environmental sciences, among the U.S. as a whole, New England, and EPSCoR states, environmental sciences accounted for less than 10 percent of academic-performed R&D.

# Research & Development Capacity

Academic R&D by Field of Study - 2001



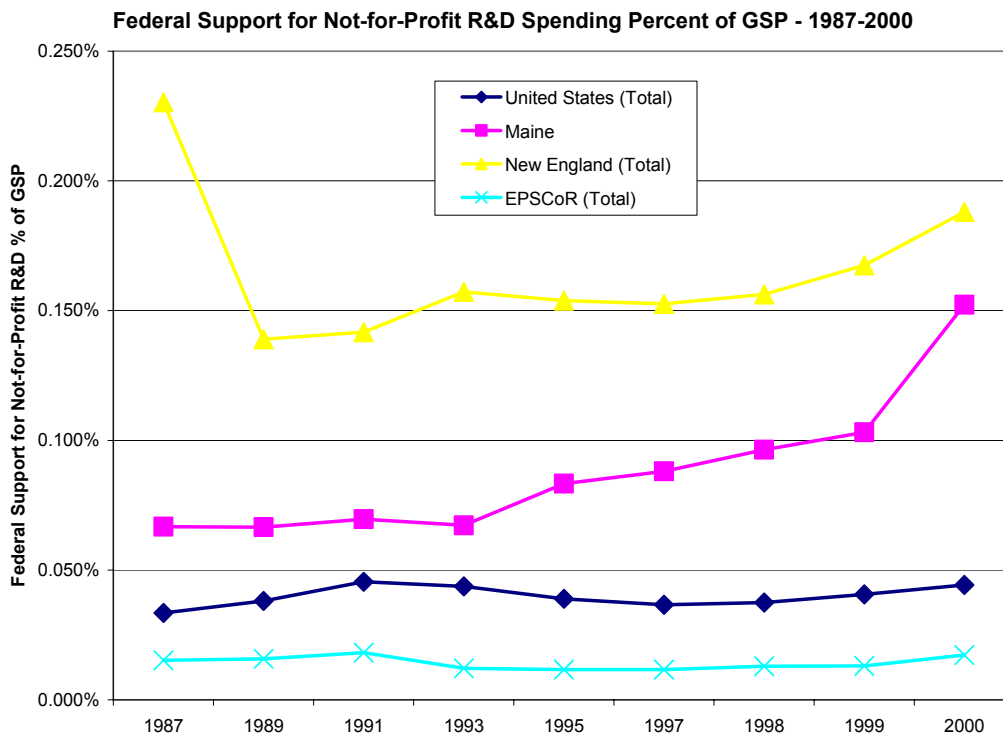
## Sources

Pre-2001 Academic R&D performance data<sup>7</sup> is from the National Science Foundation/Division of Science Resources Statistics; National Patterns of R&D Resources 2002 Data Update, derived from Survey of R&D Expenditures at Universities and Colleges; <http://www.nsf.gov/sbe/srs/nsf03313/start.htm>. 2001 data is from Survey of R&D Expenditures at Universities and Colleges 2001; <http://www.nsf.gov/sbe/sr>. Gross State Product data is from Bureau of Economic Analysis, U.S. Department of Commerce, <http://www.bea.doc.gov/bea/regional/gsp/A33>, released May 22, 2003. Worker data is from Civilian Labor Force data, U.S. Department of Labor, Bureau of Labor Statistics, Local Area Unemployment Statistics - <http://www.bls.gov/lau/stadoc.htm>.

## 4-Not-for-Profit Laboratory R&D Performance<sup>8</sup>

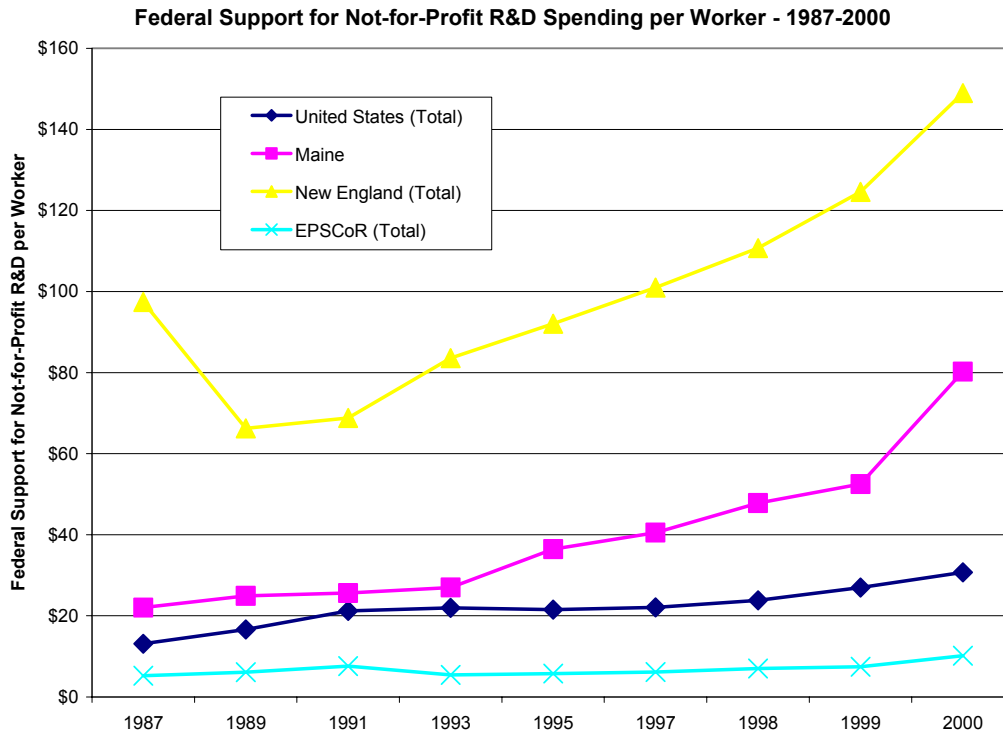
### Summary

Based on the data, Maine is clearly a national leader in R&D performed by not-for-profit research laboratories. Between 1987 and 1993 federal funding for R&D at not-for-profit laboratories in Maine remained relatively stable at levels of approximately 0.07 percent of gross state product (GSP). Since 1993, R&D performed at Maine's not-for-profit research labs from federal sources of funding grew dramatically, reaching 0.152 percent of GSP in 2000. Maine's 2000 level exceeds the level of the nation as a whole at 0.044 percent and the EPSCoR states combined at 0.017 percent of GSP. New England's R&D performed at not-for-profit research labs from federal sources of funding equaled 0.188 percent, slightly exceeding Maine's level.



On a per worker level, R&D performed at Maine's not-for-profit research labs from federal sources of funding equaled \$80 in 2000. This compares to \$31 per worker for the U.S. as a whole, \$149 per worker among New England states, and \$10 per worker among EPSCoR states.

# Research & Development Capacity



## Why This Is Significant

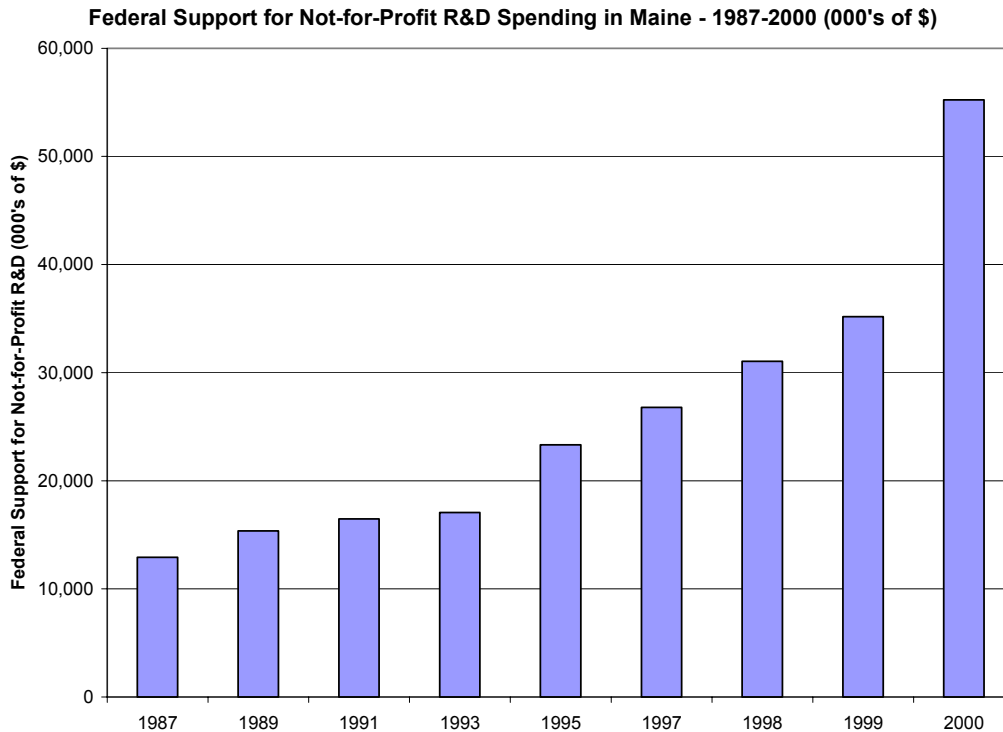
Maine has a robust and economically important not-for-profit research sector. In Maine this sector includes the institutions of Bigelow Laboratory for Ocean Sciences, Foundation for Blood Research, Gulf of Maine Research Aquarium, Jackson Laboratory, Maine Medical Center Research Institute, Mount Desert Island Biological Laboratory, and the Wells National Estuarine Research Reserve.<sup>9</sup> This is significant because Maine has historically lacked private academic institutions, such as a medical school, that focus on R&D. The not-for-profit institutions are involved in various partnerships with the University of Maine which helps increase Maine's overall R&D capacity.

## Related

In terms of absolute dollars, federal funding for not-for-profit R&D performance in Maine has increased from \$13 million in 1987 to more than \$55 million in 2000, an increase of over 320 percent.

# Research & Development Capacity

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## Sources

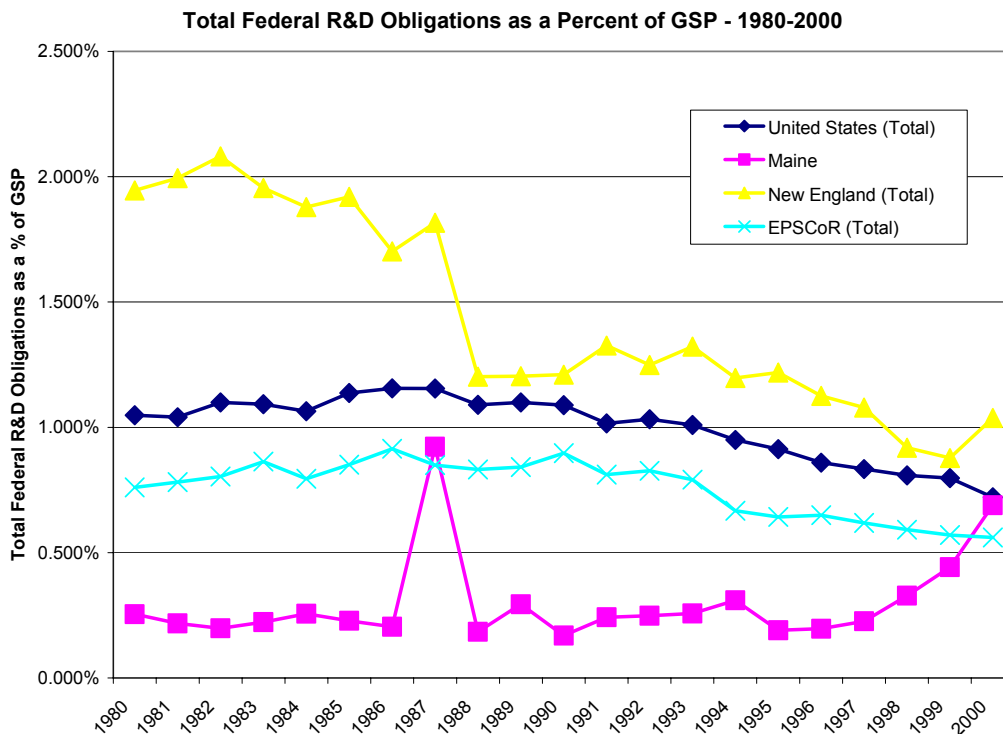
Not-for-Profit R&D performed is from the National Science Foundation/Division of Science Resources Statistics; *National Patterns of R&D Resources 2002 Data Update*, derived from Survey of R&D Funding and Performance by Nonprofit Organizations; <http://www.nsf.gov/sbe/srs/nsf03313/start.htm>. Gross State Product is from the Bureau of Economic Analysis, U.S. Department of Commerce, <http://www.bea.doc.gov/bea/regional/gsp/A33>, released May 22, 2003. Worker data is from Civilian Labor Force data, U.S. Department of Labor, Bureau of Labor Statistics, Local Area Unemployment Statistics - <http://www.bls.gov/lau/staadoc.htm>.



## 5-Federal R&D Obligations

### Summary

Over the last six years for which data is available (1995-2000), Maine experienced an increase in federal funding for R&D.<sup>10</sup> Between 1995 and 2000 federal funding for R&D in Maine increased from 0.19 percent of gross state product (GSP) to 0.69 percent. On this indicator Maine exceeds the level of EPSCoR states as a whole for which federal obligations represented 0.56 percent of GSP in 2000. Maine is on a par with the national level of 0.72 percent and below the New England level of 1.04 percent in 2000.

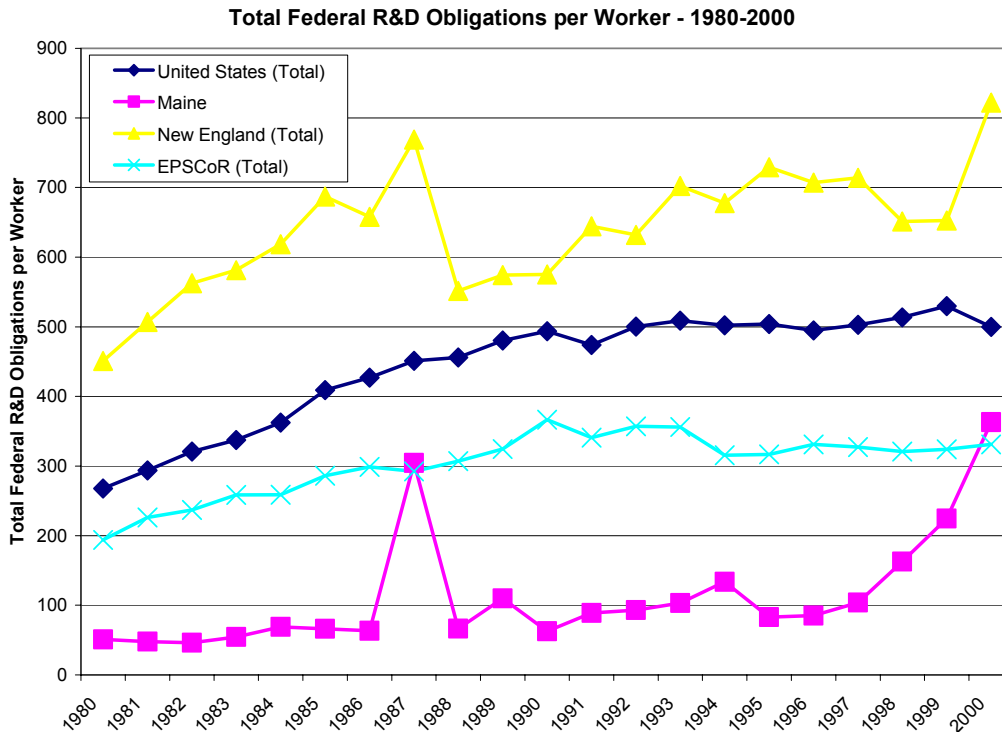


In terms of federal obligations per worker in 2000, Maine received \$363, compared to \$500 for the U.S. as a whole, \$822 for New England states, and \$331 for the EPSCoR states.

### Why This Is Significant

Federal funding is an important source of financial support for R&D, contributing approximately 25 percent of total R&D funding in the U.S. in 2000. This indicator measures Maine's capacity to access federal funds to support its R&D enterprise. State investments in R&D infrastructure build on the capacity of research entities to access federal R&D grants.

# Research & Development Capacity

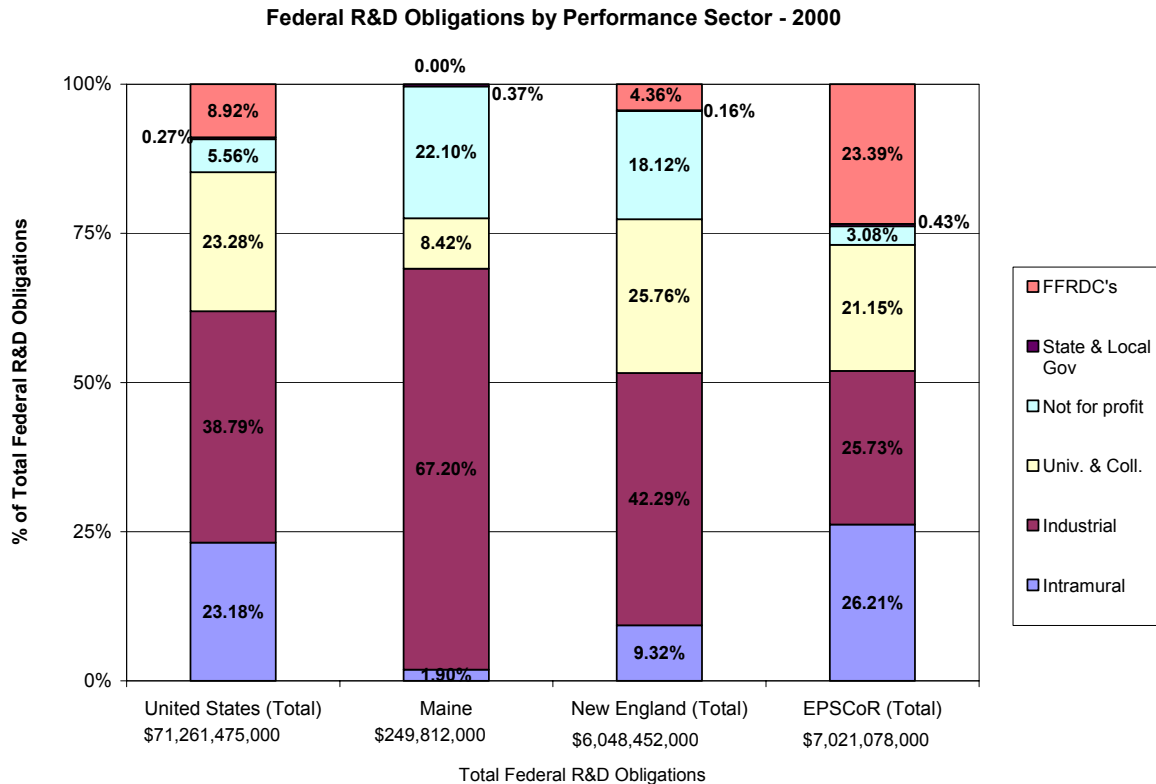


## Related

In 2000, the industry sector was the largest recipient of federally funded R&D in Maine, accounting for 67 percent of the state's federal R&D obligations. Industry was followed by the not-for-profit research laboratories, 22 percent, and universities and colleges, eight percent. All other performance sectors combined received less than three percent of Maine's federal R&D obligations.<sup>11</sup> In comparison to the reference groups - the U.S. as a whole, New England, and EPSCoR states - Maine's federal obligations for R&D are more highly concentrated in the industry and not-for-profit performance sectors and less concentrated in the academic sector.

In the same year, 70 percent of Maine's federal obligations for R&D came from the Department of Defense and 20 percent from the Department of Health and Human Services; all other federal agencies accounted for a total of ten percent. In comparison to the reference groups in 2000, Maine was much more dependent on the Department of Defense for federal R&D obligations.

# Research & Development Capacity



## Source

Federal R&D obligations<sup>12</sup> are from the National Science Foundation/Division of Science Resources Statistics; Survey of Federal Funds for Research and Development: Fiscal Years 2000, 2001, and 2002; <http://www.nsf.gov/sbe/srs/nsf02321/start.htm>. Gross State Product is from the Bureau of Economic Analysis, U.S. Department of Commerce, <http://www.bea.doc.gov/bea/regional/gsp/A33>, released May 22, 2003. Worker data is from Civilian Labor Force data, U.S. Department of Labor, Bureau of Labor Statistics, Local Area Unemployment Statistics - <http://www.bls.gov/lau/staadoc.htm>.

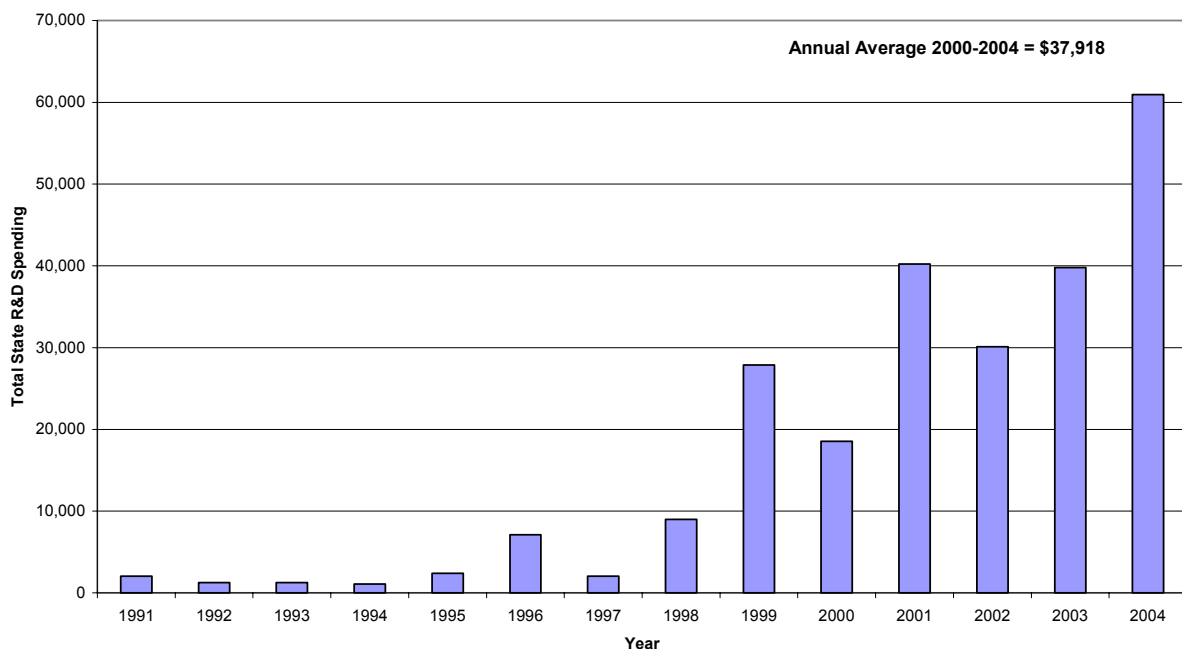
# Research & Development Capacity

## 6-State R&D Investments

### Summary

Since 1991 Maine has dramatically increased state-sponsored investments in research and development. In 1991, Maine had an annual investment level in R&D of just over \$2 million. By 2004, Maine's annual investment exceeded \$60 million. Among this \$60 million is \$24.6 million to the University of Maine System for R&D infrastructure and support, \$20 million for the Biomedical Research Program, and \$5.6 million to the Maine Technology Institute whose purpose is to support Maine businesses and research institutions that use R&D funds to develop commercial products.

State Investment in R&D - Maine - 1991-2004



Source: compiled from state budget and legislative documents, includes state appropriations and bonds

### Why This Is Significant

Maine's state-sponsored investments in research and development are used primarily to build infrastructure and leverage federal and industry research funding. Federal R&D expenditures rarely fund research equipment and facilities. Thus, state investments are essential to build physical R&D capacity and to stimulate successful private/public research partnerships.

### Source

State R&D investment was compiled from the Public Laws of Maine and state budget documents.<sup>13</sup>

# Research & Development Capacity

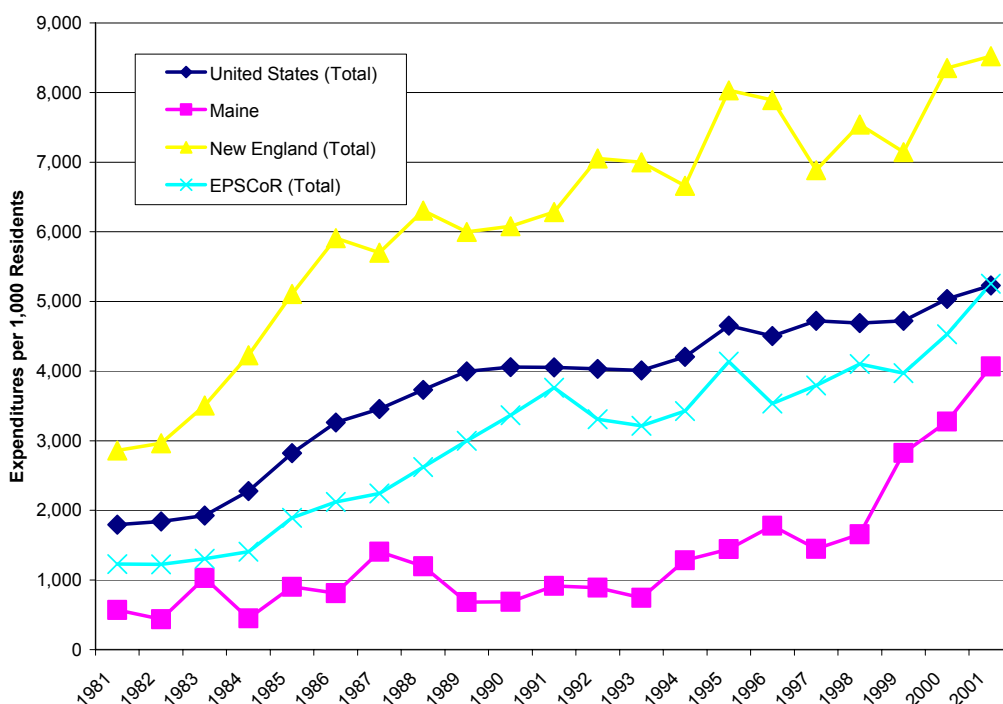
## 7-Research Equipment Expenditures at Academic Institutions

### Summary

Since 1993, expenditures at Maine's universities and colleges for research equipment per 1,000 residents have increased from \$743 in 1993 to \$4,065 in 2001. This represents a 447 percent increase.

With this recent increase in research equipment investments, Maine is beginning to catch up to reference group levels. Nationally, in 2001, \$5,228 per 1,000 residents was expended for research equipment at academic institutions. For the New England states the 2001 level was \$8,521 and for the EPSCoR states, \$5,254.

Research Equipment Expenditures at Universities & Colleges per 1,000 Residents  
1981-2001



### Why This Is Significant

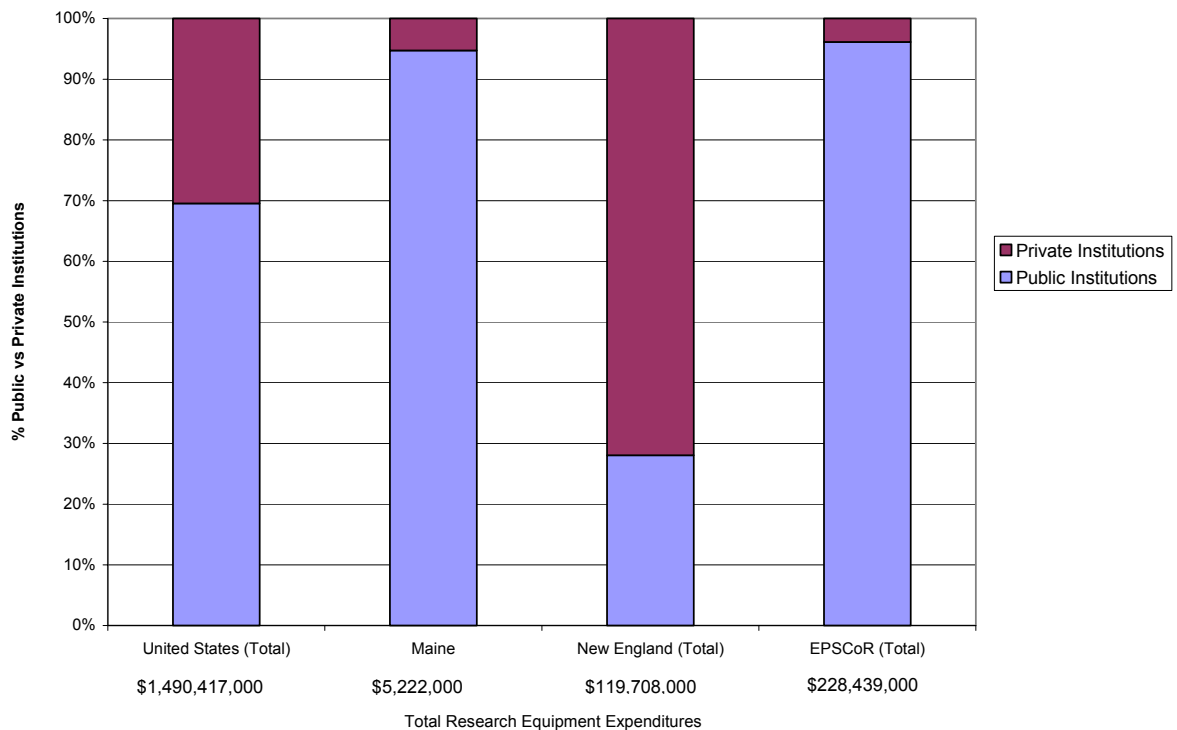
This indicator measures Maine's infrastructure investments that support academic research and development. New purchases of equipment indicate a strengthening of research capacity and the development of new research facilities, renovations and programs. Investments made in research equipment expenditures today will lead to a greater capacity to conduct R&D and attract investment in the future.

# Research & Development Capacity

## Related

Maine and the EPSCoR states have a higher concentration of research equipment investments at public institutions of higher education in comparison to New England states and the U.S. as a whole. In 2001, 95 percent of the investments in research equipment at Maine universities and colleges, and 96 percent among EPSCoR states, were made at public institutions. This compares to 70 percent in the U.S. and 28 percent among New England states. It is clear from this data that Maine lacks private academic institutions that are research-intensive in science and engineering related fields.

**Research Equipment Expenditures - Public vs Private Academic Institutions - 2001**



## Sources

Research equipment expenditures<sup>14</sup> are from the National Science Foundation, Web-CASPAR Database System from "Survey of Research and Development Expenditures at Universities and Colleges"; <http://caspar.nsf.gov>. Population data is from: 1981-1989 Intercensal Estimates of the Total Resident Population of the States, release date Aug. 1996; 1990-1999 - Table CO-EST2001-12-00 - Time Series of Intercensal State Population Estimates; 1990 to April 1, 2000; Population Division, U.S. Census Bureau; release Date: April 11, 2002; July 2000-July 2001 -Table NST-EST2003-01 - Annual Estimates of the Population for the United States and States, and for Puerto Rico: April 1, 2000 to July 1, 2003; Population Division, U.S. Census Bureau; release Date: December 18, 2003.

# *Innovation Capacity*

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## **INDICATORS:**

**8-SBIR/STTR Funding**

**9-Venture Capital Investments**

**10-Patents Issued**

## **Overview**

Financial investment along with knowledge, skill, creativity and ingenuity form a package of ingredients that foster an innovative business environment. Maine's accomplishments in creating this economic growth package are both worthy of praise and in need of improvement.

While Maine is increasing its ranking with New England states and the nation as a whole in funds as a percent of gross state product for Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR), Maine nevertheless, falls behind both New England and the nation as a whole in this area. Another area where Maine is significantly behind other states is the relative level of venture capital investments. This is a key area in need of improvement if Maine is to strengthen its economic environment for technology-based companies and businesses that have high growth potential.

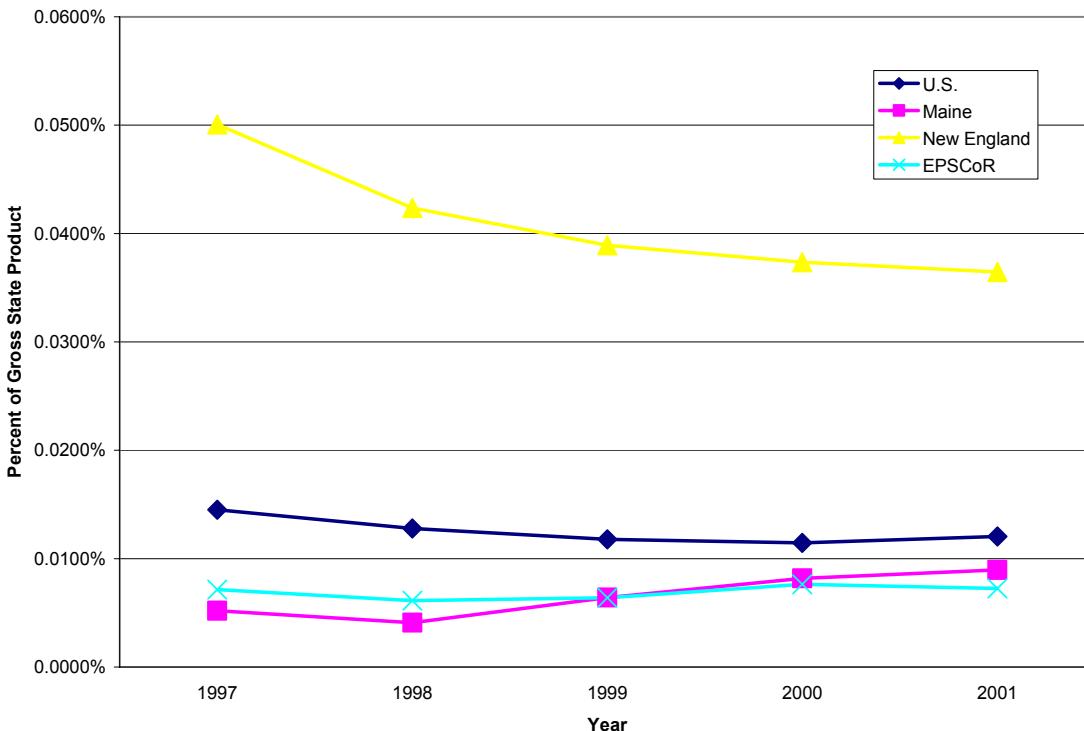
Furthermore, Maine does not have a notable score when one examines the number of patents issued to residents of Maine. Although there was an increase in the 1990's, Maine now finds itself significantly lower than New England and the nation. The number of patents is a concrete measure of attempts at creating potentially valuable commercial products.

## 8-SBIR/STTR Funding

### Summary

Between 1997 and 2002 Maine experienced an increase in SBIR/STTR funding as a percent of gross state product (GSP). In 1997, SBIR/STTR funding in Maine represented 0.0052 percent of GSP; in 2001 it represented 0.0090 percent. While Maine's level of SBIR/STTR funding as a percent of GSP continues to be below the level of New England as a whole, Maine has gained ground since 1997 on the U.S. average for this indicator. In 2001, Maine exceeded the level of all EPSCoR states combined.

Total SBIR/STTR Funding as % of Gross State Product - 1997-2001



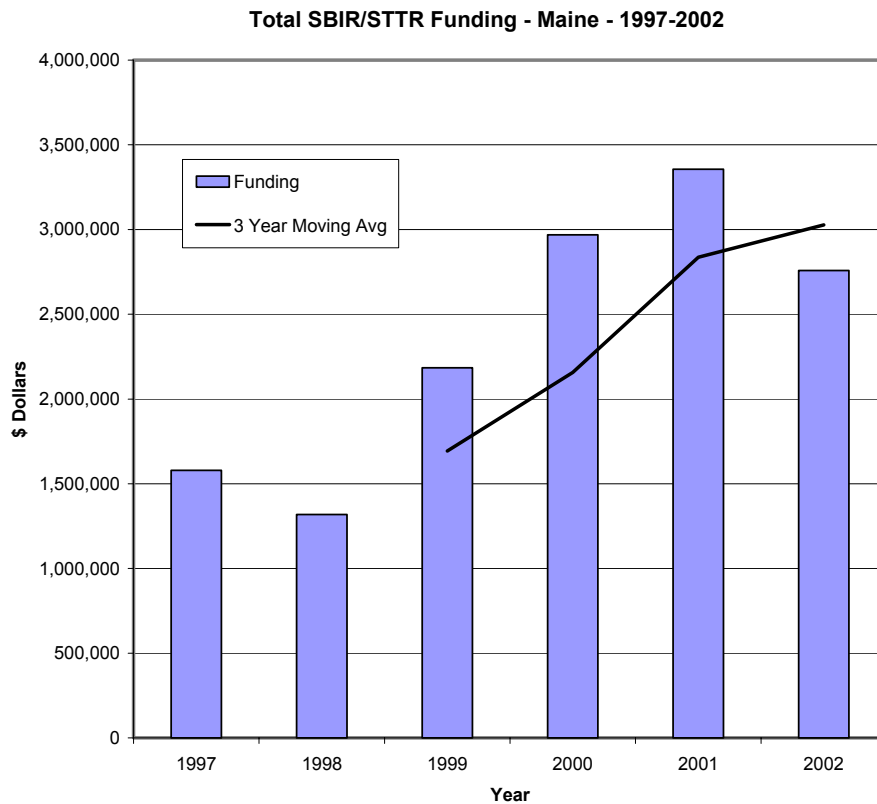
### Why This Is Significant

The Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs are important sources of early stage capital for technology-based entrepreneurs. The U.S. Congress established the SBIR program with the purpose of increasing opportunities for small businesses to participate in federal research and development and to stimulate technological innovation. The program funds high-risk R&D that may have commercial potential. It offers a way for small firms to obtain seed money to do the advanced R&D often necessary to enter into new projects. Similarly, Congress created the STTR program to encourage commercialization of university and federal laboratory R&D by small businesses and to foster the development of partnerships between universities and small firms.



# Innovation Capacity

These programs are valuable in that they help small businesses build scientific and technical leadership in their industries. In an increasingly competitive marketplace, such leadership is key to innovation and the subsequent sales that innovation brings to small firms. Success in winning SBIR awards also is often helpful in attracting outside capital investments. In 2000, the Maine Legislature required the Maine Technology Institute to provide outreach and technical assistance to help businesses access the SBIR program.

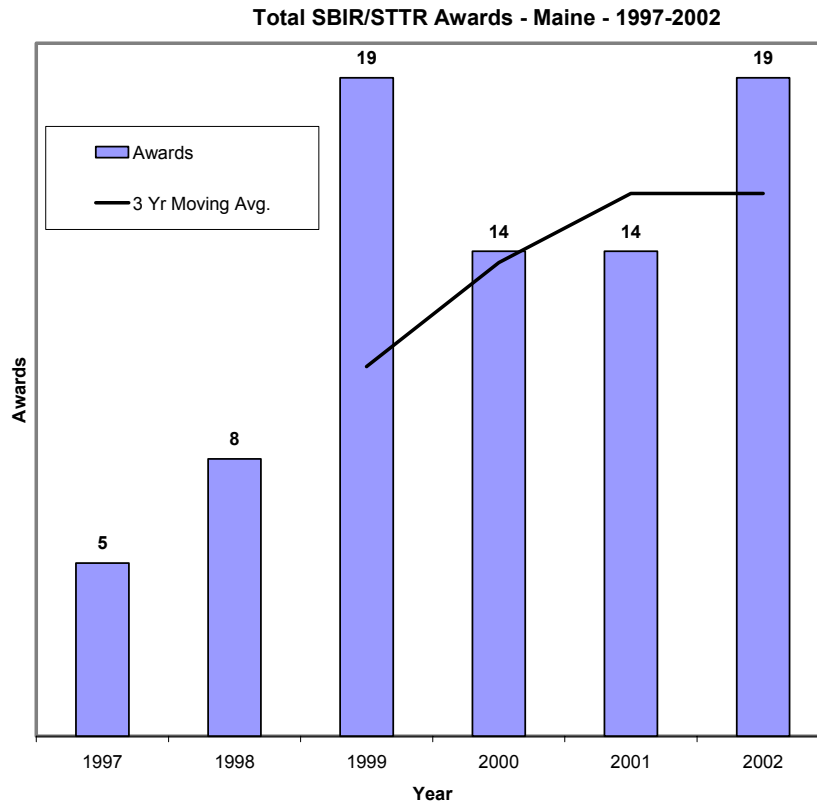


## Related

In 2002 the SBIR/STTR programs provided more than \$1.5 billion nationwide in federally sponsored, early stage capital for entrepreneurial technology-based businesses. In 2002, Maine companies received a total of \$2.8 million in SBIR/STTR awards. During that year, Maine received 19 awards, the highest award level since 1997.

# Innovation Capacity

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## Sources

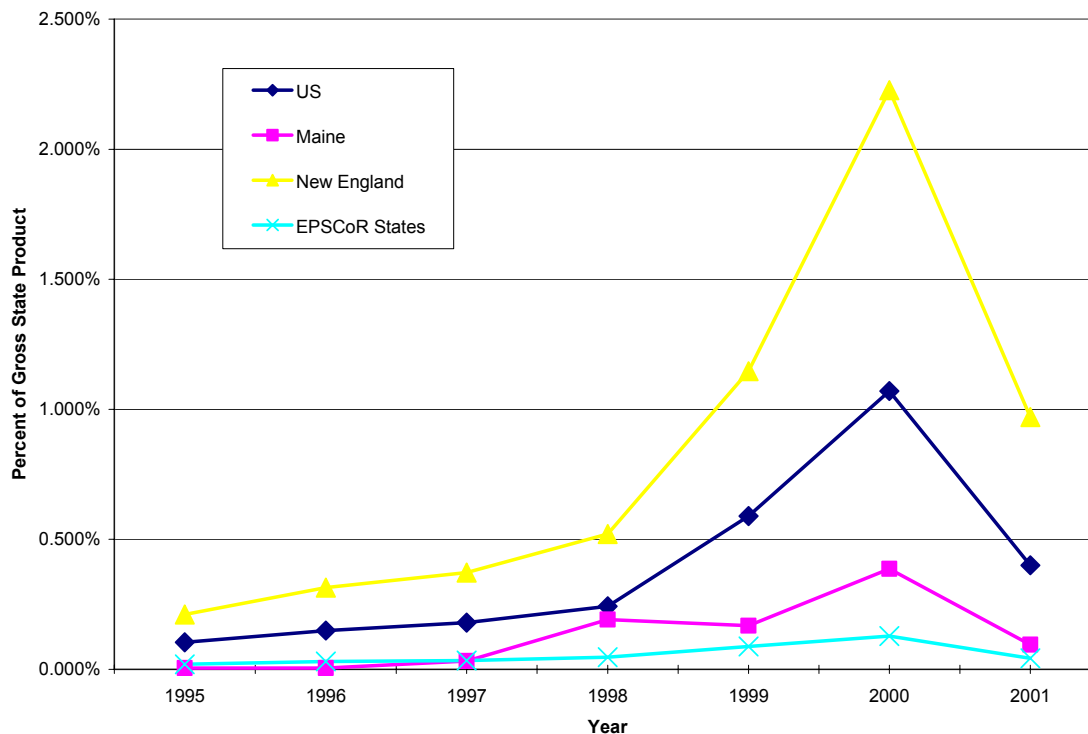
SBIR/STTR data is from the U.S. Small Business Administration, [www.sba.gov/SBIR](http://www.sba.gov/SBIR). Gross State Product data is from the Bureau of Economic Analysis, U.S. Department of Commerce, <http://www.bea.doc.gov/bea/regional/gsp/A33>; released May 22, 2003.

## 9-Venture Capital Investments

### Summary

In 2001, venture capital investments in Maine were 0.10 percent of gross state product (GSP). This was significantly lower than the New England level of 0.97 percent and the total U.S. level of 0.40 percent for the same year, but higher than the 0.04 percent level of all EPSCoR states combined. Historically, Maine's venture capital investments as a percentage of GSP remained relatively low between 1995 and 1997. This was followed by a period of increases to a peak level of 0.39 percent in 2000 before falling to 0.10 percent in 2001.

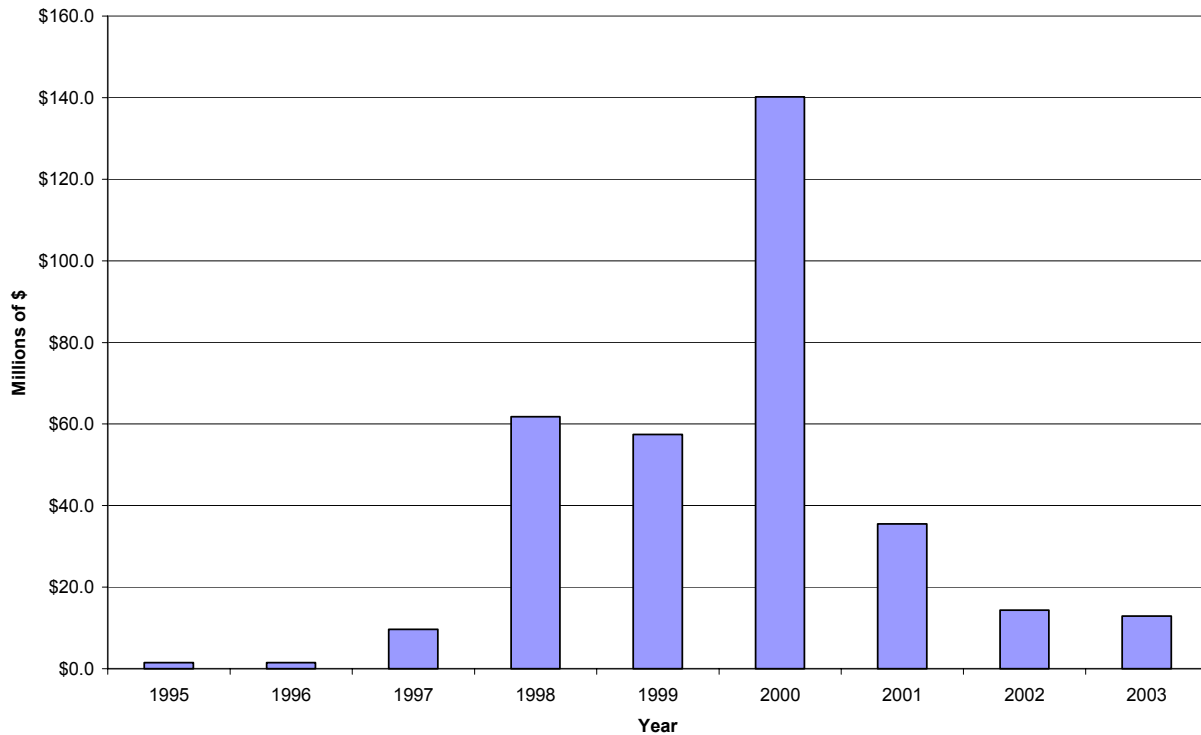
Venture Capital Investments as a Percent of Gross State Product - 1995-2001



Although venture capital data up to 2003 is available, the GSP is not yet available. Therefore, trends in the last two years cannot be fully analyzed. However, absolute venture capital levels for both Maine and the nation were lower in 2002 and 2003 than in 2001. In 2002 there was a total of \$14.4 million in venture capital investments in Maine. This was down from the level of \$140.2 million in 2000 and \$35.5 million in 2001. In 2003 venture capital investments in Maine further declined to a level of \$12.9 million. In terms of actual deals, in 2003 Maine had a total of three venture capital deals; this was down from the 2000 level of fifteen, 2001 level of nine, and the 2002 level of five. It should be noted that in general, trends in Maine's annual venture capital levels mirror the trends across the U.S.

# Innovation Capacity

Venture Capital Dollars Invested - Maine - 1995-2003



## Why This Is Significant

Venture capital is a critical source of funding for technology-based startups and companies with high growth potential. Access to capital is one of the most important success factors for technology companies. States with access to venture capital are more likely to foster the creation of technology-based companies. According to the U.S. Federal Reserve, less than two percent of small business financing comes from venture capital. However, venture capital is significant for companies with the highest growth potential. This includes technology-based companies.

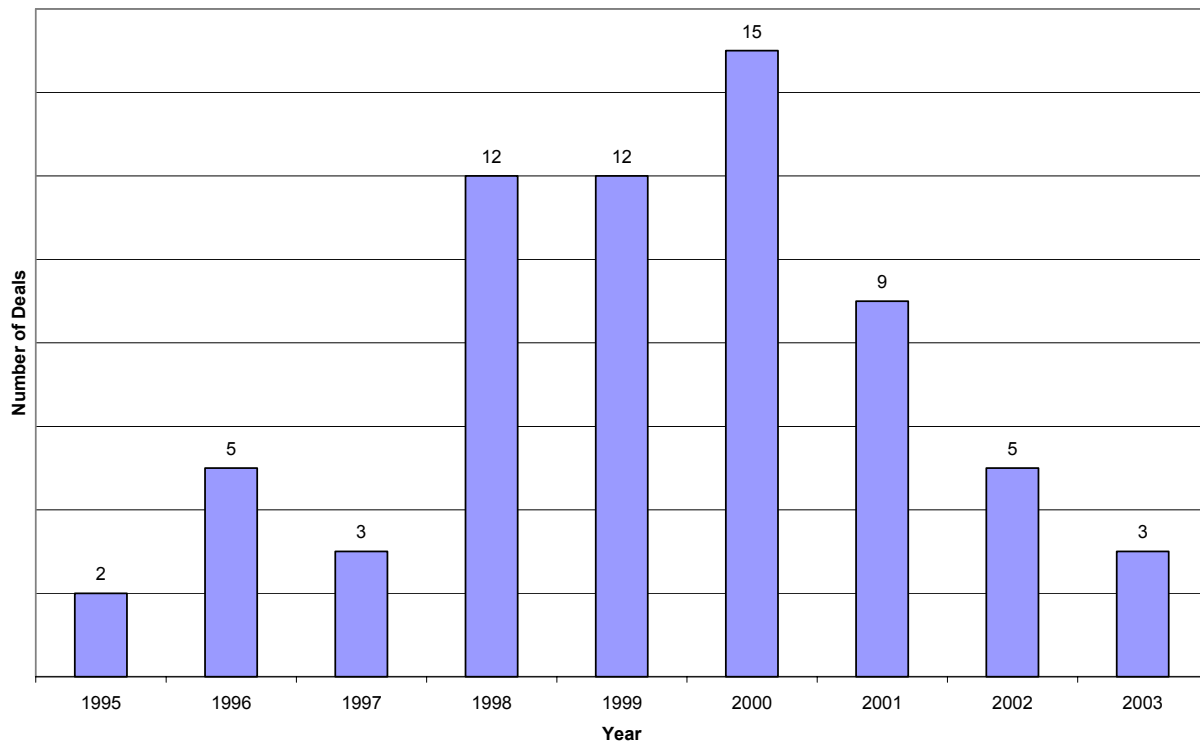
## Related

From 1995 to 2003, Maine companies received a total of \$337 million in venture capital financing. The two largest industry classes in which these investments were made were media and entertainment (\$75 million) and business services (\$58 million). These were followed by information technologies (\$46 million), software (\$37 million.), and healthcare services (\$37 million).

# Innovation Capacity

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Venture Capital Deals - Maine - 1995-2003

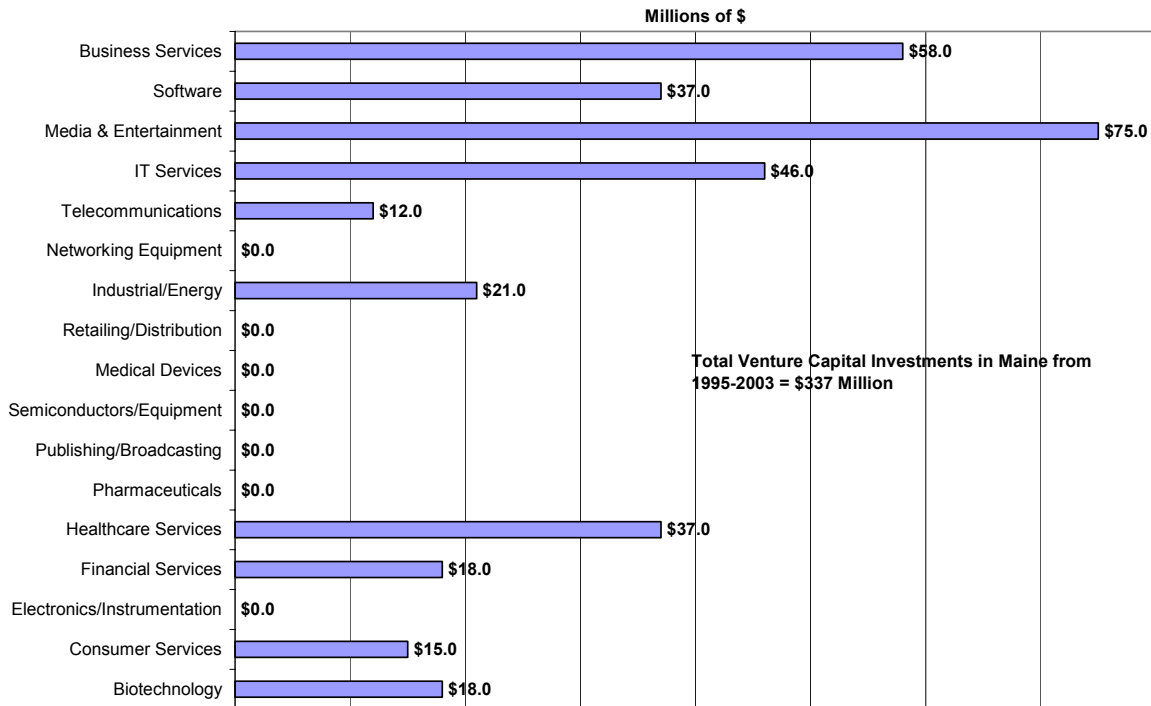


## Sources

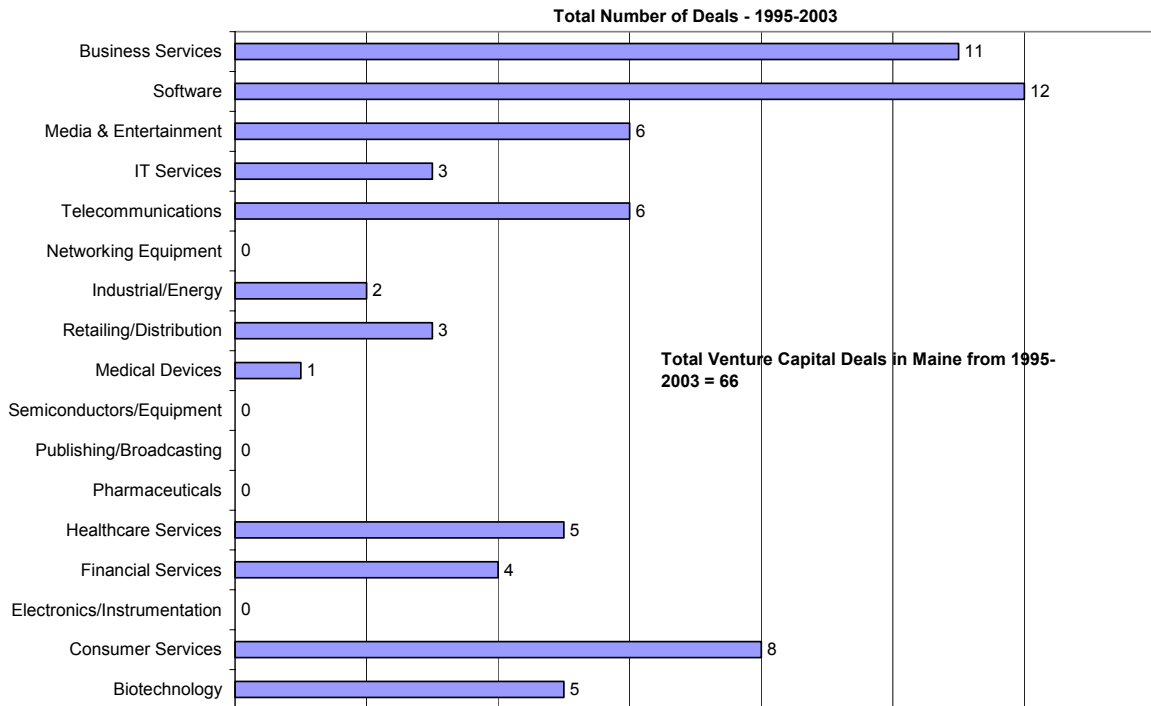
Venture capital investments data are from MoneyTree “Venture Capital Profiles by State”, based on PricewaterhouseCooper/Venture Economics/National Venture Capital Association Surveys; <http://www.ventureeconomics.com/vec/stats><sup>15</sup>. Gross state product is from the Bureau of Economic Analysis, U.S. Department of Commerce, <http://www.bea.doc.gov/bea/regional/gsp/A33>, released May 22, 2003.

# Innovation Capacity

Venture Capital Dollars Invested by Industry Sector- Maine - 1995-2003



Venture Capital Deals by Industry - Maine - 1995-2003

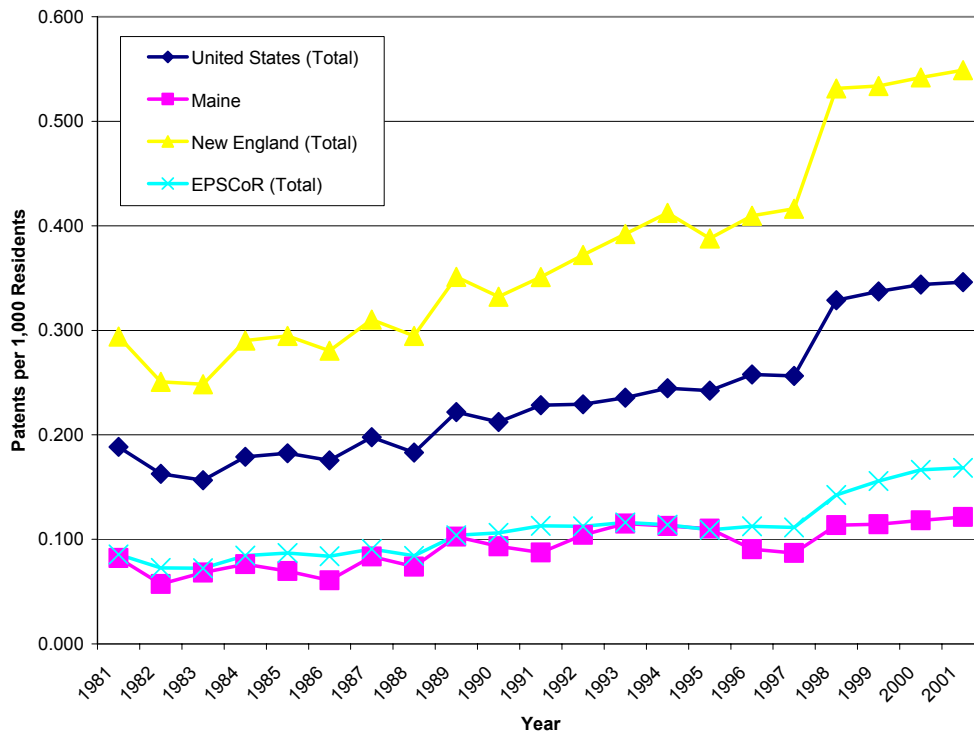


## 10-Patents Issued

### Summary

The number of patents issued to residents<sup>16</sup> of Maine is less than one-third the national average. In 2001 there were 0.12 patents issued per 1,000 Maine residents in comparison to 0.35 for the U.S. as a whole, 0.55 in New England, and 0.17 among the EPSCoR states. This trend has remained relatively consistent over the past two decades with a few exceptions. In 1980, 0.06 patents per 1,000 were issued for Maine, compared to 0.18 for the U.S. In the mid-1990s, Maine narrowed the gap in patents issued to slightly more than half the national average. However, in the last six years the gap widened once again, as the number of patents issued nationally rose steeply, outpacing the increase in Maine.

Patents Issued (all types) per 1,000 Residents - 1980-2001



### Why This Is Significant

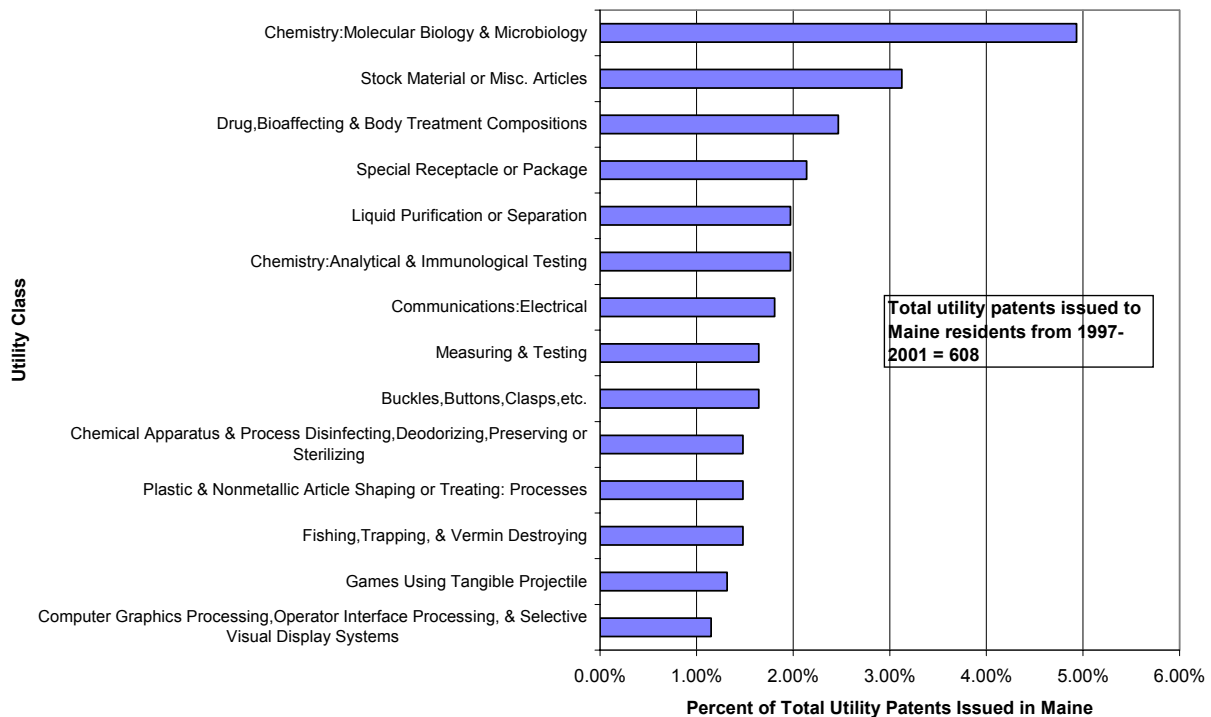
Patent activity indicates the level of innovative thinking and research that eventually may lead to commercialization of new products and services. Individuals and companies seek patent protection in anticipation of the commercial value and marketability of their new ideas. In 2000, Maine created the Maine Patent Program to provide patent assistance to businesses and individuals.

# Innovation Capacity

## Related

Between 1997 and 2001, there were a total of 608 utility patents<sup>17</sup> - that is, patents for inventions - issued to Maine residents. The largest percent of these fell within the classification entitled “Chemistry: Molecular Biology and Microbiology,” which accounted for nearly five percent. Other significant utility classes in Maine since 1997 include Stock Material, Drug, Bio-affecting and Body Treatment Compositions, Special Receptacle or Package, Liquid Purification, Chemistry for Analytical and Immunological Testing, Communications: Electrical, Measuring and Testing, and Buckles, Buttons, Clasps, etc.

**Utility Patents Issued by Class - Maine - 1997-2001 - Top Technology Classes according to Number of Patents Issued**



## Sources

Total patents issued is from “Patent Counts by Country/State and Year, All Patents, All Types, 1/1/1977-12/31/01,” U.S. Patent and Trademark Office, [www.uspto.gov](http://www.uspto.gov). Population is from Population Estimates Program, Population Division, U.S. Census Bureau, [www.census.gov/population/estimates](http://www.census.gov/population/estimates). Utility patent data are from “Patenting by Geographic Region (State and Country), Breakout by Technology Class, 1997-2001 Utility Patents, Grants by Calendar Year of the Grant.” U.S. Patent and Trademark Office, [www.uspto.org](http://www.uspto.org).



# *Employment Capacity*

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## **INDICATORS:**

**11-High Technology Employment**

**12-Net High Technology Business Formations per 10,000 Business Establishments**

**13-Ph.D. Scientists and Engineers in the Labor Force**

## Overview

Employment is one of the primary economic outcome measures. While technology industries span a wide range of economic activity and exhibit different patterns of growth and contraction, they account for an expanding share of total employment.

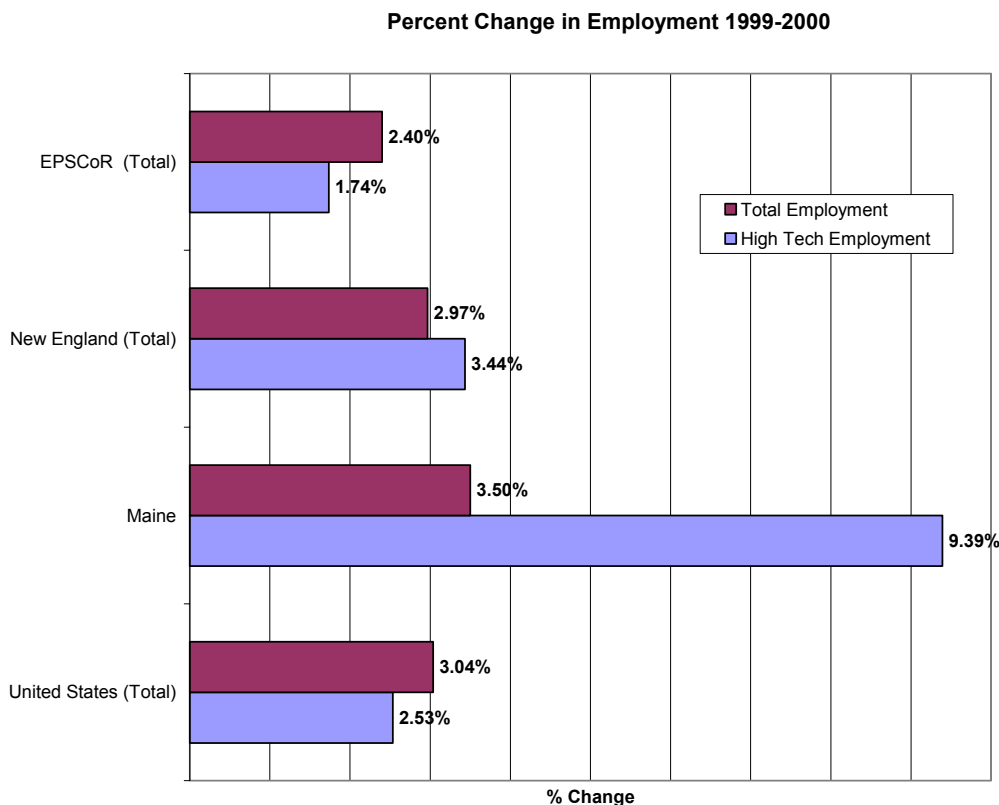
Innovation lies at the core of technology-intensive growth. Research generates new ideas and the ability to use those ideas to create new products, processes and services. This economic activity tends to occur most intensely where clusters of companies constellate around leading research universities, developing a deep pool of skilled workers and networks of investors and entrepreneurs who can turn innovative ideas into new or improved products and services. A central requirement for this innovation-driven economic growth is a skilled workforce which includes an adequate number of Ph.D. scientists and engineers.

In Maine, technology-intensive companies experienced strong employment growth in 1999-2000, outpacing growth rates among the reference groups. However, the state still has a way to go towards creating a technology-driven workforce. Relatively speaking, when it comes to Ph.D's in the workforce, Maine has a significantly smaller pool to draw upon than other states nationwide, particularly in fields such as computers, information sciences and engineering. This shortage of Ph.D. scientists and engineers imposes a potential restraint on Maine's knowledge-based economic growth.

## 11-High Technology Employment

### Summary

In 2000 Maine had a total employment level of 491,780 workers. Of that amount, 26,310 were in high technology businesses.<sup>18</sup> The importance of high technology employment is growing in Maine. Between 1999 and 2000, employment in Maine's technology-intensive industries grew at a higher rate than employment in non-technology-intensive industries. During this period, employment in Maine's technology-intensive industries grew 9.4 percent in comparison to 3.5 percent for all industries combined. Maine's high technology employment growth level between 1999 and 2000 exceeded the levels of the reference groups: During this period, high technology employment grew 2.5 percent in the U.S. as a whole, 3.4 percent in New England, and 1.7 percent among the EPSCoR states.



### Why This Is Significant

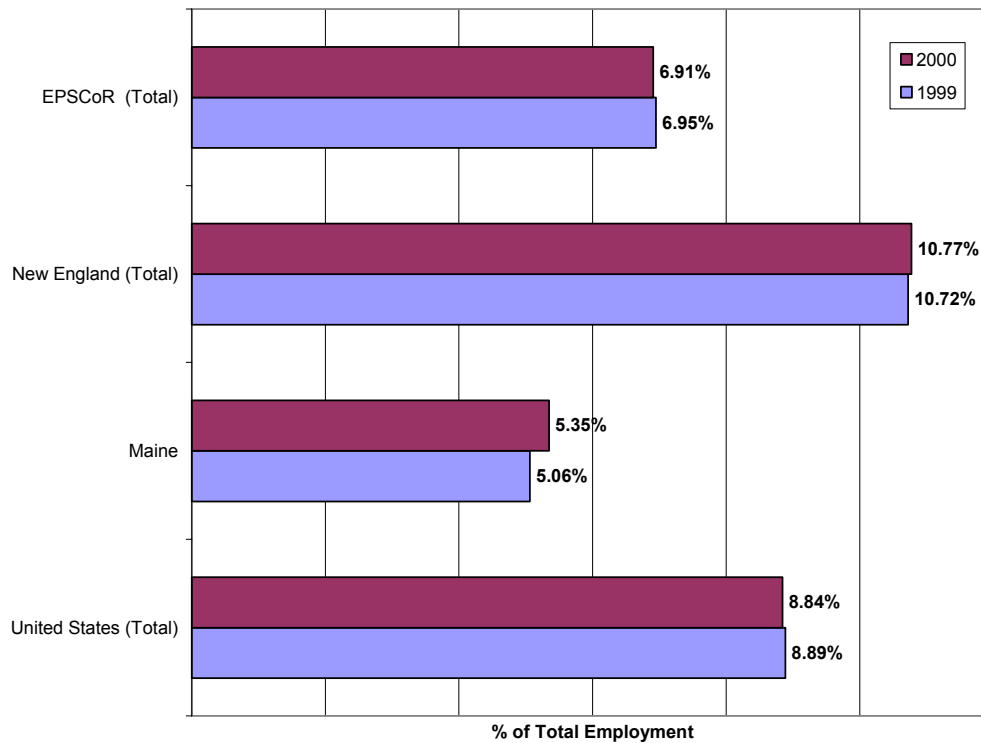
High technology job growth is an outcome indicator of Maine's ability to build, recruit and retain an educated and technically skilled workforce. It measures the level of employment opportunity created by the Maine economy. High technology jobs typically pay higher wages than non-technology related jobs. Therefore, employment growth in technology-intensive businesses helps increase the standard of living among Maine residents.

# Employment Capacity

## Related

While Maine's employment in high technology industries is growing in importance, the state still has a way to go towards creating a technology-driven workforce. In 2000, 5.4 percent of Maine's employment was in high technology industries compared to 8.8 percent in the U.S. as a whole, 10.8 percent in New England, and 6.9 percent among EPSCoR states.

Percent of Employment in High Technology Sectors 1999-2000



## Sources

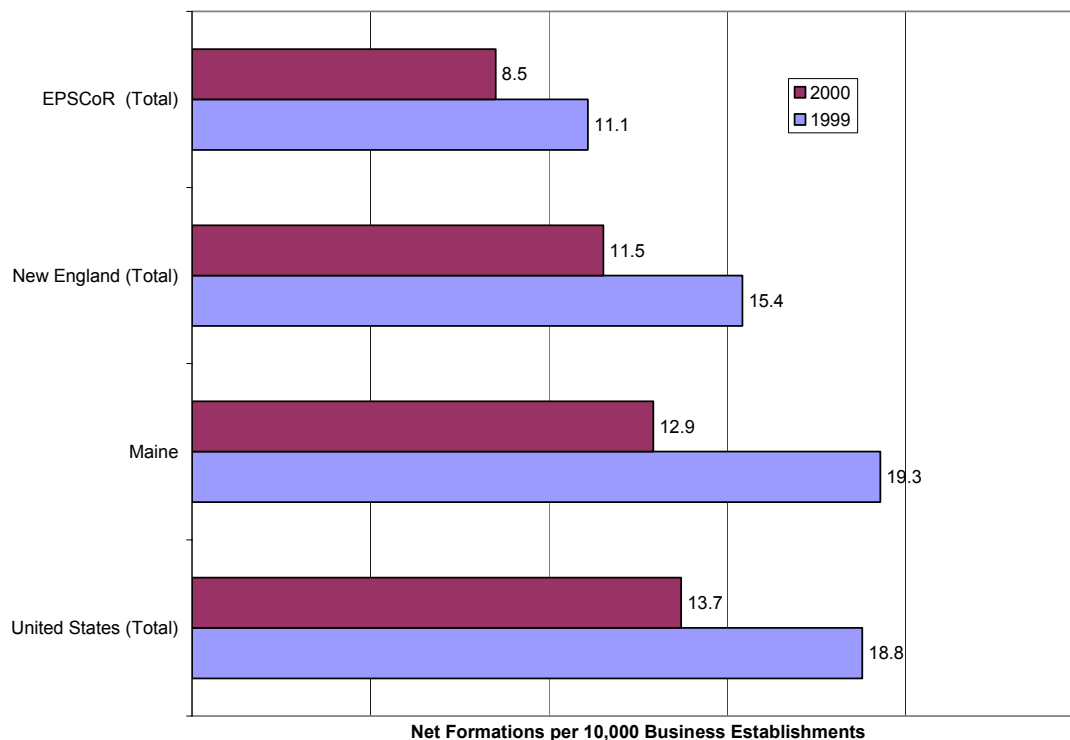
High technology employment data is based on special data tabulations from the County Business Patterns, U.S. Census Bureau, U.S. Department of Commerce. Total employment is from U.S. Census Bureau, County Business Patterns, and is available at <http://www.census.gov>.

## 12-Net High Technology Business Formations per 10,000 Business Establishments

### Summary

Net high technology business formations per 10,000 business establishments is a measure of the vibrancy of the technology sector relative to the rest of the economy.<sup>19</sup> In 2000, Maine's net high technology business formations per 10,000 business establishments equaled 12.9. This compared to 13.7 for the U.S. as a whole, 11.5 in New England, and 8.5 among the EPSCoR states.

Net High Technology Formations per 10,000 Business Establishments - 1999-2000



### Why This Is Significant

This indicator is a comprehensive measure of how successful a region is at growing the technology sector. It accounts for new business creations (or births), business failures (or deaths), and the total number of businesses in an area.

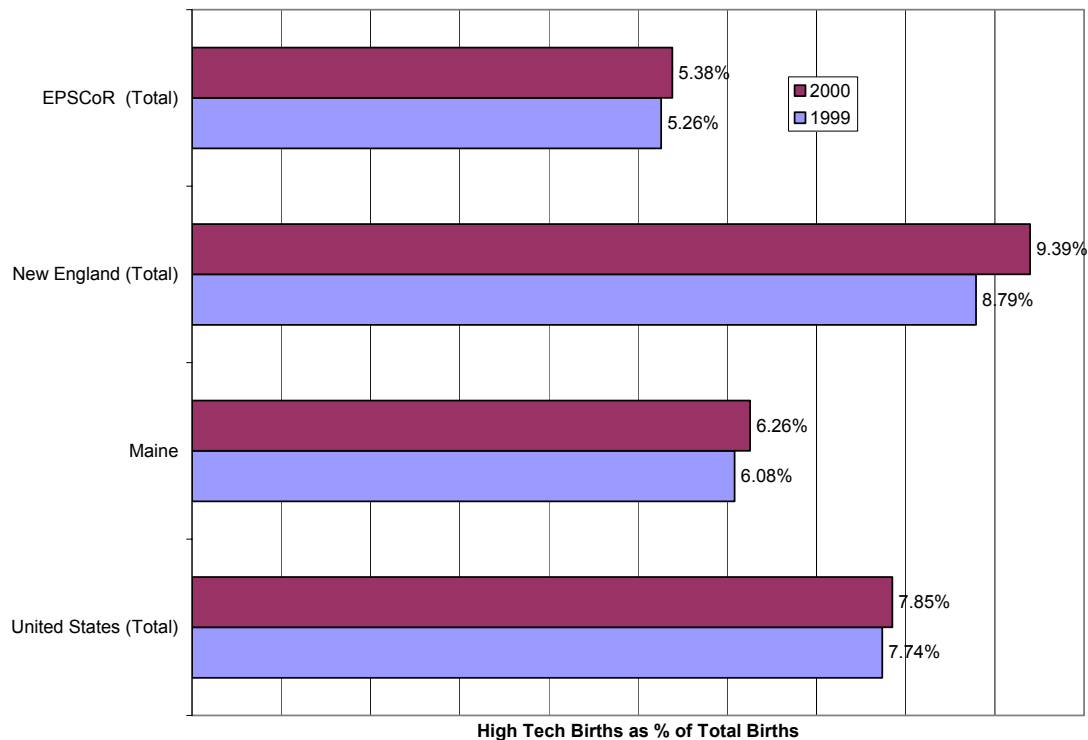
### Related

In order to grow the technology sector Maine must provide an environment that is conducive to new business formation. One measure of this is establishment births. In 2000, Maine had a total of 3,692 business establishment births. Of that amount 6.3 percent were in high tech-

# Employment Capacity

nology industries. This compares to 7.9 percent for the nation as a whole, 9.4 percent in New England, and 5.4 percent for the EPSCoR states.

**High Technology Business Births as a Percent of Total Business Births - 1999-2000**



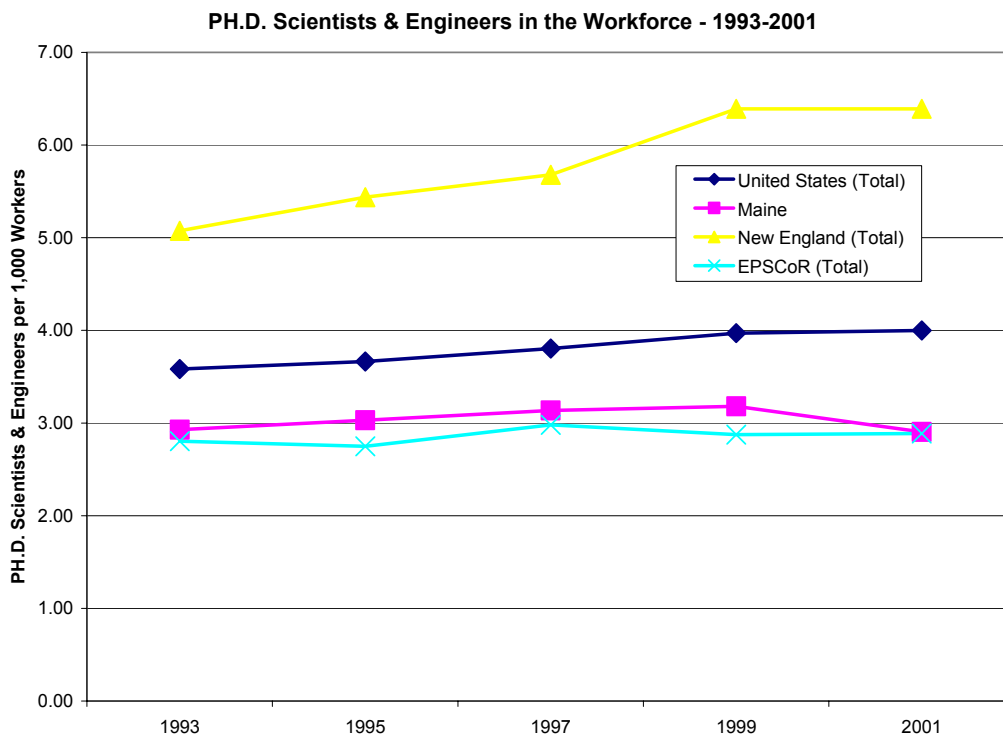
## Sources

High Technology Births, Deaths, Establishments, and Net Formations are based on special data tabulations from the County Business Patterns, U.S. Census Bureau, U.S. Department of Commerce. Total Establishments is from U.S. Census Bureau, County Business Patterns, <http://www.census.gov>.

## 13-Ph.D. Scientists and Engineers in the Labor Force

### Summary

In 2001, there were an estimated 1,990 doctoral scientists and engineers in Maine's labor force. This represented 2.9 doctoral scientists and engineers for every 1,000 Maine workers and was equal to the level in the EPSCoR states for the same year. However, while equal to the EPSCoR states, Maine, nevertheless, lagged behind New England and the nation as a whole. In 2001 New England had 6.4 employed doctoral scientists and engineers per 1,000 workers and the U.S. had 4.0.



### Why This Is Significant

A thick labor market of scientists and engineers is essential to creating a vibrant research and development enterprise. This indicator is a measure of the state's ability to attract and retain highly skilled and highly educated workers who are critical to an innovation driven economy.

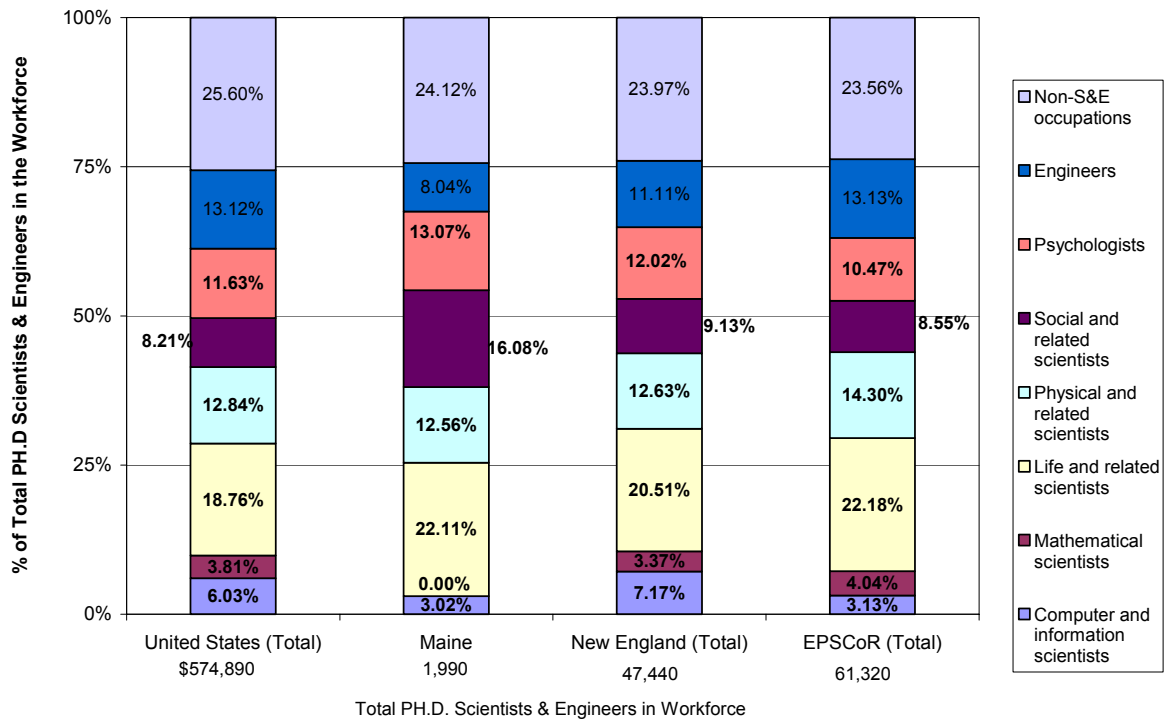
### Related

In 2001 the largest percent (24 percent) of employed Ph.D. scientists and engineers in the Maine workforce were employed in non-science and non-engineering professions.<sup>20</sup> The largest science and engineering occupation category was life and related scientists at 22 percent, fol-

# Employment Capacity

lowed by social and related scientists at 16 percent, psychologists at 13 percent and physical and related scientists at 13 percent. Engineers accounted for eight percent of Maine's Ph.D. scientists and engineers in the Maine workforce. In relation to the reference group, Maine had a higher concentration of employed Ph.D. scientists and engineers in social sciences and a lower concentration in engineering occupations.

**PH.D. Scientists & Engineers in the Workforce by Occupation - 2001**



## Sources

Ph.D. scientist and engineer data is from the National Science Foundation/Division of Science Resources Statistics, *Survey of Doctorate Recipients*, <http://www.nsf.gov/sbe/srs>. Data for workers is based on the civilian labor force and is from U.S. Department of Labor, Bureau of Labor Statistics, Local Area Unemployment Statistics - <http://www.bls.gov/lau/staadoc.htm>.

# Education Capacity

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## **INDICATORS:**

**14-Education Attainment**

**15-Science and Engineering Degrees Awarded**

**16-Higher Education Enrollment among Young People**

**17-Math and Science Skills of High School Students**

**18-Math Gender Equity among High School Students**

**19-Percent of High Schools Offering Advanced Placement Courses**

**20-Ability to Pay for College**

## Overview

Few, if any major documents about economic growth and innovation technology omit a discussion of the importance of an educated workforce. Rather, all efforts toward healthy economic growth point to the business community's reliance on educated employees. Moreover, support for a sound public education system is ever present in the national, state, and local community citizen debates. Our society and all its members - families, individuals, employers, and governmental and private organizations - provide support for education in various ways, such as spending time on learning activities, encouraging and supporting learning, and investing money in education.

According to the Organization for Economic Cooperation and Development (OECD), Center for Educational Research and Innovation, both individuals and government entities benefit from a quality education system. For individuals, the potential benefits lay in general quality of life and in the economic returns of sustained, satisfying employment. For nations, states and communities, the potential benefits lay in economic growth and the development of shared values that underpin social cohesion.

The United States and other industrialized nations make substantial investments in education. In 1999, public and private expenditures per student for the member countries of OECD averaged \$4,850 at the combined elementary and secondary level and \$9,210 at the postsecondary level. The United States and Switzerland, two of the world's wealthiest countries, ranked highest in expenditures per student at the elementary/secondary and postsecondary levels.<sup>21</sup> Accordingly, many employers support the efforts of their workforce to expand their knowledge base. Among employed adults ages 25-64 who participated in adult education in 2001, 87 percent received employer financial support for work-related education.

How does Maine stand in comparison to the nation and other New England states in building the education capacity of its citizens? In some areas, Maine stands very well: (1) When compared to the national average of science and engineering degrees awarded per 1,000 population, Maine slightly exceeds the national average. This reflects, to an extent, the scientific and technical capacity of Maine's postsecondary schools and indicates the population's capacity for scientific and technical work. (2) Maine exceeds the national average percent of high schools that offer Advanced Placement classes.

Unfortunately, Maine is not performing as well in other key indicators of education capacity-building: (1) Maine's female high school students who take the Scholastic Aptitude Test (SAT) typically score lower than their male peers. Gender disparity diminishes the potential of all of Maine's citizens. (2) Considering the costs of sending young people to postsecondary in-



## *Education Capacity*

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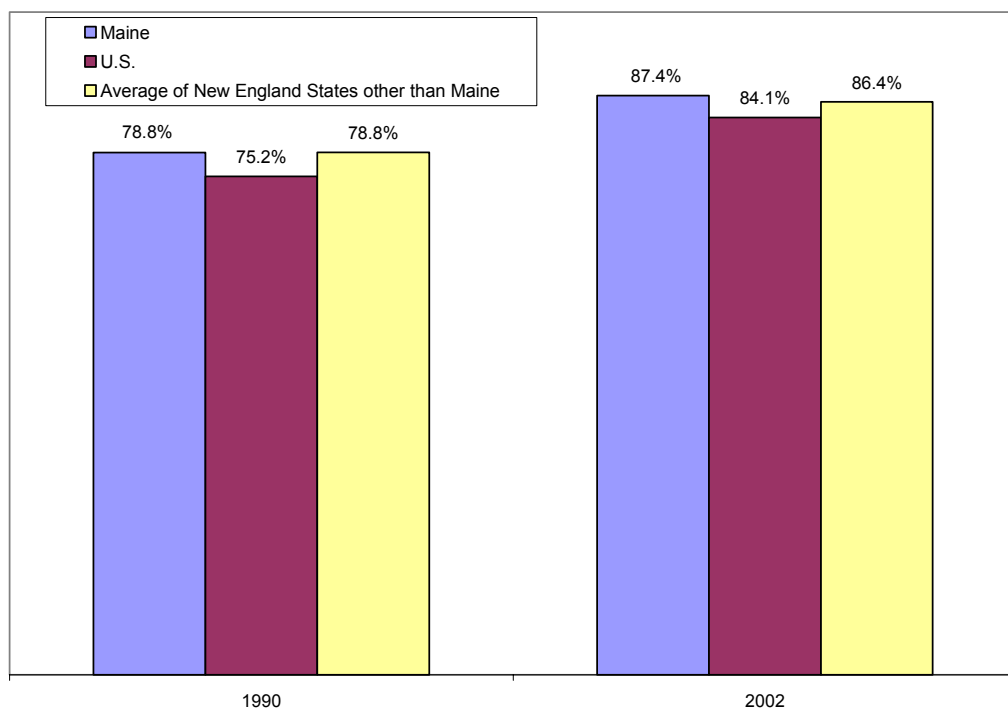
stitutions, Maine families must pay a larger portion of their income than families nationwide. These issues create challenges the state must face in its efforts to build a population enriched both in employable skills and quality of life.

## 14-Education Attainment

### Summary

In terms of high school graduation rates, Maine continues to outperform the nation. In 2002, 87.4 percent of Maine residents 25 years of age and older had completed high school, compared to 84.1 percent for the U.S. as a whole, and 86.4 percent for the other New England states.

Percent of Population 25 Years or Older Who Have Completed High School - Maine, New England & U.S. - 1990 & 2002

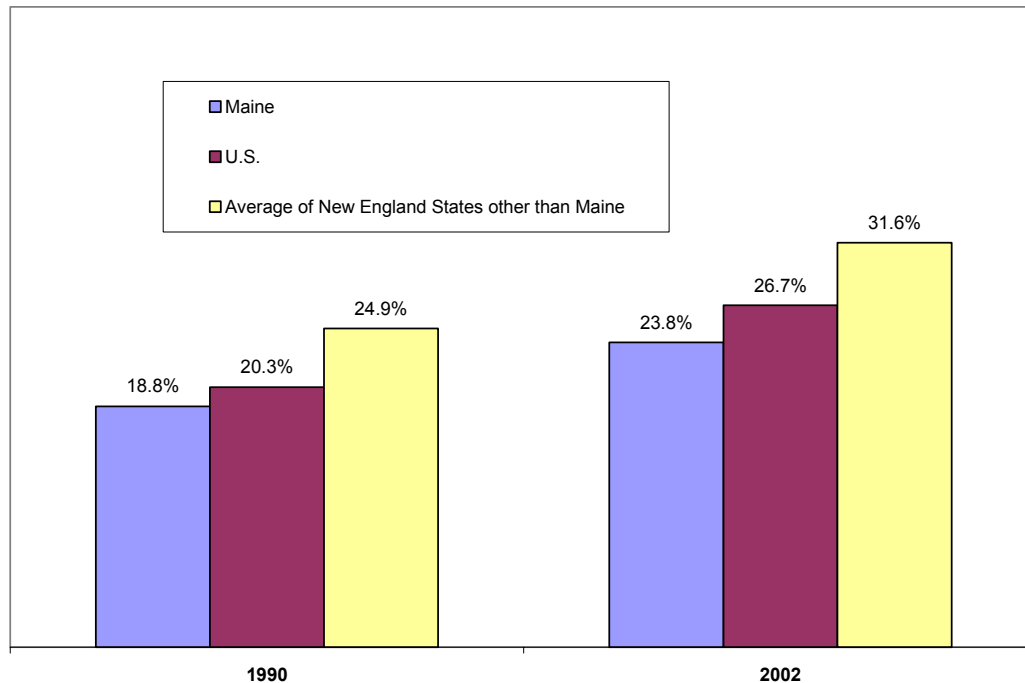


While Maine traditionally has outpaced the nation with a higher than average percentage of high school graduates, it has ranked well below both the national and New England averages in the percentage of adults with a four-year college degree. This higher education gap increased in the 90s.

The percentage of Maine residents 25 years and older who have attained a bachelor's degree or more rose from 18.8 percent in 1990 to 23.8 percent in 2002 - an increase of 26.6 percent. This increase was not enough to prevent Maine from falling further behind the nation as a whole, which experienced a 31.5 percent increase. With 23.8 percent of adults having a bachelor's degree in 2002, Maine remains below the national average of 26.7 percent and well below the New England average of 31.6 percent.

# Education Capacity

Percent of Population 25 Years or Older Who Have a Bachelor's Degree or More - Maine, New England & U.S. - 1990 & 2002



## Why This Is Significant

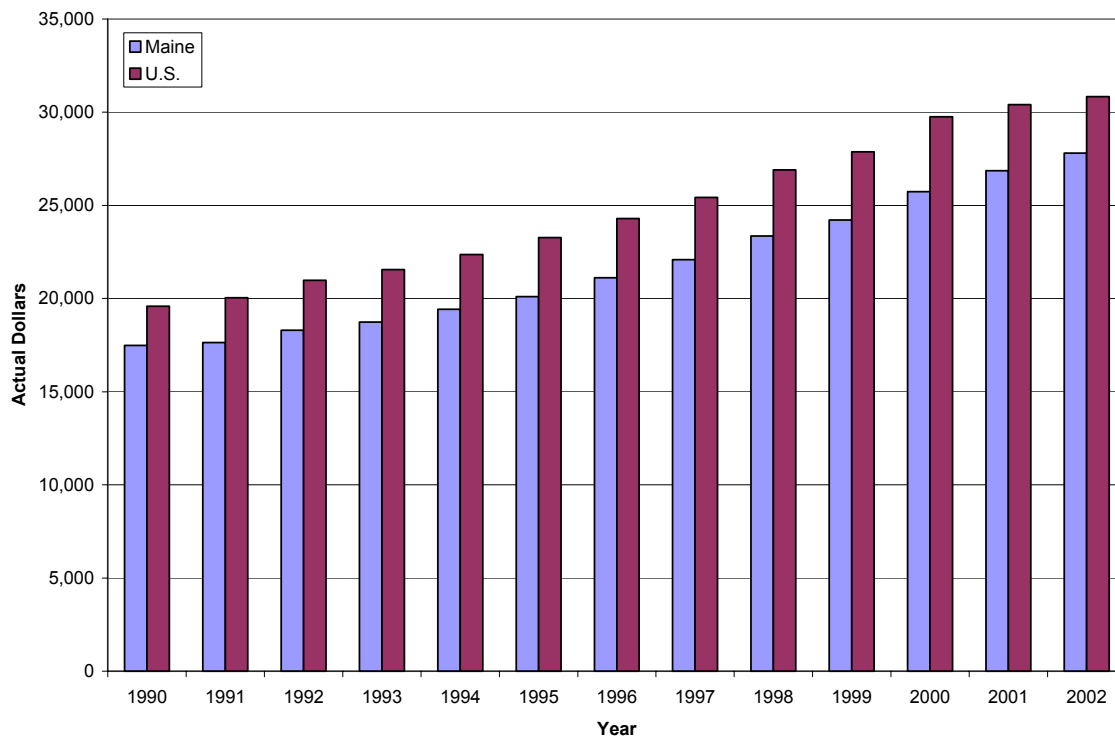
Analysis conducted by the Maine State Planning Office as part of *30/1000 Initiative* reveals that the economic well-being of a state is strongly tied to two factors: (1) the percent of the population with a bachelor's degree or higher, and (2) the level of expenditures for research and development. This analysis is supported by national research.<sup>22</sup> Wages are typically higher in technology-intensive industries; these are the same industries that increasingly require workers with higher education degrees.

## Related

Per capita income in Maine has increased steadily since 1990; in the last two years the state's annual growth rate has outpaced the nation's. However, the state still lags well behind the U.S. as a whole. In 2002, per capita personal income in Maine was \$27,804, compared to \$30,832 for the U.S. National data indicate that earnings increase as educational attainment levels increase.<sup>23</sup> In order for Maine to increase its per capita income relative to the rest of the U.S., improvements above and beyond what is occurring nationally must be made.

# Education Capacity

Per Capita Personal Income - Maine & U.S. - 1990-2002

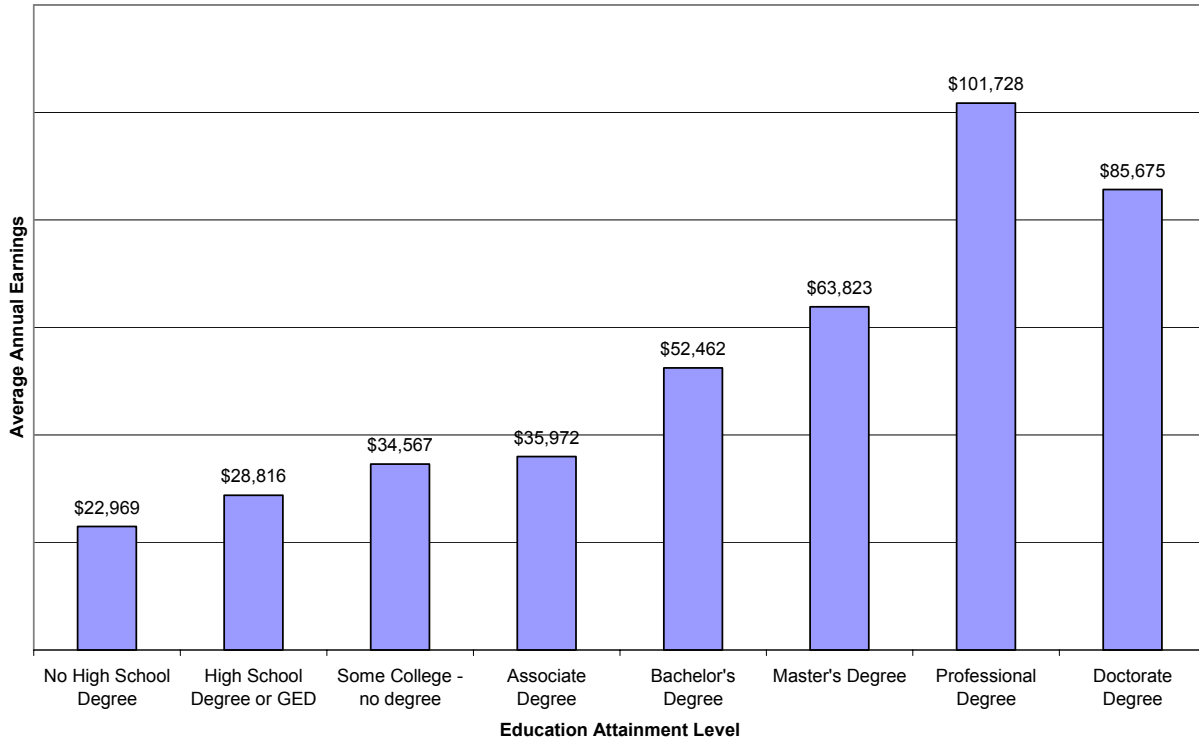


## Sources

Education attainment data are from United States Department of Commerce News, *Educational Attainment of the Population 25 Years and Over, March 2001, 2002*. U.S. Census Bureau, [www.census.gov/Press-Release/www/2003](http://www.census.gov/Press-Release/www/2003). Per capita personal income data are from U.S. Department of Commerce, Bureau of Economic Analysis, Regional Accounts Data, State Personal Income, [www.bea.doc.gov/bea/regional](http://www.bea.doc.gov/bea/regional). Earnings data are from the Current Population Survey, Annual Demographic Survey, March Supplement, *Educational Attainment*. U.S. Census Bureau and Bureau of Labor Statistics, U.S. Department of Commerce, March 2002, [http://ferret.bls.census.gov/macro/032002/perinc/new03\\_001](http://ferret.bls.census.gov/macro/032002/perinc/new03_001).

# Education Capacity

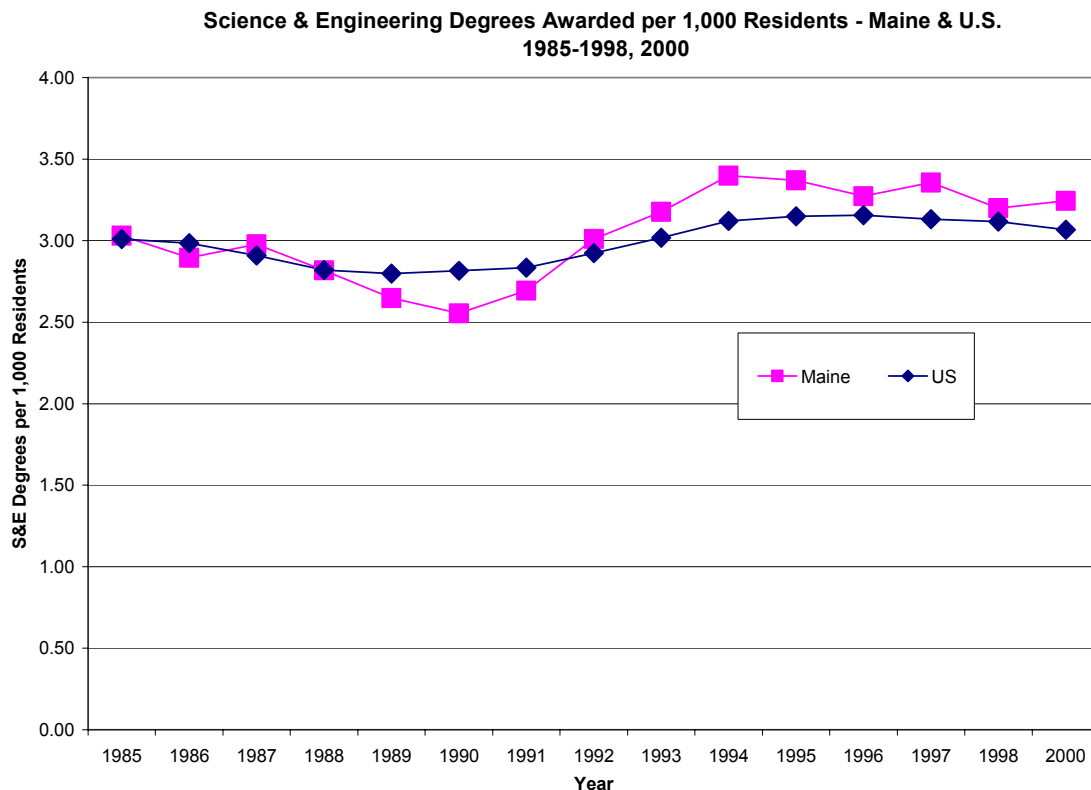
Earnings by Education Attainment of the Population 25 Years or Older - U.S. - 1990-2002



## 15-Science and Engineering Degrees Awarded

### Summary

In 2000 Maine colleges and universities awarded 4,144 degrees in science and engineering disciplines. This represented 3.24 science and engineering degrees per 1,000 Maine residents, which is higher than the national level of 3.07 per 1,000 residents. Since 1992, Maine has awarded more science and engineering degrees per 1,000 residents than the U.S. as a whole.



### Why This Is Significant

The extent to which Maine colleges and universities are awarding science and engineering degrees is an indicator of both the science and technical capacity of the state's postsecondary schools and the potential for workers with science and technical abilities among Maine's workforce. Both of these are fundamental requirements for developing a solid foundation for research and long-term, technology-driven innovation.

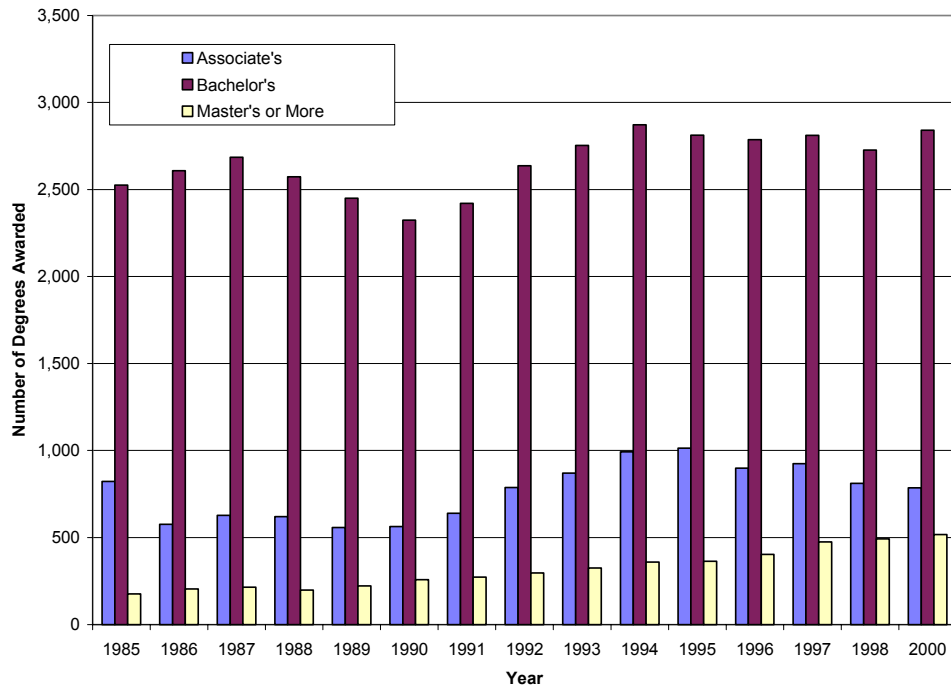
### Related

Of the 4,144 science and engineering degrees awarded in Maine in 2000, 69 percent (2,841) were bachelor's degrees, 19 percent (786) were associate's degrees, nine percent (367) were masters, three percent (111) were first professional, and one percent (39) was doctoral degrees. The growing importance of advanced degrees is reflected in the award trend data. Since

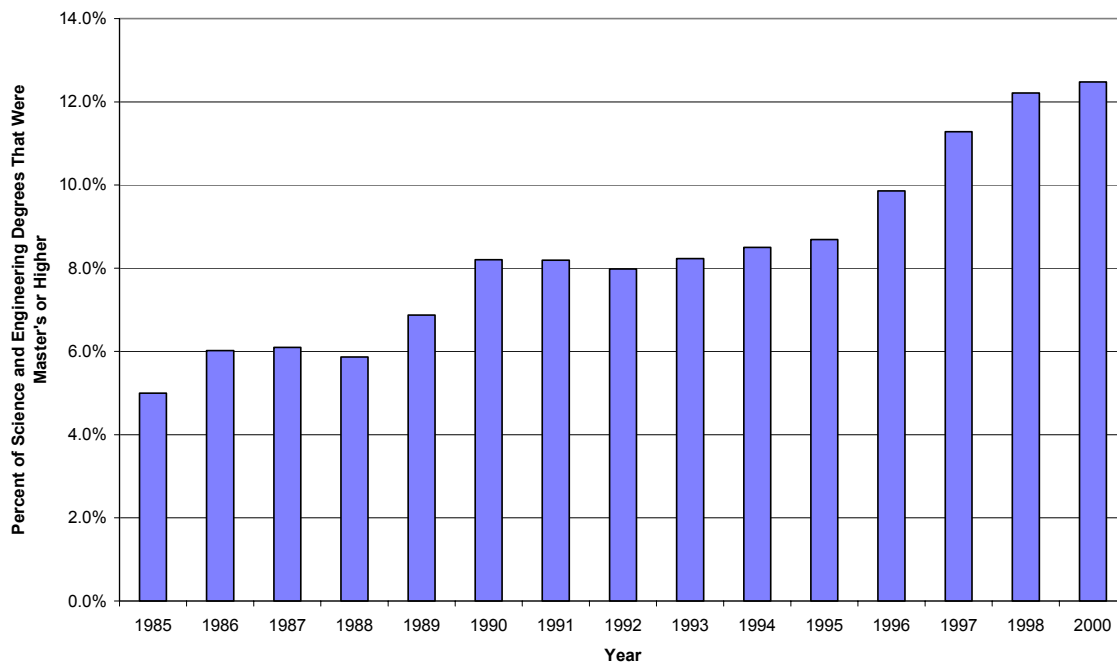
# Education Capacity

1985 the number of graduate degrees (masters or higher) awarded in science and technology has increased steadily from a level of 5.0 percent in 1985 to 12.5 percent in 2000.

**Science and Engineering Degrees Awarded by Degree Level - Maine  
1985-1998, 2000**



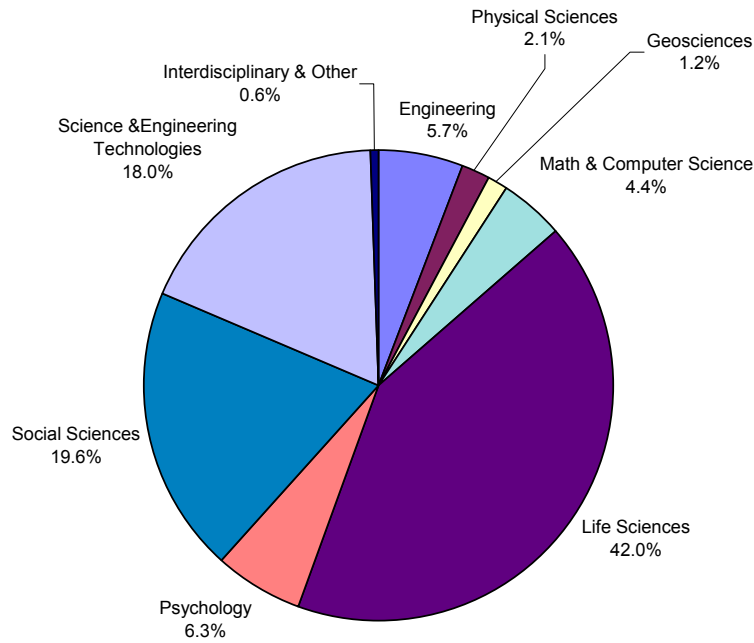
**Master's or Higher Degrees in Science and Engineering - Maine  
1985-1998, 2000**



# Education Capacity

In terms of the academic disciplines in which degrees were awarded by Maine and the U.S. in 2000, Maine had a higher concentration in life sciences and a lower concentration in math and computer science, and engineering. In 2000, 42 percent of Maine's science and engineering degrees were awarded in life sciences, 5.7 percent in engineering, and 4.4 percent in math and computer sciences. This compares to 34.1 percent in life sciences, 10.7 percent in engineering, and 10.2 percent in math and computer sciences for the U.S. as a whole.

**Science & Engineering Degrees Awarded by Degree Discipline - Maine - 2000**



**Total S&E Degrees = 4,144**

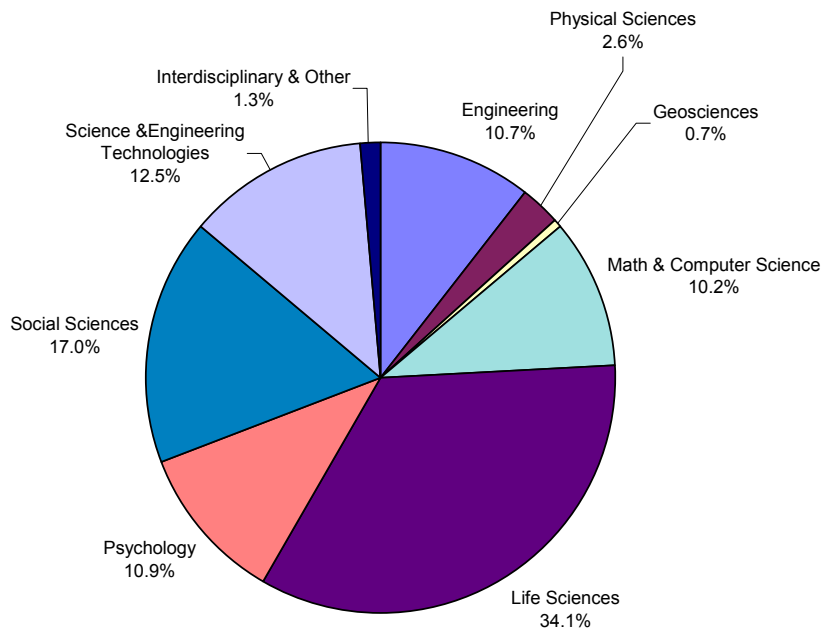
Includes associate's, bachelor's, master's, first professional, and doctorate degrees



# Education Capacity

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Science & Engineering Degrees Awarded by Degree Discipline - U.S. - 2000



Total S&E Degrees = 865,690

Includes associate's, bachelor's, master's, first professional, and doctorate degrees

## Sources

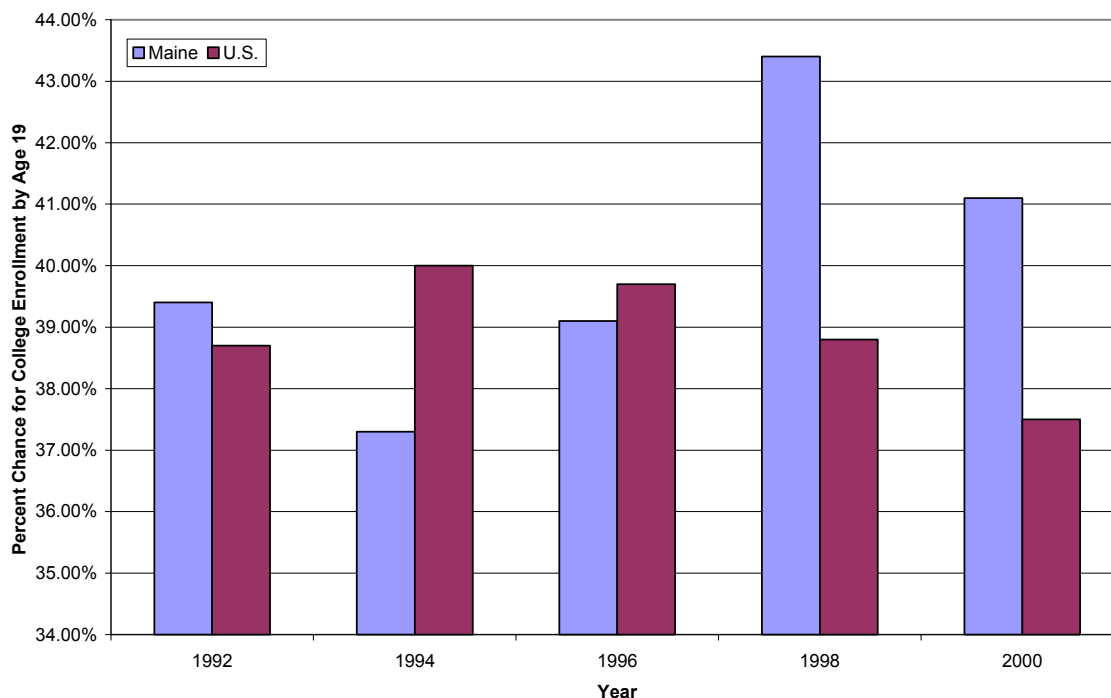
S&E Degrees Awarded<sup>24</sup> was extracted from the National Science Foundation WebCAS-PAR Database System [www.caspar.nsf.gov](http://www.caspar.nsf.gov); and is based on the Higher Education General Information Survey and Integrated Post-Secondary Education Data System, National Center for Education Statistics, U.S. Department of Education [www.nces.ed.gov](http://www.nces.ed.gov). Population is from the Population Estimates Program, U.S. Census Bureau, American Factfinder, *T1. Population Estimates [5] 2002 Population Estimates* <http://factfinder.census.gov>.

## 16-Higher Education Enrollment among Young People

### Summary

In 2000, Maine 19 year-olds had a 41.1 percent chance of being enrolled in post-secondary education. This represents a significant increase from the 1994 level of 37.3 percent but a decrease from the 1998 level (43.4 percent). Maine performs above the national average on this indicator (37.5 percent) because the state's high school graduation rate exceeds the national average.

Chance for College Enrollment by Age 19 - Maine & U.S. - 1992-2000



### Why This Is Significant

Higher education attainment among the population is increasingly important if Maine is to develop a technology-intensive economy and one that promotes personal economic well-being. The extent to which young adults complete high school and continue to higher education is a good indicator of future potential education attainment and aspirations among young adults.

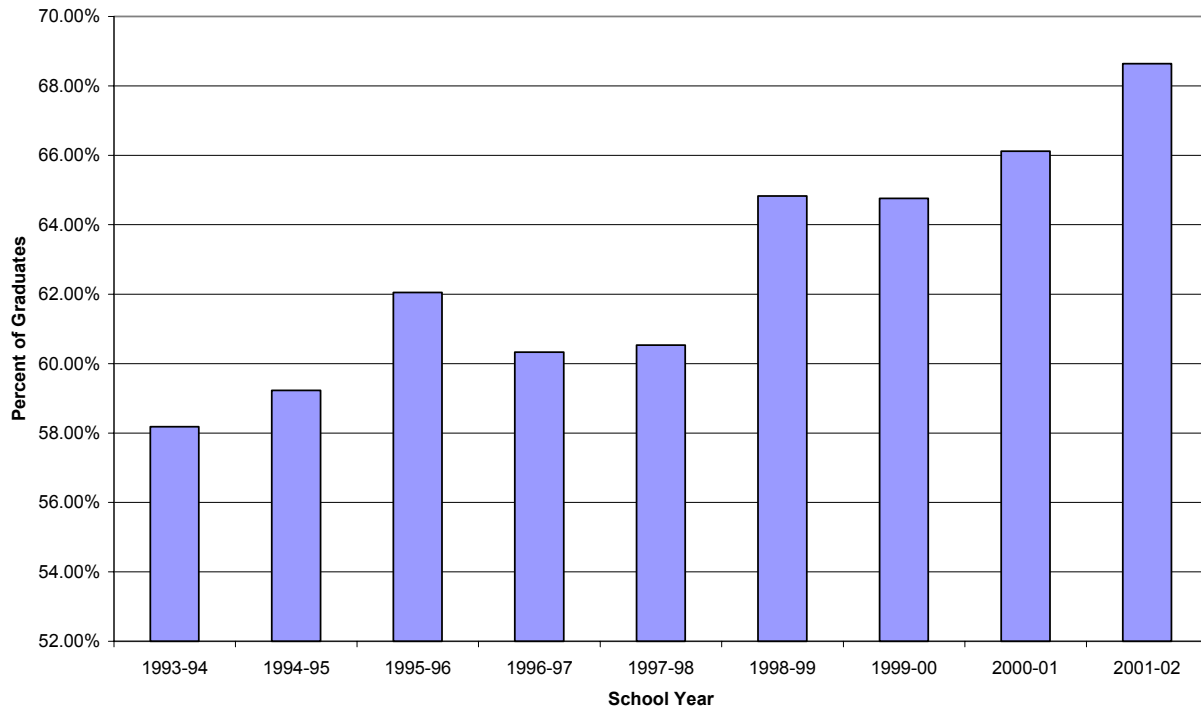
### Related

One measure of the aspirations of Maine high school students is their intention to attend college. In 2001-2002 a survey of high school seniors found that 68.6 percent of high school seniors indicated an intention to go on to postsecondary education. This is slightly higher than

# Education Capacity

the 2000-2001 level of 66.1 percent and considerably higher than the 1997-1998 level of 60.5 percent.

**Public High School Graduates Who Intend to Go on to Post Secondary Education - Maine - 1994-2002**



## Sources

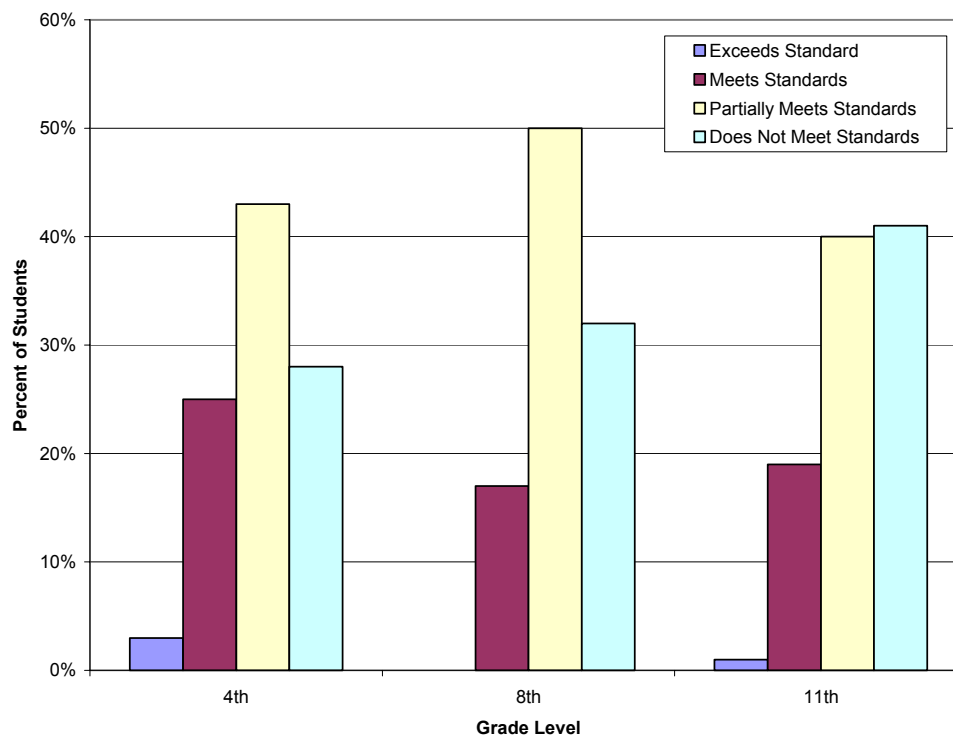
Data on chances of attending college by age 19 are reported by the Mortenson Research Seminar on Public Policy Analysis of Opportunity for Postsecondary Education, [www.postsecondary.org](http://www.postsecondary.org). Chance for College by Age 19 equals the product of the public high school graduation rate and the college continuation rate.<sup>25</sup> The data for intention to go on to post-secondary education comes from the Maine Department of Education, *Graduates on to Post Secondary Schools, by County and Unit, Public Schools*, <http://www.state.me.us/education/enroll/grads/gradspost.htm>. Results are based on a survey of Maine high school seniors in the spring of each school year in which seniors are asked to indicate if they intend to go on to post secondary education.

## 17-Math and Science Skills of High School Students

### Summary

One of the best measures of primary and secondary educational performance for Maine students is the Maine Educational Assessments (MEA). The MEA is given to students annually in 4<sup>th</sup>, 8<sup>th</sup>, and 11<sup>th</sup> grades. In 2002-2003, 20 percent of Maine's 11<sup>th</sup> grade students met or exceeded performance standards in math. Another 41 percent of Maine's students did not meet performance-level standards, compared to 35 percent in 1998-1999.<sup>26</sup>

Maine Educational Assessment - Performance Levels for Math - 2002-03



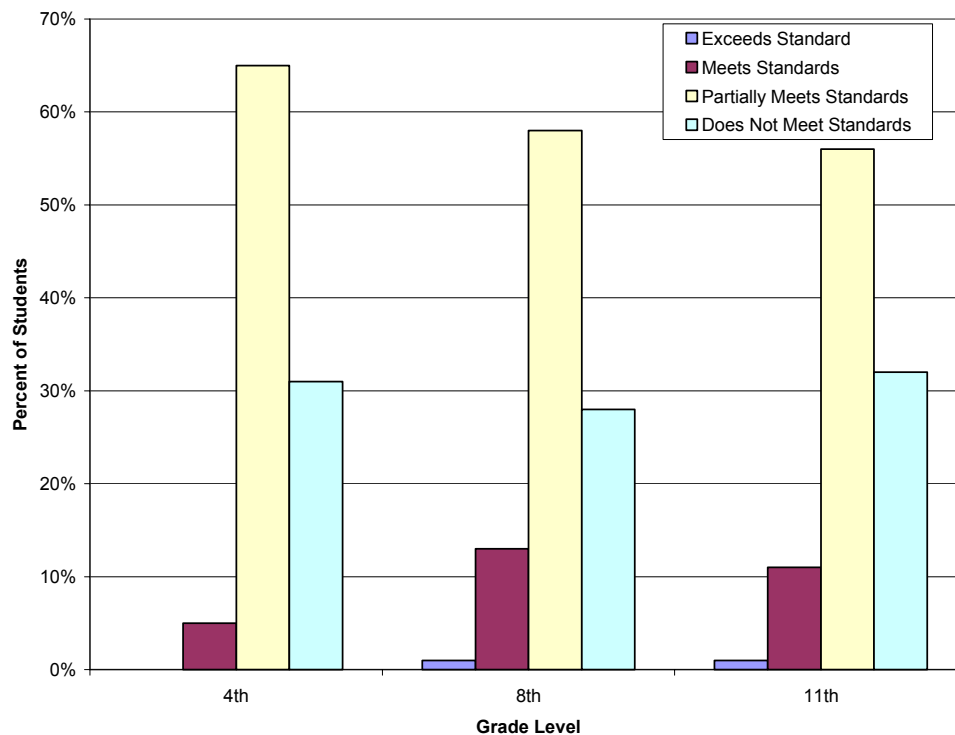
In science, for 2002-2003, 12 percent of Maine's eleventh graders met or exceeded standards. Another 32 percent did not meet standards in science, compared to 30 percent in 1998-1999.

### Why This Is Significant

Proficiency in mathematics is a fundamental requirement for many technology-related jobs. Performance in math and science among primary and secondary students reflects the readiness of Maine students to major in science and engineering in college and pursue high-tech careers.

# Education Capacity

Maine Educational Assessment - Performance Levels for Science - 2002-03



## Related

The Maine Learning Results sets high standards for students in mathematics and science, and when compared to the rest of the nation, Maine students perform extremely well in these subjects. Recent national exams in mathematics, however, show students in other states catching up.

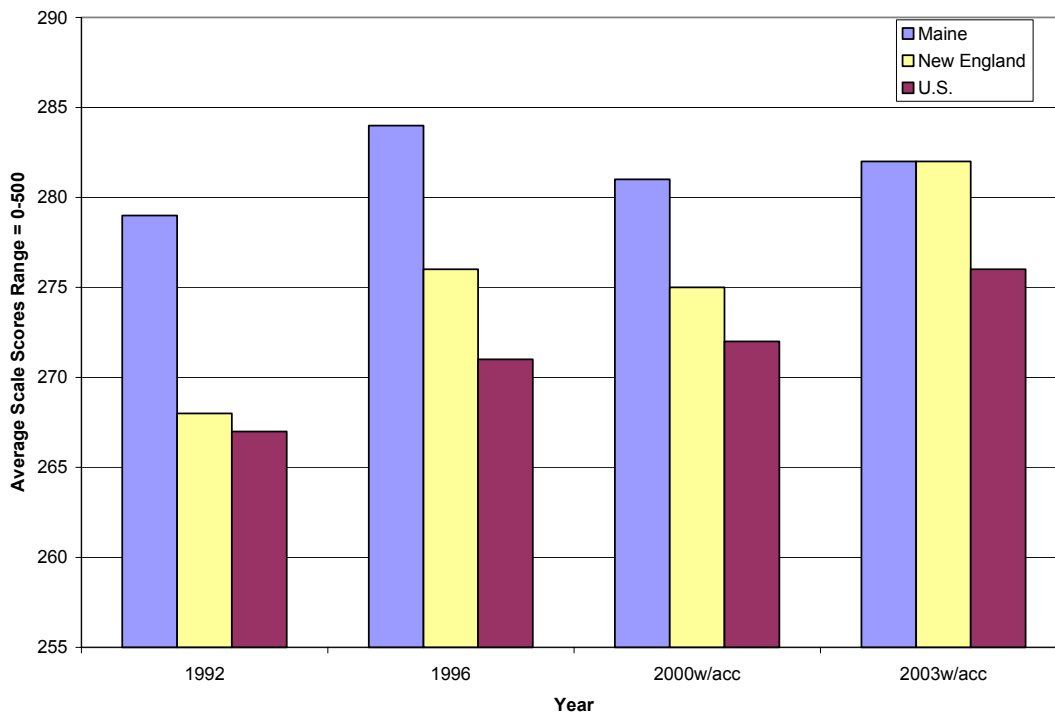
On the 2000 National Assessment of Educational Progress (NAEP), Maine eighth graders turned in the second highest *science* scores in the country (average score of 160 in comparison to 149 for the U.S. as a whole). This marked a slight slip from 1996, when Maine eighth graders achieved the highest scores in the nation (average score of 163).

On the 2003 NAEP *mathematics* test, Maine eighth graders scored 282, slightly higher than in 2000 (281) but lower than in 1996 (284).<sup>27</sup> Whereas the score of 284 placed Maine eighth graders first in the country in 1996, the 2003 score (282) placed them higher than 26 of the 53 states and jurisdictions (i.e., District of Columbia), not significantly different from those in 18 jurisdictions, and lower than those in only eight jurisdictions. Maine eighth graders matched the scaled score of the other New England states.

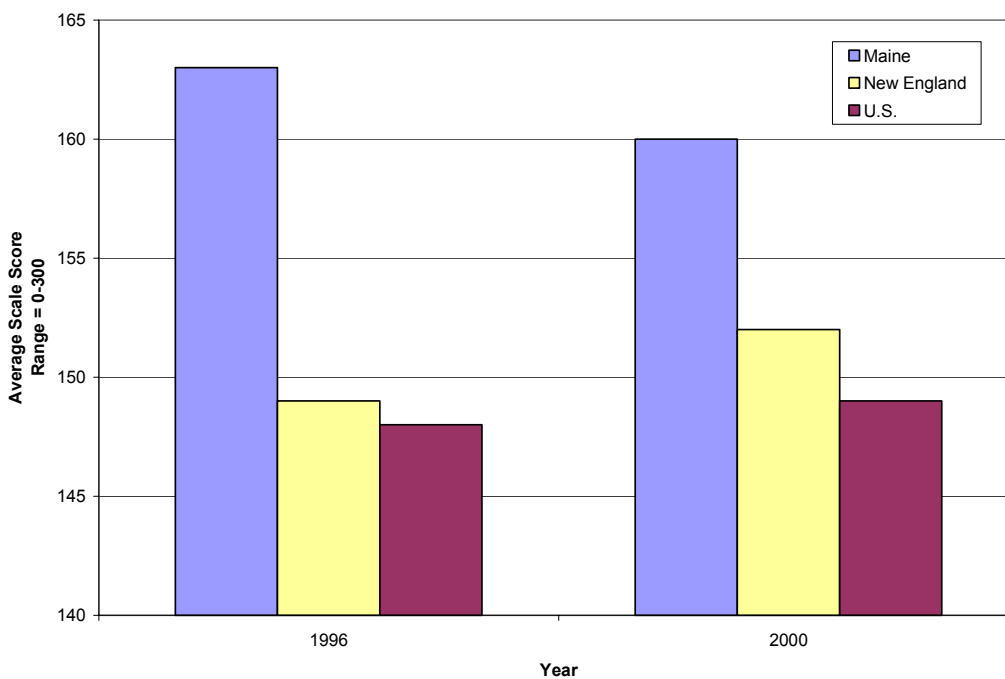
Maine's fourth graders performed similarly to their eighth grade counterparts. On the 2003 NAEP *mathematics* test, Maine fourth graders scored 238, matching the New England average and exceeding the U.S. average (234). Of the 53 states and jurisdictions that participated in the test, the fourth graders' average scaled score placed them higher than those students in 23 jurisdictions, similar to those in 21 jurisdictions, and lower than only eight jurisdictions.

# Education Capacity

National Assessment of Educational Progress - Math Scores for 8th Graders - Maine, New England & U.S. - 1992, 1996, 2000, 2003



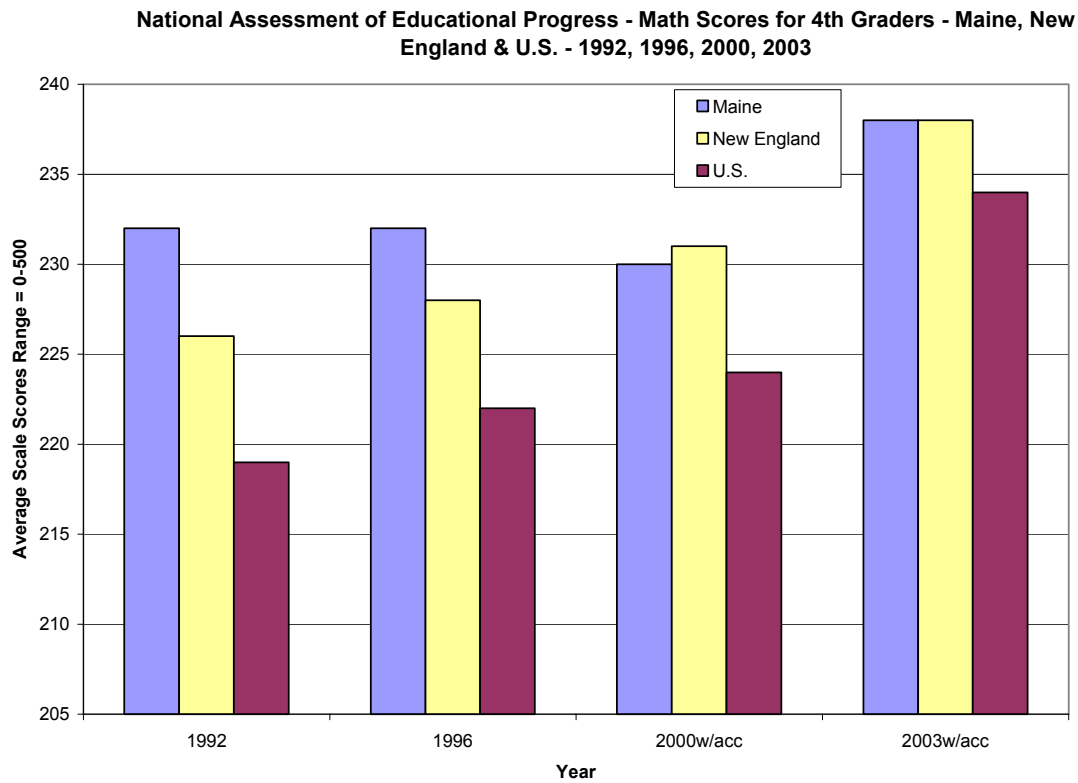
National Assessment of Educational Progress - Science Scores for 8th Graders - Maine, New England & U.S. - 1996 & 2000



# Education Capacity

## Sources

MEA data are from the Maine Department of Education, *Maine Educational Assessment 1998-99, 1999-00, 2000-01, 2001-02, and 2002-03 State Results*, downloaded from [www.state.me.us/education](http://www.state.me.us/education). NAEP data is from the National Assessment of Educational Progress (NAEP), National Center for Education Statistics, *The Nation's Report Card*, [www.nces.ed.gov/nationsreportcard](http://www.nces.ed.gov/nationsreportcard).

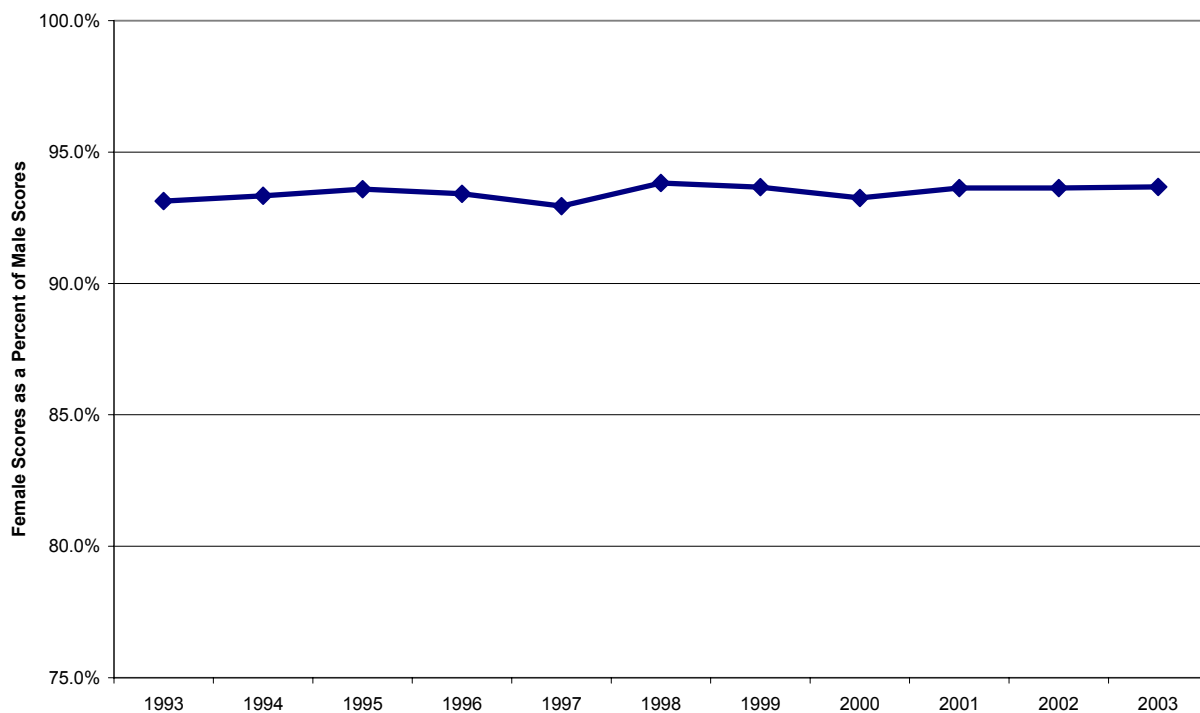


## 18-Math Gender Equity among High School Students

### Summary

In 2003, Maine females scored 6.3 percent lower on the Scholastic Aptitude Test (SAT) math test than their male counterparts. The historical data since 1993 indicates that Maine has made relatively little gain in increasing gender equity in math performance.

Scholastic Aptitude Test Math Scores - Gender Equity Index - Maine  
1993-2003



### Why This Is Significant

For Maine to be competitive in technology intensive industries, all workers - men and women - need to be competent in math. Gender disparity in math competency indicates that Maine is not achieving its full potential in terms of creating skilled and educated workers. This is particularly important given that the total number of Maine workers is not expected to grow significantly over the next twenty years, and that the percentage of all workers who are women has been steadily increasing in recent years.

### Related

The Maine Educational Assessment (MEA) also reports performance by gender. MEA data for math and science performance of eleventh graders support SAT data on gender disparity. In both 2001-2002 and 2002-2003 MEAs for math and science, the percent of fourth, eighth, and

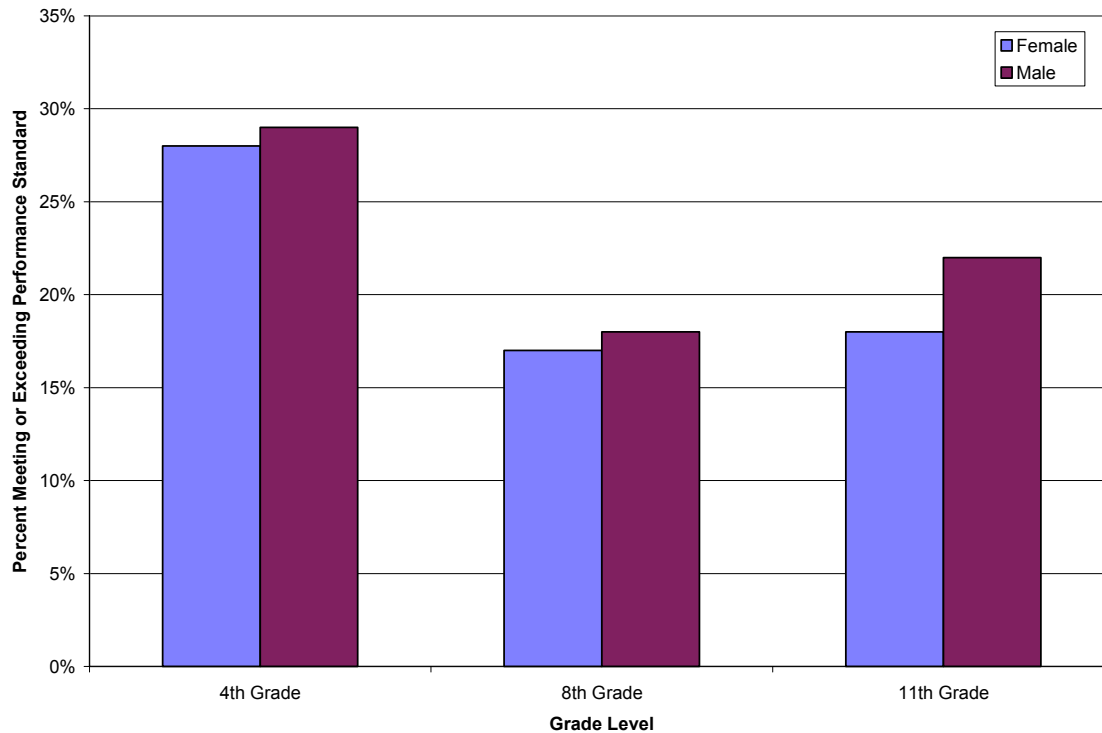


# Education Capacity

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eleventh grade girls who met or exceeded the performance standards was consistently lower than that of boys. In 2002-2003, the gender gap is highest at the eleventh grade level for math and at the eighth grade level for science.

**Maine Educational Assessment - Math Performance Levels by Gender - 2002-03**

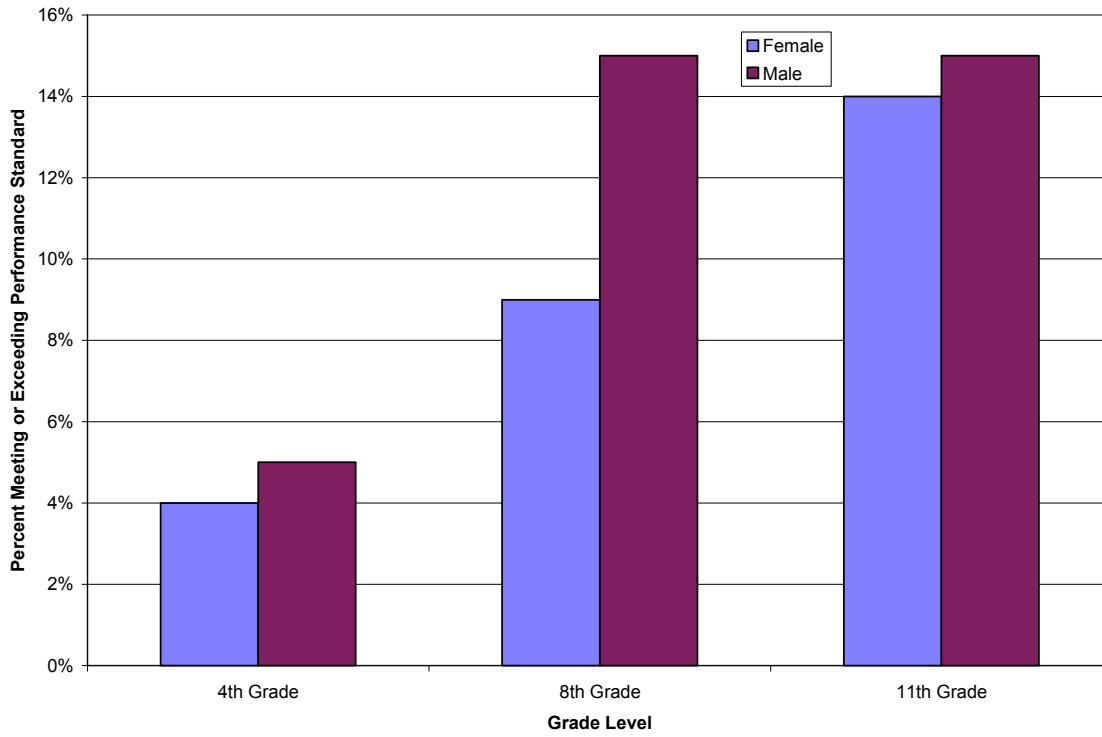


## Sources

SAT score data is from the College Board, *College Bound Seniors Reports*, [www.collegeboard.org](http://www.collegeboard.org). The MEA data is from the Maine Department of Education, *Maine Educational Assessment Performance Analysis 2002-2003*, downloaded from web site at [www.state.me.us/education](http://www.state.me.us/education).

# Education Capacity

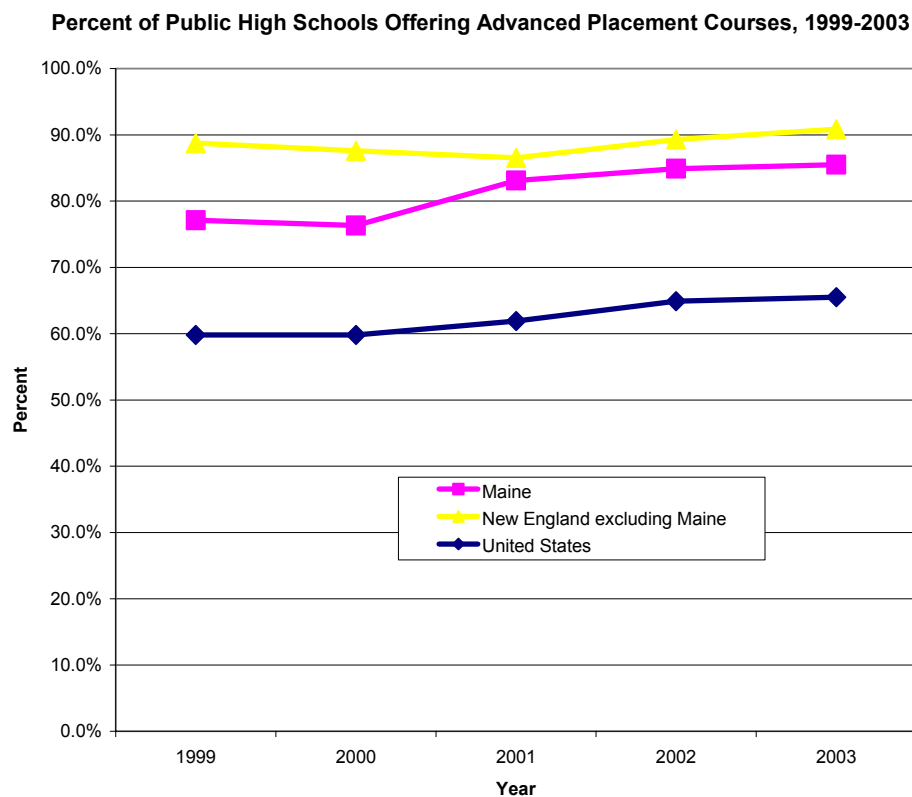
Maine Educational Assessment - Science Performance Levels by Gender - 2002-03



## 19-Percent of High Schools Offering Advanced Placement Courses

### Summary

The number of Maine high schools offering Advanced Placement (AP) courses grew between 1999 and 2001 and has remained relatively stable since. In 2003, 85.5 percent of Maine's public high schools offered AP courses, while in 1999, only 77.1 percent did so. For the nation as a whole, 65.5 percent of public high schools offered AP courses in 2003. In the same year, Maine, among the New England states, exceeded Rhode Island (81.4 percent) and Vermont (84.4 percent) but trailed Massachusetts (100 percent), New Hampshire (88.5 percent), and Connecticut (100 percent).



### Why This Is Significant

The Advanced Placement Program, sponsored by The College Board which disseminates the Scholastic Aptitude Test (SAT), provides high school students an opportunity to take college-level courses while in high school. Successful completion of the course(s) culminates in the Advanced Placement test for each of several content areas. Achieving a grade of three or more in a five-point scale allows the student to qualify for college credit in corresponding courses in participating colleges. The AP program is universally believed to represent high academic stan-

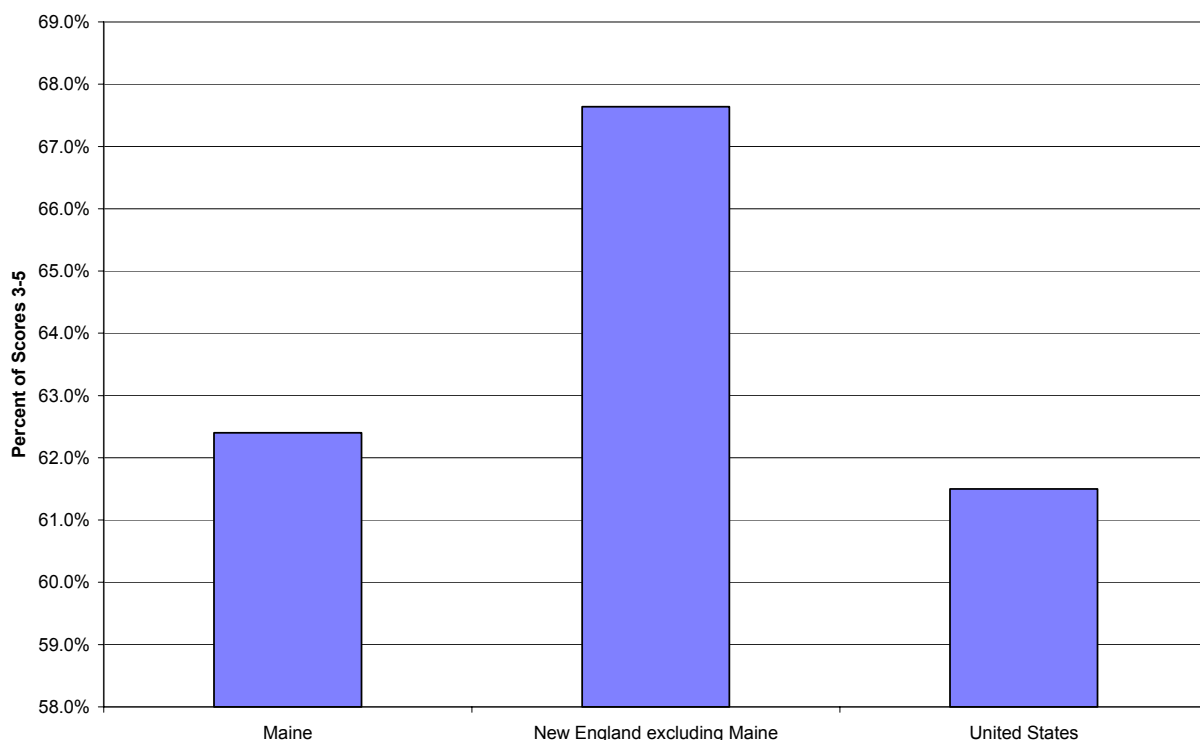
# Education Capacity

dards and effective teaching practices, and to positively influence participating students' transitions to college.

## Related

Considering numbers of Maine students taking the AP exams, of the 2002-2003 11<sup>th</sup> and 12<sup>th</sup> grade enrollment number (33,335<sup>28</sup>), 4,565 students took one or more AP exams (Total exams taken equaled 6,735). Almost two-thirds (62.4 percent) of the exams resulted in scores of three or more on a scale of one through five. It is a score of three through five that allows a student the opportunity to qualify for college credit in participating colleges and universities.

Performance of Students Taking AP Exams - 2003



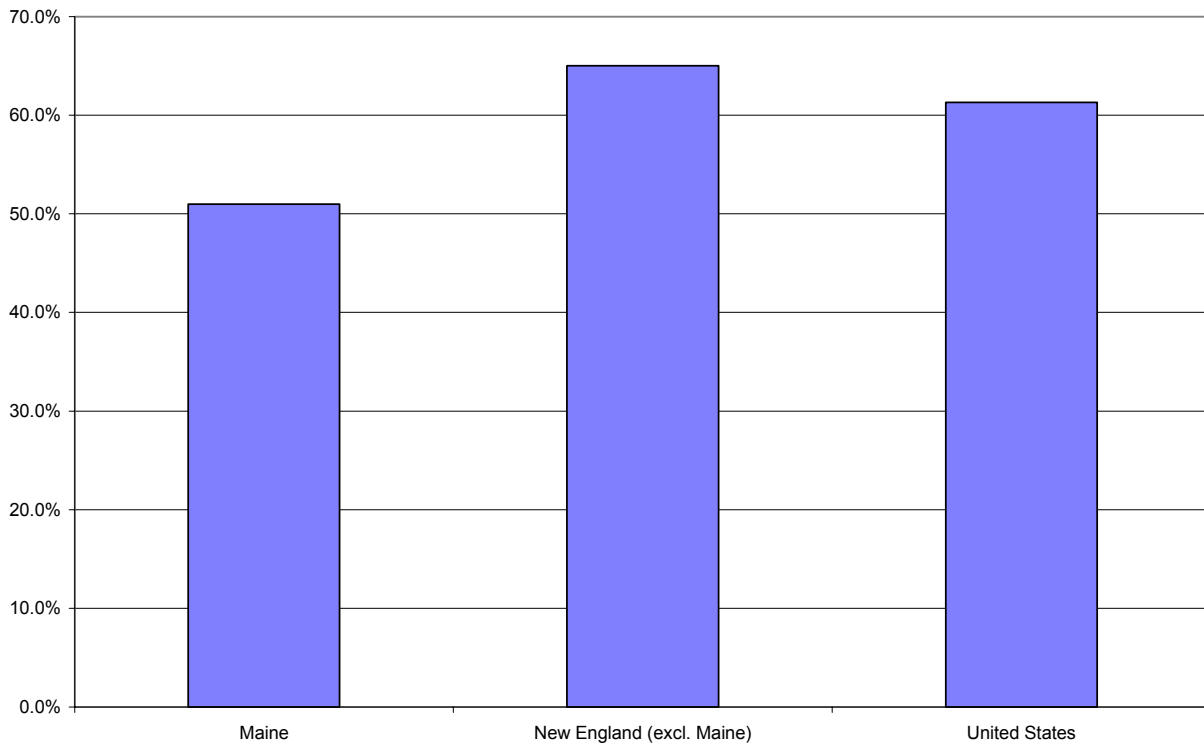
Exam results in Maine's neighboring states showed that in 2003, results of qualifying grades in AP exams in all of the other New England states exceeded Maine's exam results. For instance, Connecticut students took a total of 27,566 AP exams that resulted in 73.3 percent showing grades of three through five; Massachusetts's results were 72.6 percent, Vermont's - 67.3 percent, New Hampshire's - 68.3 percent, and Rhode Island's - 64.2 percent. It was only in comparison to the national average (61.5 percent) that Maine scored higher, at 62.4 percent.

In 2003 there were 34 subject areas, 12 of which related to math and science. In percent of exams taken that were math- and science-related, Maine students took significantly fewer such exams than all of the other New England states and the United States as a whole. Maine's percent, 51, was more than ten points lower than the national percent (61.3) and 14 points lower than the average of the other New England states (65 percent).

# Education Capacity

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Percent of Advanced Placement Exams That Are in Math and Science Content Areas - 2003



## Sources

Advanced Placement Program data was obtained from The College Entrance Examination Board, *School Report of AP Examinations 2002-2003 (By State)*.

[www.apcentral.collegeboard.com](http://www.apcentral.collegeboard.com)

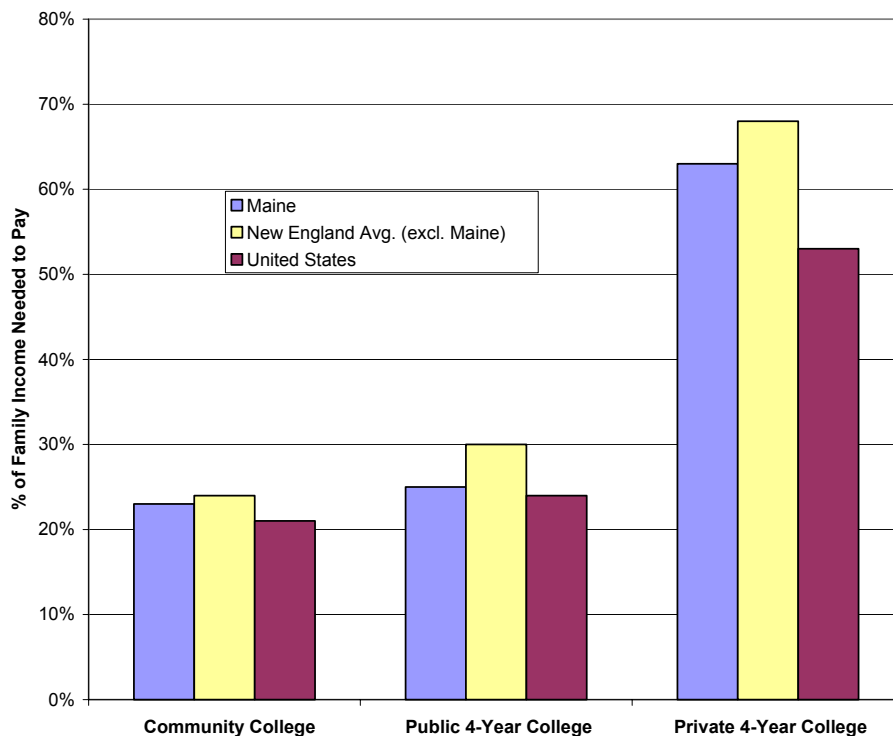
## 20-Ability to Pay for College

### Summary

For this indicator, ability to pay for college is measured as the percent of the average family income that is needed to pay for college expenses (minus financial aid). In 2002, Maine families needed 23 percent of their income for a student to attend a community college, 25 percent of income for a student to attend a public four-year college, and 63 percent of income for a student to attend a private four-year college.

A comparison of these results to other states showed that for a student to attend a community college, Maine's families (paying 23 percent of income) had to pay relatively less than families in other New England states (24 percent of income) but more than families nationally (21 percent). While attendance at a public four-year college required 25 percent of a Maine family's income in 2002, a New England family had to pay 30 percent. Nationally, on the other hand, a family had to pay only 24 percent of its income. The 63 percent of a Maine family income necessary to send a student to a private four-year college is lower than the New England average (68 percent) but significantly higher than the national average of 53 percent.

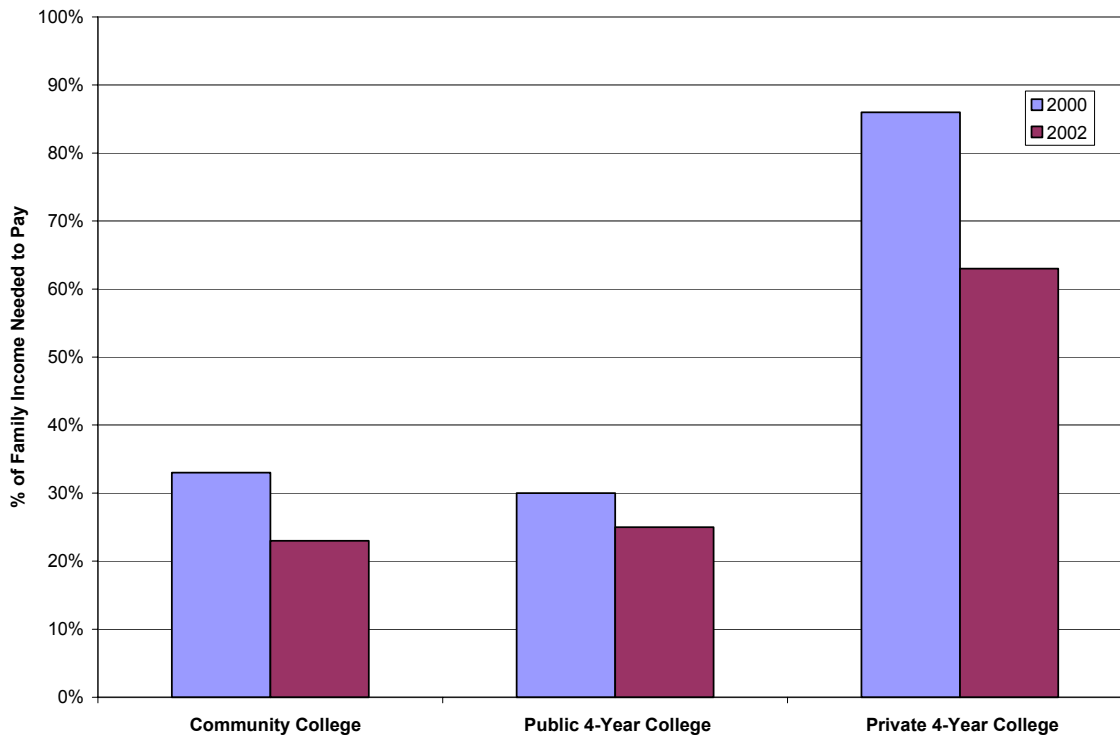
Percent of Family Income Needed to Pay for College - 2002



On the ability to pay for college indicators, Maine experienced significant improvement between 2000 and 2002. In 2000, Maine families needed 33 percent of their income for a student to attend a community college, 30 percent for a public four-year college, and 86 percent of income for a student to attend a private four-year college.

# Education Capacity

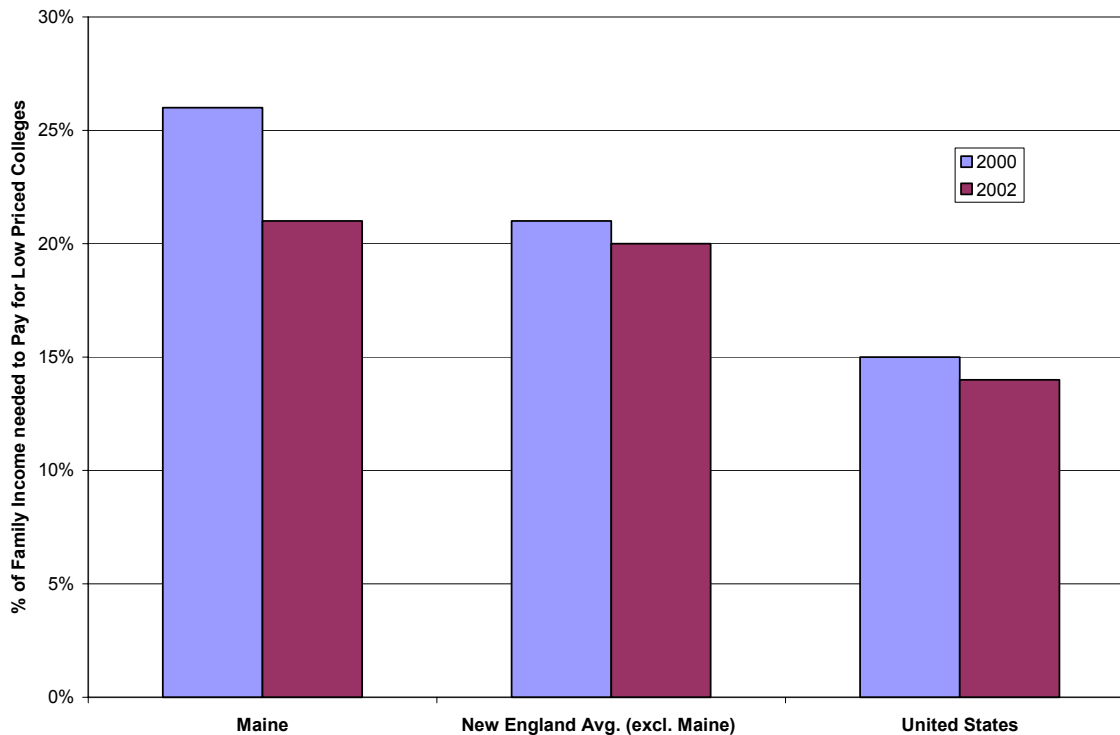
Percent of Family Income Needed to Pay for College - Maine - 2000-2002



However, Maine has a ways to go in terms affordability for its poorest families. In 2002, the percent of family income among the lowest income quintile needed to pay for “low priced” institutions was 21 percent as opposed to 20 percent in all other New England states and 14 percent in the nation as a whole.

# Education Capacity

Percent of Family Income Needed to Pay for College at Low-Priced Colleges for Poorest Family Income Quintile - 2000-2002



## Why This Is Significant

While there were several roads to success in past generations for young people upon leaving high school, the present path to earning a decent livelihood is more and more dependent upon a successful college career. Traditional manufacturing jobs have been replaced by jobs that require academic skills, often of a high degree. This changing scene of the American workplace calls for an examination of college affordability. In the academic year 2002-03 “the average total price for full-time undergraduates to attend four-year institutions - including tuition, fees, room, board, books, supplies, etc. - was more than \$12,800 at public institutions and almost \$28,000 at private institutions. Over the past decade, inflation-adjusted tuition prices at public and private four-year colleges and universities jumped nearly 40 percent, while the median income of families with a head of household 45 to 54 years old (those families most likely to have traditional college-age children) rose only eight percent.”<sup>29</sup>

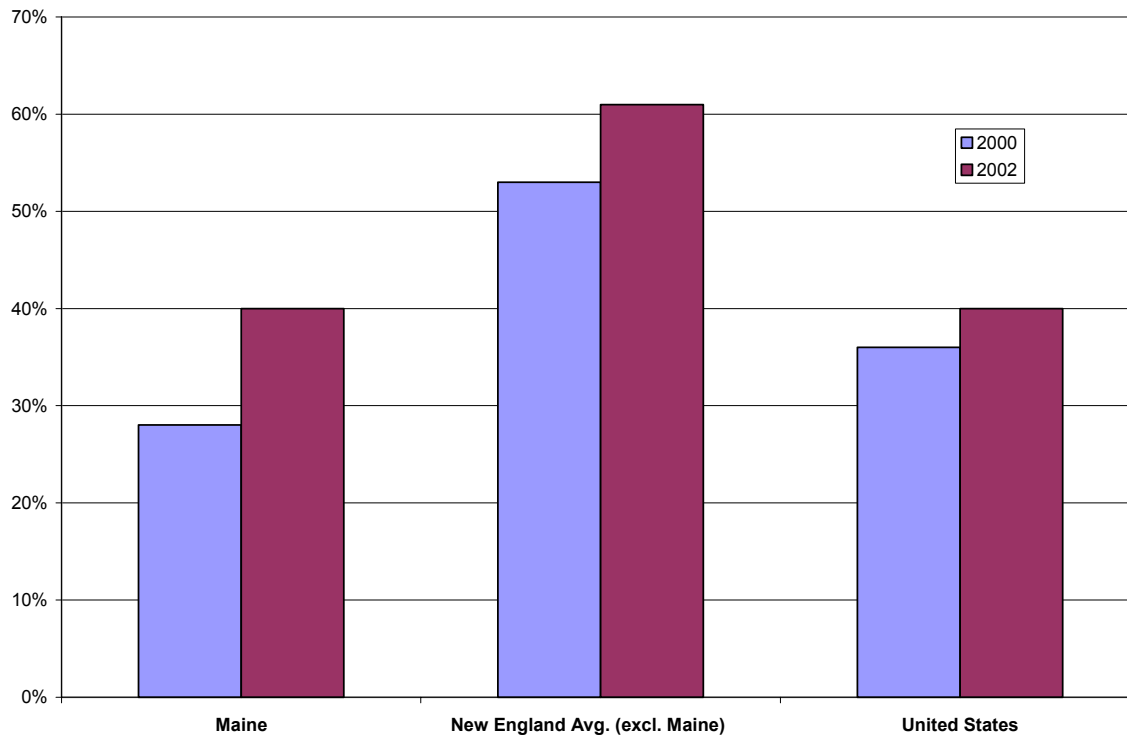
## Related

In terms of state grant aid targeted to low-income families as a percent of federal Pell Grant aid to low-income families, in 2002, Maine was equal to the national level of 40 percent, but well below other New England states at 61 percent. Maine’s 2002 level of 40 percent on this related indicator is up considerably from its 2000 level of 28 percent.



# Education Capacity

State Need-Based Financial Aid as a Percent of Federal Aid - 2000-2002

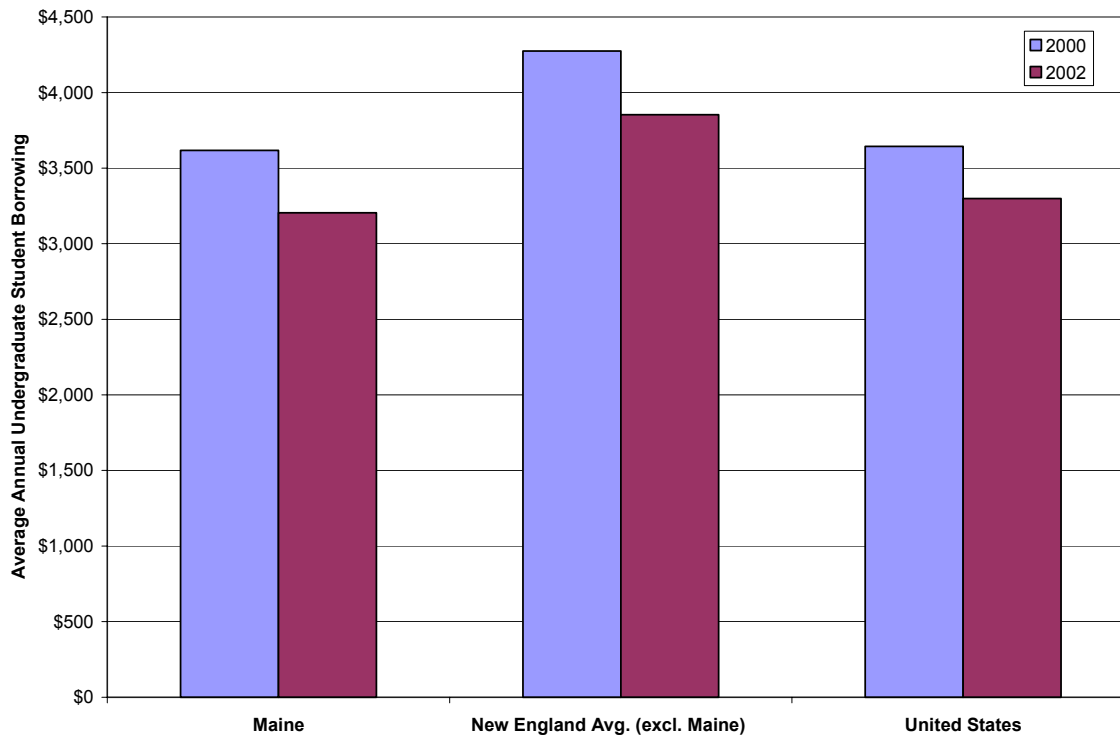


In terms of what all of the figures mean for the bottom-line, or how much students have to borrow to attend college, in 2002 Maine students borrowed, on average, \$3,205 annually. This is about \$650 lower than the New England average (\$3,854) and slightly higher than the national average (\$3,299). Maine's 2002 borrowing level is down considerably from its 2000 level of \$3,617.

# Education Capacity

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Average Annual Student Borrowing for Undergraduates - 2000-2002



## Sources

The information on college affordability and related indicators is from The National Center for Public Policy and Higher Education, *Measuring Up 2002: The State-by-State Report Card for Higher Education*, <http://measuringup.highereducation.org>.

# *Connectivity Capacity*

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## **INDICATORS:**

**21-Internet Connectivity**

**22-Household Connectivity**

**23-High Speed Internet Access**

**24-Classroom Connectivity**

## **Overview**

The Information Superhighway has transformed every segment of society, from families to schools to businesses, from neighborhoods to communities to states and nations. The ability to use the Superhighway, the ability to connect and communicate directly relates to innovation, inventions, and ingenuity, the ingredients that help to expand economic growth and raise standards of living.

Maine's rankings in rates of connectivity vary. For instance, in terms of household connectivity, Maine households have slightly higher access to the Internet than households nationwide, relatively speaking. In classroom connections, Maine students closely match the levels of connectivity of students throughout the nation. This is very important in terms of economic health because Internet connectivity in classrooms has a great impact on the sophistication and complexity of curricula at all grade levels. This helps to support the basis for an educated and talented population.

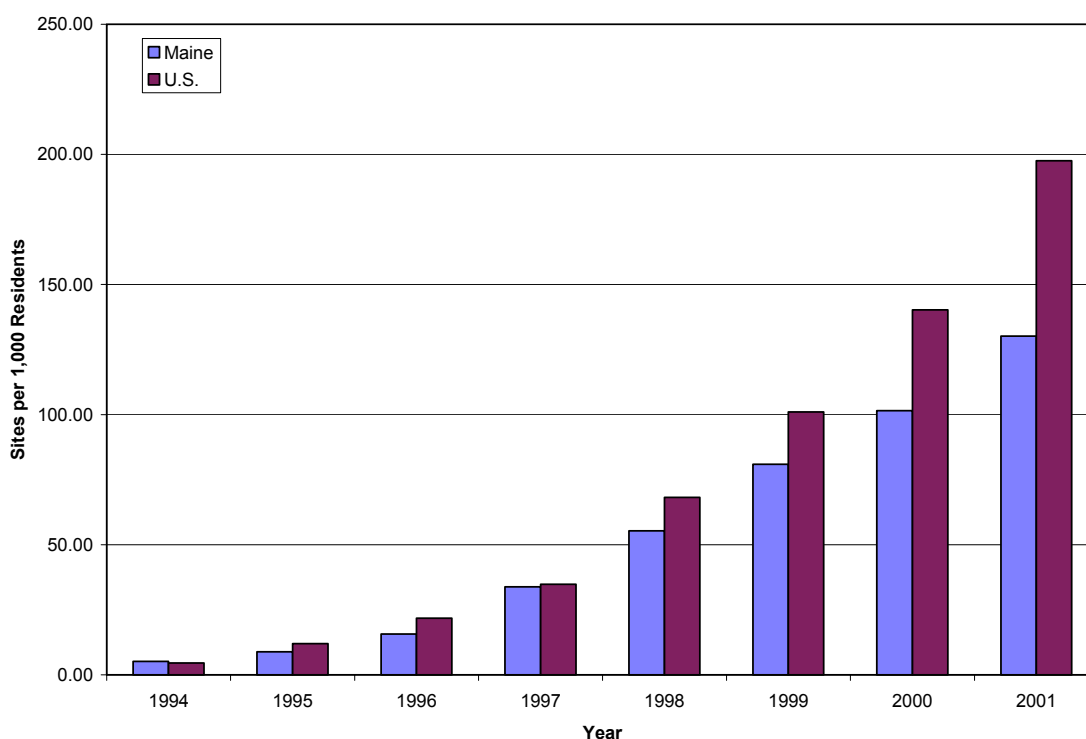
To the contrary, however, Maine's access to Internet host sites per 1,000 residents falls significantly behind that of every thousand residents nationally. The number of hosts per 1,000 people is a measure of a state's use of the most direct level of Internet connectivity.

## 21-Internet Connectivity

### Summary

The number of Internet host sites in Maine has increased significantly over the last eight years. In 2001, there were an estimated 167,158 Internet host sites in Maine. This is more than 26 times the number estimated in 1994 of 6,378. Nationally, the growth in the number of Internet hosts has outpaced growth in Maine. There are an estimated 198 hosts for every 1,000 residents nationwide, whereas in Maine there are an estimated 130 hosts per 1,000 residents.

Internet Host Sites per 1,000 Residents Maine & U.S. - 1994-2001



### Why This Is Significant

An Internet host is any computer system physically connected to the Internet. Individual households and businesses must go through a host to access the web. The number of hosts per 1,000 people is a measure of a state's use of the most direct level of Internet connectivity.

Internet access has become increasingly important in many fields of endeavor. Technology intensive workers, researchers, educators and students require state-of-the-art telecommunications infrastructure. Businesses need high-speed transfer of electronic data among units within their operations, suppliers and customers. Researchers rely on electronic access for collaboration with colleagues throughout the world. Teachers and students are increasingly reliant on information technologies to supplement and enrich classroom-learning experiences. A high score on this indicator suggests that a state is likely to be utilizing this technology.

# *Connectivity Capacity*

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## **Sources**

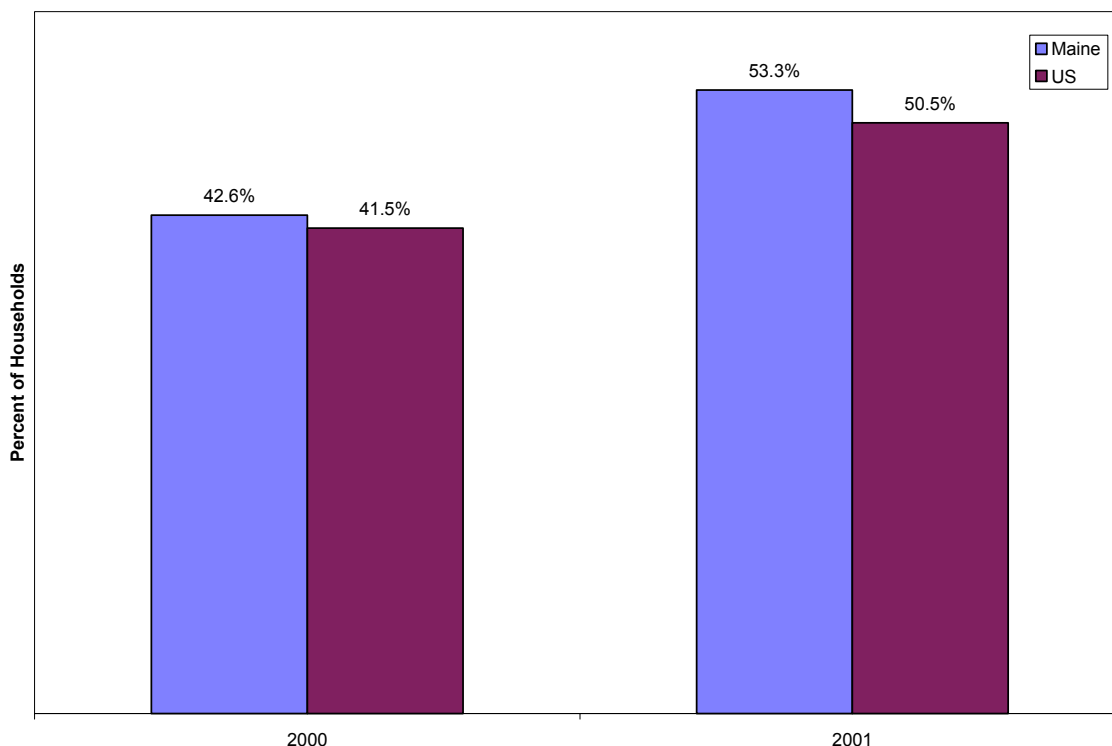
The Internet host data<sup>30</sup> comes from Matrix.net; [www.matrix.net](http://www.matrix.net) and is reprinted with permission. Population data for 1994 through 1999, 2001 is from Population Estimates Program, Population Division, U.S. Census Bureau, [www.census.gov/population/estimates](http://www.census.gov/population/estimates). The 2000 population data is from the U.S. Census 2000. The business use of Internet data comes from the Maine Development Foundation, *2000 Survey of Maine Businesses*. [www.mdf.org/survey](http://www.mdf.org/survey).<sup>31</sup>

## 22-Household Connectivity

### Summary

The percent of households with Internet access increased considerably in Maine from a level of 43 percent in 2000 to 53 percent in 2001. Maine households have higher access to the Internet than their counterparts in the U.S. In 2001, 51 percent of U.S. households had access; this was an increase from the 2000 U.S. level of 42 percent.

Households with Internet Access - Maine & U.S. - 2000-2001



### Why This Is Significant

Household Internet access provides citizens with the opportunity to utilize the Internet for business, education and personal uses 24 hours a day. The Internet is gaining increasing significance as a means of information exchange, communications, business transactions and research. This indicator measures the ease with which Maine citizens can access this information tool compared to the rest of the nation.

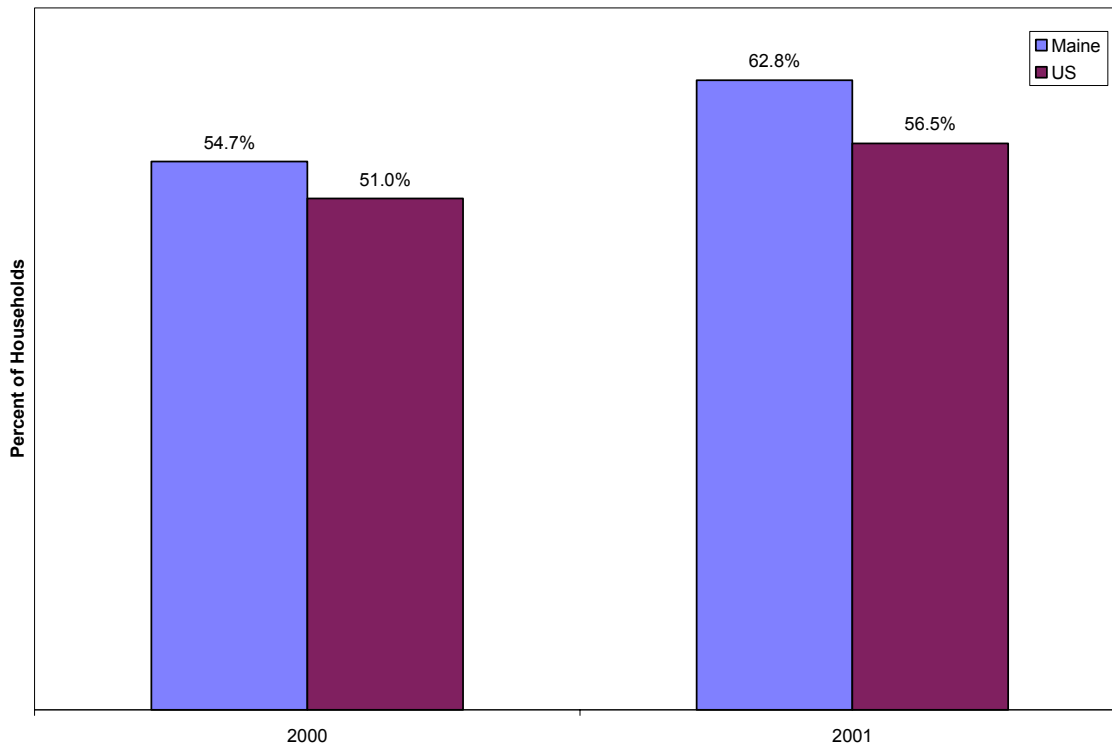
### Related

Maine citizens are better equipped for computer use than the nation as a whole. In 2001, it was estimated that 63 percent of Maine households (up from the 2000 level of 55 percent) had computer access at home, compared to 57 percent nationwide (up from the 2000 level of 51 percent).

# Connectivity Capacity

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Households with Computers - Maine & U.S. - 2000-2001



## Sources

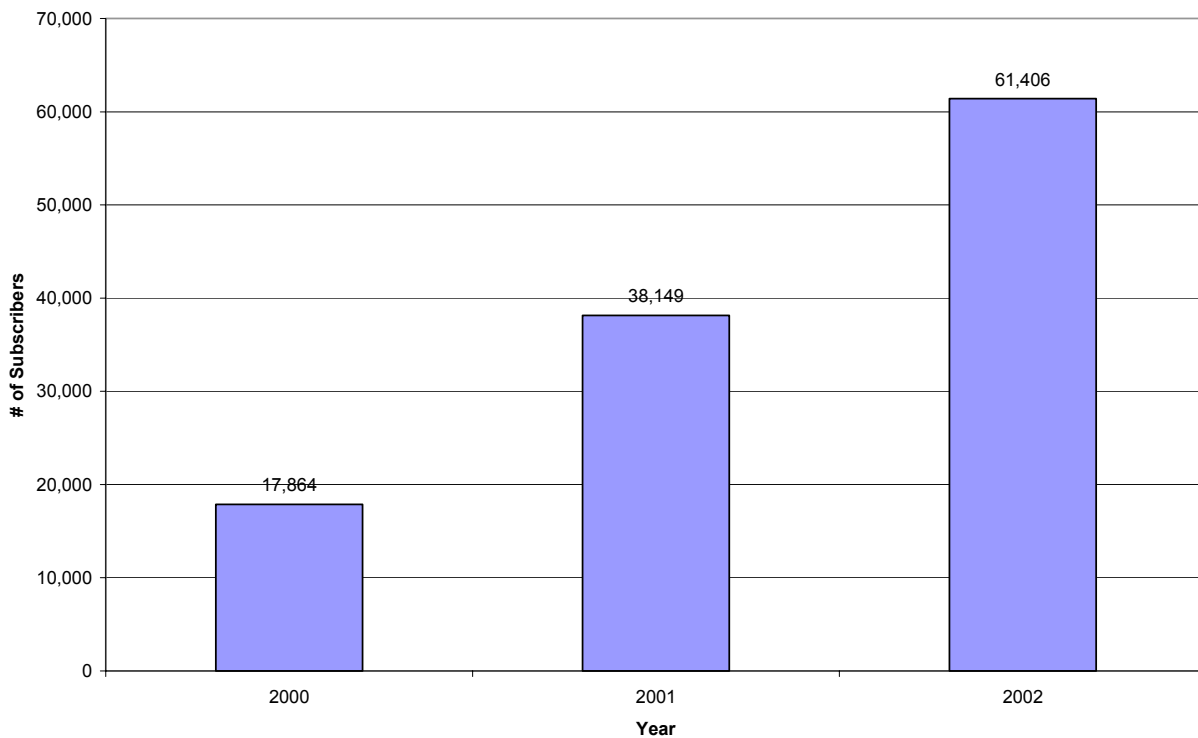
Household computer and Internet access data is from *A Nation Online: How Americans Are Expanding Their Use of the Internet*, February 2002; National Telecommunications and Information Administration (NTIA) and the Economics and Statistics Administration, U.S. Department of Commerce; [www.ntia.doc.gov](http://www.ntia.doc.gov). The NTIA report is based on data from the U.S. Bureau of the Census, 2001 Population Survey.

## 23-High Speed Internet Access

### Summary

Maine has seen a significant increase in broadband<sup>32</sup> Internet subscribers,<sup>33</sup> from 17,864 in 2000 to 61,406 in 2002. This represents an increase of 244 percent.

**Broadband Internet Subscribers, Maine - 2000-2002**



### Why This Is Significant

The degree to which broadband technology is available and used in Maine determines, to a significant extent, the degree to which Maine is technologically competitive. For instance, companies that rely on e-commerce for sales transactions, as an example, require broadband technology. Likewise, entities engaged in research and development require high capacity communications technology.

According to the American Electronics Association, an organization of more than 3,000 companies engaged in aspects of high technology, “Widespread broadband deployment will have a positive effect on many areas of everyday life, ranging from communications, entertainment, and healthcare to education and job training.” Many economists indicate that broadband use and accessibility that is embedded in the quintessential American household and business as a necessity for all rather than only a luxury for few will expand U.S employment by as many as 1.2 million new jobs and add as much as \$500 billion to the nation’s economy.

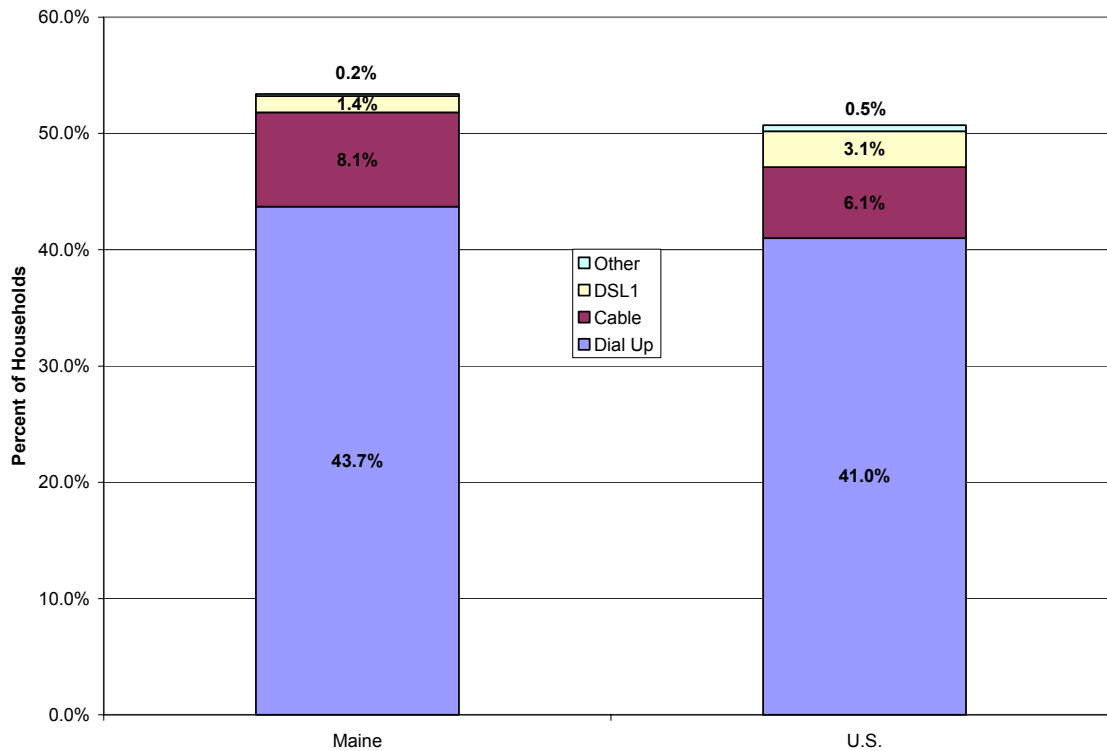


# Connectivity Capacity

## Related

In terms of the method of Internet access used in Maine households, dial-up is dominant. Those who use dial-up equal 44 percent. This is followed by cable at eight percent and DSL at one percent. Maine's reliance on dial-up and cable is slightly higher than that of the U.S., while its reliance on DSL is slightly lower.

Household Internet Access by Method of Access, Maine, U.S. - 2001



## Source

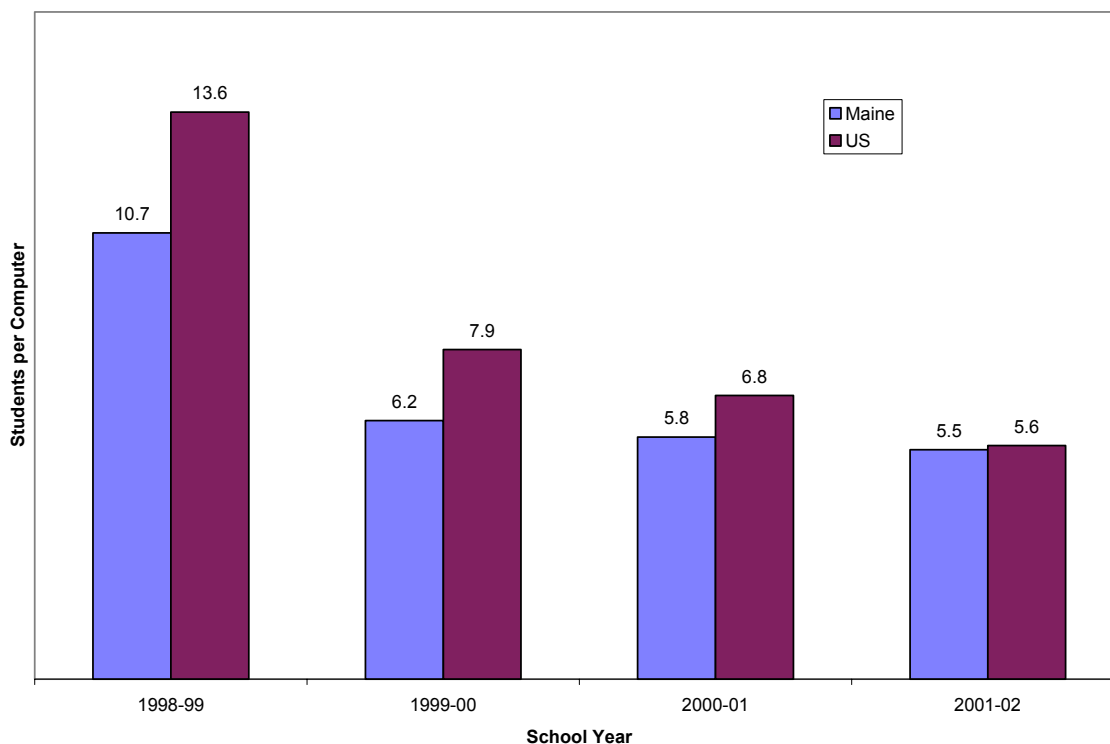
Data, provided by the Federal Communications Commission, was produced in a report by the American Electronics Association, *Broadband in the States 2003: A State-by-State Overview of U.S. Broadband Deployment*.

## 24-Classroom Connectivity

### Summary

In 2002, Maine students had a similar level of access to the Internet as students in the nation as a whole. In that year, there were 5.5 students per Internet-connected computer for students in grades K-12 in Maine, compared to 5.6 students for the nation. Student access to Internet-connected computers in Maine improved more than 48 percent between 1999 and 2002. While Maine once held a significant edge on this indicator, since 1999 the rest of the nation has caught up. Looking to the future however, Maine has recently adopted a laptop initiative that provides a laptop to every 7<sup>th</sup> grade student. It is safe to assume that Maine's progress on this indicator will likely begin to outpace the U.S. as a whole, since Maine's initiative is one of the first in the nation.

K-12 Students per Internet Connected Computer - Maine & U.S. - 1999, 2000, 2001, 2002



### Why This Is Significant

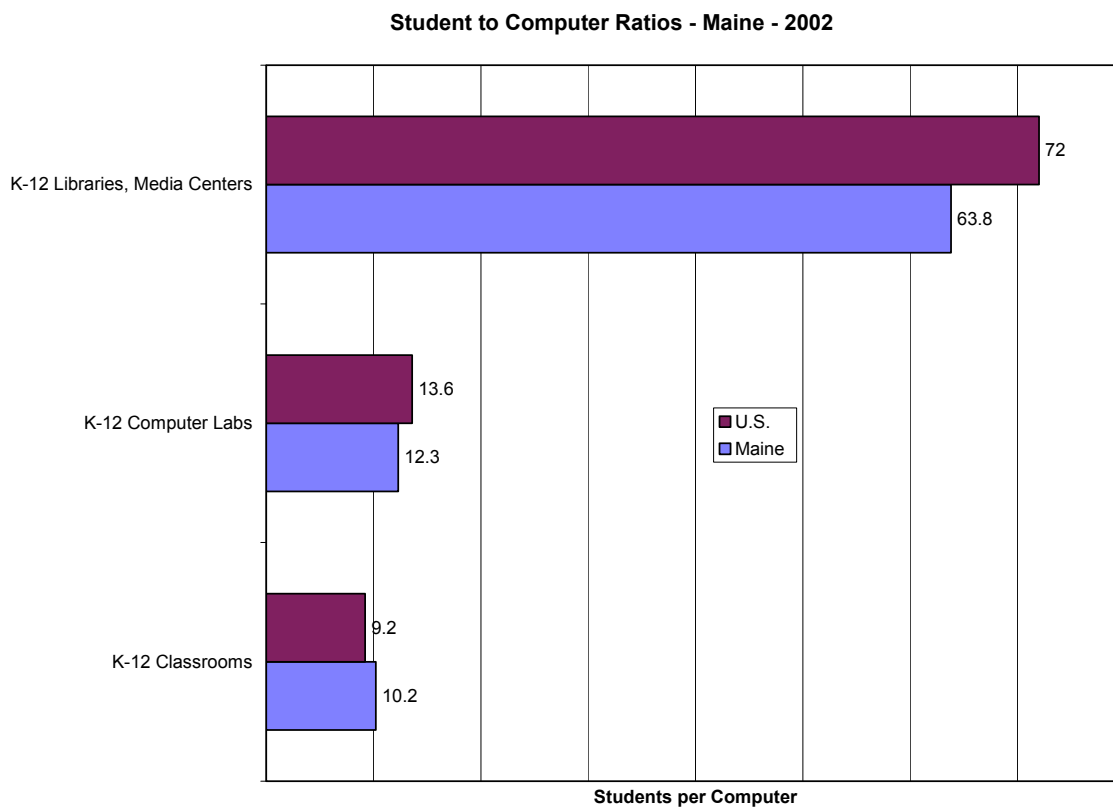
The Internet provides access to research and information that can enhance classroom curriculum at every grade level. Easy access to Internet-connected computers is needed for teachers to effectively incorporate information technologies into the learning environment.

Computer literacy is increasingly becoming a minimum requirement of employers. In 2000, 64 percent of Maine businesses surveyed indicated that computer literacy of high school graduates was critically important.<sup>34</sup>

# Connectivity Capacity

## Related

In 2002, the ratio of Maine students to computers in K-12 classrooms (including Internet and non-Internet connected computers) was 10.2 students compared to 9.2 in the nation. The computer lab ratios were 12.3 for Maine and 13.6 nationwide. K-12 libraries and media centers provided one computer per 63.8 students in Maine and one computer per 72 students in the nation as a whole.

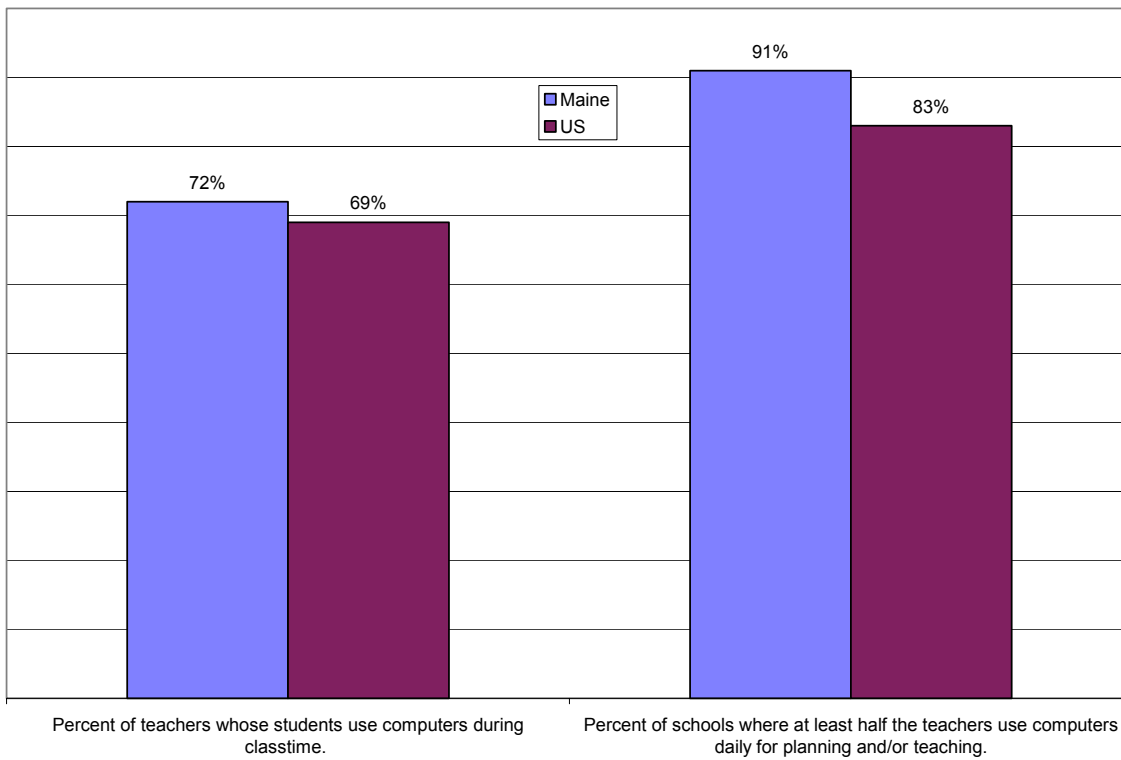


Maine teachers make greater use of computers than their counterparts nationwide. In 2000, 72 percent of Maine teachers indicated that their students use computers during class time compared to 69 percent of teachers in the U.S. In addition, 91 percent of Maine teachers use computers daily for planning and/or teaching compared to 83 percent of teachers in the nation.

# Connectivity Capacity

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Teacher Use of Computers, Maine, US - 2000



## Sources

Student to computer ratios and teacher use of computers data are from *Technology in Education 2002*, Education Week, based on a survey conducted by Market Data Retrieval; [www.edweek.org/sreports](http://www.edweek.org/sreports).

## Endnotes

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<sup>1</sup> EPSCoR focuses on those states that have historically received lesser amounts of federal R&D funding and have demonstrated a commitment to develop their research bases and to improve the quality of science and engineering research conducted at their universities and colleges. The program currently operates in 23 states: Alabama, Alaska, Arkansas, Delaware, Hawaii, Idaho, Kansas, Kentucky, Louisiana, Maine, Mississippi, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, South Carolina, South Dakota, Tennessee, Vermont, West Virginia, and Wyoming, as well as the Commonwealth of Puerto Rico and the U.S. Virgin Islands. This description is from the EPSCoR Web site at: <http://www.ehr.nsf.gov/epscor/start.cfm>.

<sup>2</sup> Data on individual company R&D is not available. However, the spike in 1995 in industry R&D was likely due to one or a few large companies performing federally funded R&D.

<sup>3</sup> Total R&D includes R&D for all performance sectors including industry, universities and colleges, non-profit institutions, federal government, and federally funded research development centers from all sources of funding. Detailed industry R&D for 1991 in Maine is not available from NSF and therefore summary data for that year is omitted from this analysis. Not-for-profit performed R&D as reported by NSF includes only that which is funded by the federal government. Therefore, this data understates the intensity of not-for-profit performed R&D.

<sup>4</sup> Maine experienced a significant spike in industry performed R&D in 1995, reaching a total of \$286 million. Data on individual company R&D is not available. However, the spike in 1995 in industry R&D was likely due to one or a few large companies performing federally funded R&D.

<sup>5</sup> Industry R&D for 1991 is not reported by NSF due to non-disclosure requirements.

<sup>6</sup> Academic Fields of Study are defined as: Engineering (aeronautical and astronautical, bioengineering and biomedical, chemical, civil, electrical, mechanical, metallurgical and materials); Physical Sciences (astronomy, chemistry, physics); Environmental Sciences (atmospheric, earth sciences, oceanography); Mathematical Sciences; Computer Sciences; Life Sciences (agricultural, biological, medical); Psychology; Social Sciences (economics, political science, sociology); unclassified.

<sup>7</sup> Academic R&D performance excludes federally funded research and development centers administered by academic institutions, of which Maine has none.

<sup>8</sup> Excludes nonprofit federally funded research and development centers administered by academic institutions for which there are none in Maine but that do exist nationally. Also, the not-for-profit data only includes research expenditures funded by the federal government because data from other funding sources is not available on a state basis.

<sup>9</sup> Each of these institutions contributes to Maine's robust not-for-profit R&D infrastructure. However, it must be noted that Jackson Laboratories accounts for the significant portion of not-for-profit R&D performance. For 2002, Jackson Labs reported total research funding in excess of \$50 million (Tanski, T., Richards, S., (2002) *Research and Development in Downeast Maine, An Inventory of Assets*”).

<sup>10</sup> The federal R&D data in this section represent obligations as opposed to outlays. According to NSF, obligations represent the amounts for orders placed, contracts awarded, services received, and similar transactions during a given period, regardless of when the funds were appropriated and when future payment of money is required.

<sup>11</sup> This includes federally funded research and development centers (FFRDC's). These are R&D-performing organizations that are exclusively or substantially financed by the Federal Government and are supported by the Federal Government either to meet a particular R&D objective or, in some instances, to provide major facilities at universities for research and associated training purposes. Each center is administered either by an industrial firm, a

# Maine Innovation Index

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university, or another nonprofit institution. Maine has no FFRDC's. Intramural performers are the agencies of the Federal Government. Their work is carried on directly by federal agency personnel.

<sup>12</sup> Includes the obligations of the 10 or 11 major R&D supporting agencies that were requested to report this information; together they represent 96 percent or more of the total R&D obligations.

<sup>13</sup> State R&D investments in Maine include portions of funding within the following program areas:

UMS Maine Economic Improvement Fund  
Small Business Innovation Grant Assistance Program (now at MTI)  
Research and Development Bond  
UMS Infrastructure  
Other: Science Works, MERITS  
Maine Technical College System  
Maine Department of Education  
Maine Technology Institute  
Maine Biomedical Research Program  
Maine Applied Technology Center System  
Maine Science and Technology Foundation (now defunct)  
Centers for Innovation  
EPSCoR  
Maine Technology Investment Fund (now defunct)  
Small Enterprise Growth Fund

<sup>14</sup> This includes research equipment expenditures at all degree-granting institutions, public and private.

<sup>15</sup> Maine data on venture capital is typically under-reported. The MoneyTree survey is a self-reporting survey and not all companies report. It should also be noted that Maine has several venture-type fund programs that are typically not reported in the venture capital data including the Small Enterprise Growth Fund and CEI Ventures Fund.

<sup>16</sup> The residence of the first-named inventor determines the origin of a patent.

<sup>17</sup> The utility patent data excludes design patents, plant patents, reissues, defensive publications, and statutory inventions registrations.

<sup>18</sup> Definition of High Technology is from the U.S. Department of Commerce, based on 39 NAICS codes corresponding to high-technology industries. Data by NAICS codes are only available back to 1999.

<sup>19</sup> Net high technology formation is calculated by subtracting technology establishment births from technology establishment deaths. It is expressed for this indicator as a ratio to 10,000 total business establishments.

<sup>20</sup> Occupation categories include: computer and information scientists; mathematical scientists; life and related scientists (biological and agricultural science, environmental sciences, health sciences); physical and related scientists (chemistry, earth, atmospheric, ocean, physics and astronomy); social and related scientists (economics, political science, sociology, and anthropology); psychology; and engineering (aerospace, aeronautical, chemical, civil, electrical, computer, materials, metallurgical, and mechanical).

<sup>21</sup> *International Comparisons of Expenditures for Education, The Condition of Education 2003*. National Center for Education Statistics. Indicator 40. International Comparisons of Expenditures for Education.

# Maine Innovation Index

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<sup>22</sup> The Mortenson Research Seminar on Public Policy Analysis of Opportunity for Postsecondary Education, [www.postsecondary.org](http://www.postsecondary.org) for further analysis on this subject.

<sup>23</sup> Current Population Reports, *Educational Attainment in the United States*, U.S. Census Bureau, U.S. Department of Commerce, March 2000.

<sup>24</sup> The science and engineering degrees awarded data per 1,000 residents includes associates, bachelors, masters, first professional, and doctorate level degrees. Science and engineering degree fields include the science fields of engineering (aerospace, chemical, civil, electrical, mechanical, materials, and industrial), physical sciences (astronomy, chemistry, and physics), geosciences (atmospheric, earth, and oceanography), math and computer sciences (mathematics and statistics, and computer science), life sciences (agricultural, biological, and medical), psychology, social sciences (economics, political science and public administration, sociology, anthropology, linguistics, history of science, and area and ethnic studies), science and engineering technologies (science technologies, engineering technologies, and health technologies) and interdisciplinary sciences. The masters or more category in the related chart includes masters, first professional, and doctorate degrees.

<sup>25</sup> "Chance for College by Age 19" is reported by the Mortenson Research Seminar on Public Policy Analysis of Opportunity for Postsecondary Education and equals the product of the public high school graduation rate and the college continuation rate. The public high school graduation rate equals high school graduates divided by the number of 9th grade enrollments 4 years prior. The data is based on "Public Elementary and Secondary Education Statistics," National Center for Education Statistics, [www.nces.ed.gov](http://www.nces.ed.gov). The college continuation rate equals the number of fall freshman enrolled anywhere in the U.S. who were high school graduates the previous spring. The data is from the biannual Integrated Postsecondary Education Data System, National Center for Education Statistics, [www.nces.ed.gov](http://www.nces.ed.gov). Chance for college 1990 data was not released, and data on college continuation rates prior to 1990 for some states including Maine lacked completeness for reliable estimates. Therefore, examination of trends prior to 1990 is not advisable; see "Postsecondary Education Opportunity," The Mortenson Research Seminar on Public Policy Analysis of Opportunity for Postsecondary Education, Number 69, Oskaloosa, Iowa, March 1998, [www.usha.uh.edu/TCRSBchnaceforcollege.html](http://www.usha.uh.edu/TCRSBchnaceforcollege.html).

<sup>26</sup> The MEA has the advantage over other educational assessment tests of being completed by each Maine student in grades four, eight, and eleven each year. The MEA was restructured for 1998-99 to reflect the goals and objectives of Maine's Learning Results initiative. Therefore, results for 1998-99 and later are not comparable to earlier results. Other assessment tools, such as the National Assessment of Educational Progress (NAEP), are completed by a sample of Maine schools. For the 1996 NAEP mathematics assessments, 93 Maine public schools participated and for the 1996 science assessments, 95 Maine public schools participated. While the NAEP and other nationally administered test such as Scholastic Aptitude Test (SAT) allow for comparisons between Maine and the rest of the U.S., the MEA provides the most comprehensive measure of progress among Maine's students. In order to make comparisons to students across the U.S. these national indicators are also utilized in this report card (see related data for this indicator as well as the indicator on gender disparity).

<sup>27</sup> The 2000 and 2003 NAEP scores include scores for students participating through accommodations. Accommodations are related to assessing students with disabilities and/or students for whom English is not their first language. Prior to 1996, no accommodations were permitted.

<sup>28</sup> Applied Educational Research, Princeton, NJ and The College Board: Enrollment numbers differ slightly from those reported by the Maine Department of Education.

<sup>29</sup> *The Gap Between College Costs and Student Resources* by Kenneth E. Redd, Director of Research and Policy Analysis, National Association of Student Financial Aid Administrators, National Center for Education Statistics, 2003.

# *Maine Innovation Index*

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<sup>30</sup> The numbers of hosts are estimates for January of each year. An internet host is defined as a domain name that has an associated IP address. It is an estimate of the minimum number of computer systems connected to the Internet. It is a minimum estimate because a given host may support numerous Internet connections. Currently, no method is available to accurately determine the number of users accessing Internet services via a given host. It is also considered a minimum estimate because surveys of hosts may be blocked from reaching certain hosts by firewalls. For more information on Internet host surveys, see Internet Infrastructure Indicators, Organization for Cooperative Economic Development, October 1998.

<sup>31</sup> Percentages represent percent of valid responses (those indicating an answer to the question: "What telecommunications systems and services are currently used by your company?")

<sup>32</sup> "Broadband" is defined as high-speed data lines that provide the subscriber with data transmissions at speeds in excess of 200 kilobits per second (kbps) in at least one direction.

<sup>33</sup> "Subscriber" is equivalent to a line in service. An active line may have one or more users.

<sup>34</sup> Maine Development Foundation *2000 Survey of Maine Businesses*, [www.mdf.org/survey](http://www.mdf.org/survey)