UNDERSTANDING ALASKA UPDATE

University of Alaska Research: An Economic Enterprise[1]

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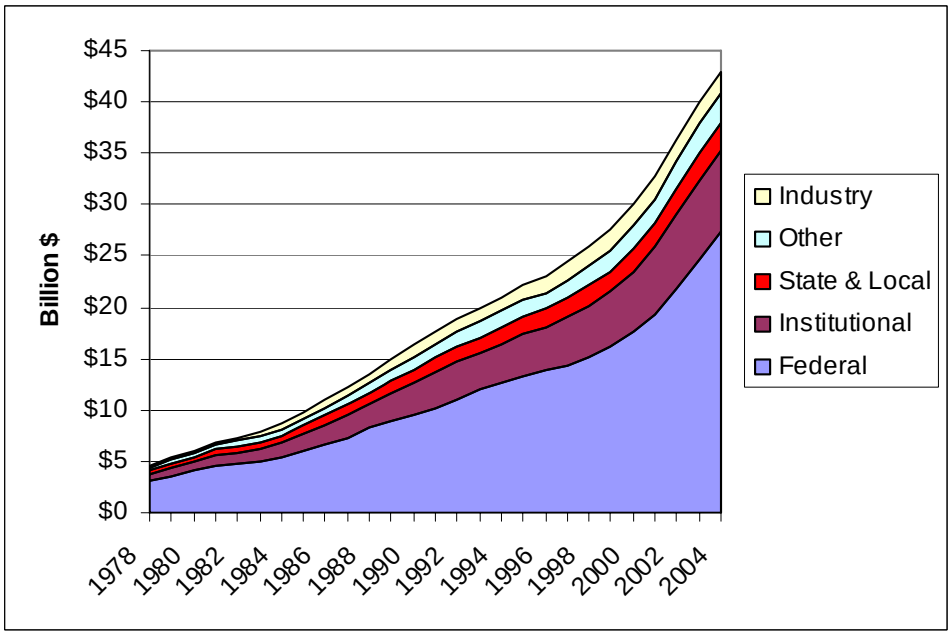
National Trends in University Research

Nearly $50 billion of the $312 billion of total U.S. research and development expenditures in 2004 (preliminary) consisted of university research. Excluding federally funded research and development centers administered by universities, like the Los Alamos National Laboratory, total research-related revenues of U.S. universities were $43 billion in FY 2004, continuing a positive trend stretching back at least to the early 1950s.

Figure 1. U.S. University Research Revenues: Historical Growth

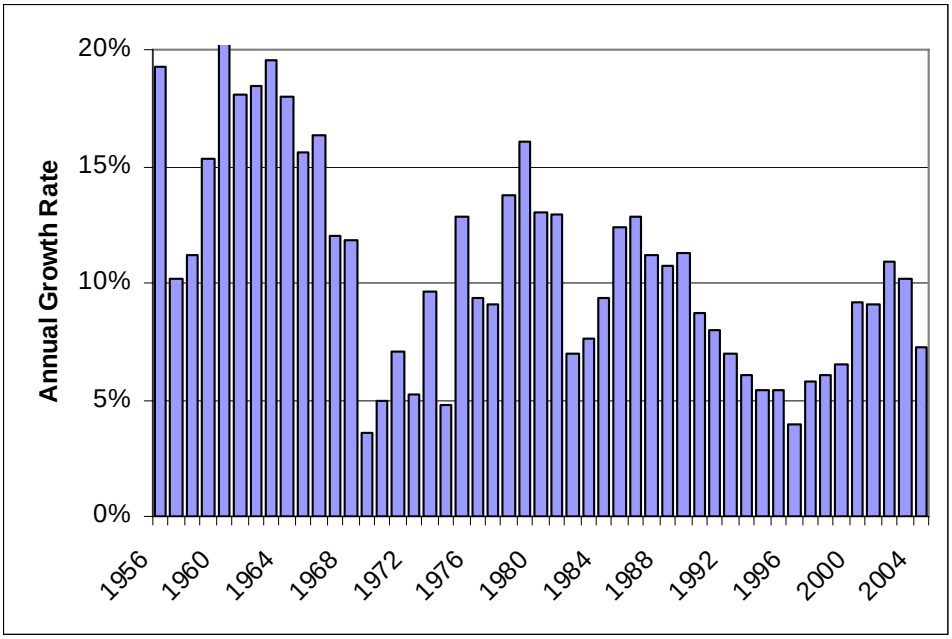


Source: National Science Foundation

[1] This paper updates the June 2004 ISER analysis entitled The Economics of University Research.

In the last 50 years the annual increase in research revenues has ranged between 4 and more than 20 percent, and since 1978 it has averaged 9 percent--considerably above the overall growth rate for the U.S. economy.

Figure 2. U.S. University Research Revenues: Annual Growth Rate



Source: National Science Foundation

The federal government is the largest source of funding for university research, accounting for 64 percent in 2004. Internal university funding (institutional funding) is next in order of importance, contributing 18 percent of the total. State and local governments account for nearly 7 percent, as does the category of other (including nonprofit organizations). Private industry is the smallest category of contributor, providing less than 5 percent.

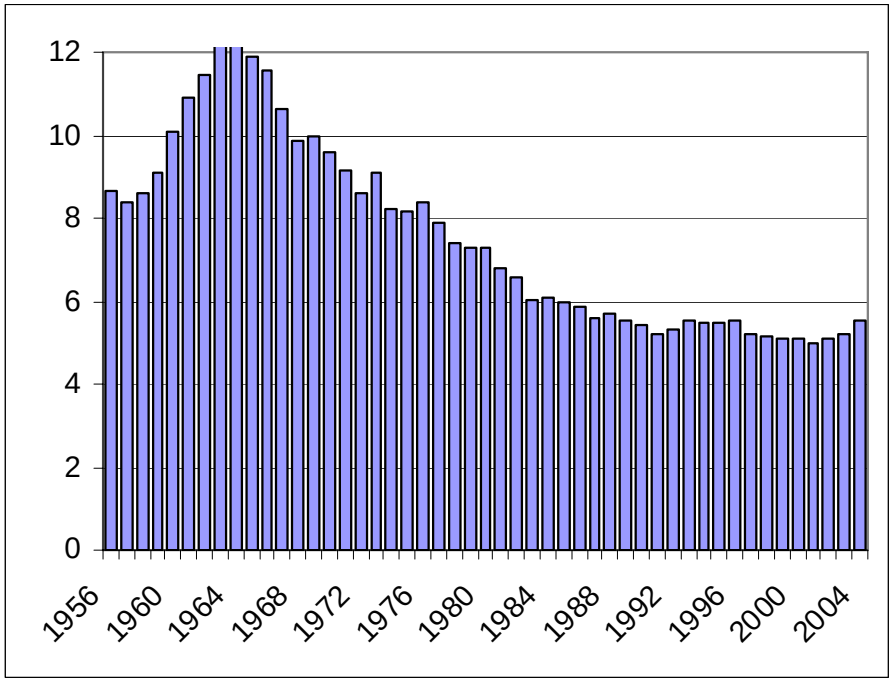
Table 1. Sources of U.S. University Research Funding, 2004

	Billion $	Share
TOTAL	$ 42.95	100%
Federal Government	$ 27.38	63.8%
Institutional Funds	$ 7.77	18.1%
State and Local Govt	$ 2.85	6.6%
Other	$ 2.84	6.6%
Industry	$ 2.11	4.9%
Source: National Science Foundation		

A research multiplier is one way to summarize the productivity of internal (institutional) research funding in generating external funds for research. It is defined as the ratio of total research dollars to internal (institutional) university funding. Nationally the multiplier has trended downward over time, but in the last 20 years it has stabilized in a range between 5 and 6. The

multiplier was 5.5 in 2004 meaning that each internal dollar of university funding generated total research funding of $5.50.

Figure 3. U.S. University Research Multiplier



Source: ISER from National Science Foundation data

University of Alaska Research Revenues

Total research and development spending (including not only academic but also government and private research) in Alaska in 2003, the most recent year for which complete information is available, was $321 million. Alaska ranked 48th among the states, consistent with the size of its economy, measured by gross state product. Academic research was a higher share of total research and development, as reflected by Alaska's rank of 43rd among the states.

Table 2. Alaska Research and Development (R&D) Profile, 2003

	Amount (Million $)	State Rank
Total	$321	48
Industry	$36	51
Academic	$141	43
Other	$144	Na
Gross State Product (Billion 2004 $)	$34	47
Source: National Science Foundation		

The importance of academic research in Alaska is also reflected in the amount of spending in relation to population and the work force. In 2003 university research was $215 per capita in Alaska compared with the U.S. average of $135.

Table 3. Alaska Academic Research and Development (R&D) Spending per Person in 2003, Alaska and U.S.			
	Alaska	U.S. Average	Ratio
Per Capita	$215	$135	1.59
Per Worker	$422	$269	1.57
Source: ISER from National Science Foundation data			

University of Alaska research revenues have been increasing for at least a decade, and in FY 2006 exceeded $151 million. Of this total, less than $20 million came from the state general fund (institutional funds). At the same time the research multiplier, a measure of the productivity of internal funding (institutional or state general fund), has been trending upward. In 2006 it was 7.6, indicating that each state general fund dollar allocated to research produced $7.60 in total research funding for the university.

Table 4. Sources of University of Alaska Research Revenue (Million $)					
	State General Fund (a)	**All Other**	**Total (b)**	**Research Multiplier (b / a)**	**Growth Rate of Total Revenue**
FY98	$15.1	$62.1	$77.2	5.1	
FY99	$13.0	$68.5	$81.5	6.3	5.5%
FY00	$15.4	$75.3	$90.7	5.9	11.3%
FY01	$16.3	$92.9	$109.4	6.7	20.7%
FY02	$16.3	$103.4	$119.8	7.3	9.5%
FY03	$16.6	$116.5	$133.1	8.0	11.1%
FY04	$16.8	$121.4	$138.3	8.2	3.9%
FY05	$18.7	$126.3	$145.0	7.7	4.9%
FY06	$19.9	$131.5	$151.3	7.6	4.3%
Source: University of Alaska Statewide Budget and Institutional Research					

As is the case nationally, university research in Alaska is highly dependent on federal spending, which provided $111 million in 2006, including funds that passed through state government and private (and nonprofit) enterprises.

Table 5. University of Alaska's Direct Research Expenditures by Source of Funds (Million $)							
	Direct From Federal	Total From State		Total From Other		Total	Item: Total Federal
		Direct	Fed Pass Through	Direct	Fed Pass Through		
	a		b		c		(a+b+c)
FY01	$ 54.7	$ 1.8	$ 2.3	$ 8.3	$ 19.0	$ 86.1	$ 76.0
FY02	$ 67.2	$ 2.5	$ 3.0	$ 9.7	$ 14.6	$ 97.1	$ 84.9
FY03	$ 80.7	$ 2.0	$ 2.4	$ 10.0	$ 15.7	$ 110.8	$ 98.8
FY04	$ 91.4	$ 1.4	$ 1.6	$ 10.4	$ 10.7	$ 115.5	$ 103.7
FY05	$ 97.1	$ 1.8	$ 1.1	$ 13.9	$ 8.6	$ 122.6	$ 106.8
FY06	$ 100.4	$ 2.4	$ .7	$ 15.0	$ 10.0	$ 128.6	$ 111.1
These figures exclude state general fund support.							
Expenditures differ from awarded amounts because many grants are multiyear awards.							
Source: Data supplied by MAUs via UA Information Systems: Banner SI Closing Extracts 2001- 2006. Compiled by Statewide Budget and Institutional Research							

University Research's Direct Economic Impact

Over half of the University of Alaska's research budget in 2006 (excluding $13.1 million of indirect cost recovery that provided general university support) was paid out in wages and benefits to 1,292 university employees.[2] The next largest budget item was contracted services, comprising a diverse array of purchases, from computer and aircraft maintenance to facilities rental to freight services. Purchases of capital equipment were largely computer related and miscellaneous research equipment, but also included items such as safety and transportation equipment. Commodity purchases included a variety of items such as field camp supplies, food for animals, and fuel for planes and boats. Travel included both in-state and out-of-state travel. Small amounts were budgeted for student aid and miscellaneous expenses.

Table 6. University of Alaska Research: Direct Expenditures by Category, 2006		
	Million $	Share
Total	**$ 138.2**	
Wages	$ 52.6	38 %
Benefits	$ 25.0	18 %
Contracted Services	$ 33.2	24 %
Capital Equipment	$ 7.3	5 %
Commodities	$ 8.5	6 %

[2] Full-time equivalent employees

Travel	$ 6.3	5 %
Student Aid	$ 3.5	3 %
Miscellaneous	$ 1.7	1 %
Source: University of Alaska Statewide Budget and Institutional Research		

Although some of these purchases, like computer and other research equipment, were made outside the state and had little effect on the Alaska economy, most of the research budget funds either wages paid to Alaska workers or purchases from Alaska businesses. Because of this, the total effect on Alaska's economy is large, relative to the total amount spent on university research.

Adding to the direct effect of university research on the economy is the spending associated with visiting scholars who travel to Alaska to conduct their own research activities, funded through their home academic institutions in other states.[3] The economic effect of these visitors is analogous to that of tourists visiting Alaska from other parts of the world, bringing outside money into the state and spending it to the benefit of the Alaska economy.[4]

Growth Since 2003

Total university research spending increased 14 percent between FY 2003 and 2006, with most of the growth occurring in personal services and benefits. Payroll growth of 16 percent contributed to an increase of 5 percent in total employment, after taking into account growth in the average wage. The rapid increase in costs of employee benefits, which grew by 53 percent, absorbed a large share of the total increase in spending.

Table 7. University of Alaska Research: Recent Growth (Million $)

	FY 2003	FY 2006	Change	% Change
TOTAL	$ 121.6	$ 138.2	$ 16.6	13.7%
Personal Services and Benefits	$ 62.8	$ 77.6	$ 14.9	23.7%
Staff Benefit Expense*	$ 12.9	$ 19.7	$ 6.9	53.4%
Payroll	$ 45.3	$ 52.6	$ 7.4	16.3%
Average Wage	$ 36,852	$ 40,753	$ 3,900	10.6%
Direct Jobs	1,228	1,292	64	5.2%

[3] For example, Toolik Field Station in Northern Alaska every year hosts large numbers of non-resident researchers during the summer field season. The effect of these non-resident researchers is not included in our estimate of the total economic effect of university research on the state economy.

[4] University and other research facilities in Alaska also attract tourist visitors to the state and help to enhance the quality of the experience of visitors. Examples include the Sealife Center in Seward and the museum at the University in Fairbanks.

*Benefits here excludes sick and holiday pay and tuition wavers.
Source: ISER

University Research Total Economic Effect

Most of the money that funds university research in Alaska comes from sources outside the state, or in-state sources that could spend their research dollars elsewhere. So university research can be viewed as an economic enterprise similar to the metal mining industry, the seafood industry, the timber industry, the oil and gas industry, or any of the other basic industries that drive the state economy. Each brings new dollars into the state.

The infusion of research dollars into Alaska leads to expansion of the economy. These dollars pay the salaries of Alaska workers and support sales to Alaska businesses. Their economic effect extends beyond the direct effect of paying for the cost of research. The economic multiplier generates employment, payroll, and business sales throughout the state.

The total economic effect of university research can be measured by the number of jobs supported, total payroll produced, and business sales generated within the state by research dollars. In 2006 2,392 jobs could be traced back to university research spending. Of this total, 1,292 jobs were within the university—faculty, staff, student assistants, and others—and 1,100 were in a broad range of private businesses scattered throughout the state—in industries like construction, transportation, wholesale and retail trade, and services.

The total payroll associated with these jobs was more than $92 million, with a little over half going to university employees and the rest to workers in the private economy.

We estimate direct in-state procurement of $49 million was associated with the university research budget. As indicated, this includes purchases of a wide array of services and commodities, as well as some construction and transportation services. Employees spending their paychecks, and companies doing business with the university that also made local procurement purchases generated an estimated $76 million more in business sales throughout Alaska, for a total of $125 million in sales.

Table 8. University of Alaska Research: Total Economic Effect in 2006 (Million $)	
Jobs	
Total	2,392
University	1,292
Private	1,100
Payroll (Million $)	
Total	$ 92.1
University	$ 52.6
Private	$ 39.5
Private Business Sales (Million $)	

Total	$ 125.2
Direct Procurement	$ 49.3
Other Sales	$ 75.9
Source: ISER calculations	

Characteristics of the Research Industry

Viewed as an economic enterprise, university research has a number of attractive features.

- Labor Intensive—Over 1/3 of the revenues from this industry (38 percent) went directly into payroll.
- High Wage—The average wage is higher than the economy-wide average.
- Quality Jobs—Most jobs come with a full benefits package that adds considerable value over and above the wage.
- Year-Round Employment—Although some jobs are seasonal or only for the academic year, most are year-round, and may offset the summer seasonal decline in teaching activity at the university.
- Diverse Job Mix—The variety of research activities generates a diverse mix among the private sector jobs that depend on research spending.
- High Resident Job Share—Residents hold most of the jobs in university research.
- Stable—Spending on university research nationally has increased each year for at least the last 50 years and for at least the last 10 within Alaska.
- Growing—Growth in spending on university research has outpaced growth in the overall U.S. economy.
- Footloose—Research can be conducted wherever there is a decent laboratory with support for the scientists. It need not be located in proximity to resource deposits, as is the case for our natural resource industries, or close to markets, as is the case for most services.
- Environmentally Benign—University research is a clean industry with minimal effects on the quality of the environment.
- Low Burden on Government—Government regulation and oversight is not required.
- Non-Competitive with Other Industry—University research does not generate conflicts over appropriate and conflicting uses of the environment and natural resources.

- Stable Potential Tax Base—Although it does not directly create a product that is taxable, the large payroll and in-state procurement per dollar of spending on research create potential tax bases of personal and business income.

- Backward Linkages—Unlike some industries (like oil and gas and rural tourism) that are "enclaves" physically located in Alaska but not linked to the rest of the economy through purchases of local inputs, the large procurement budget and urban location for most research activities result in strong backward linkages that foster economic activity in support industries.

- Forward Linkages—There are no direct forward linkages in the form of sales to other sectors of the economy from university research, but most of Alaska's resource industries also lack forward linkages.

Benefit to Cost Comparison

The state general fund appropriation to the university for general support of research in 2006 was $19.8 million, about 8 percent of the total university general fund budget of $248 million. Total university research expenditures in that year were $151.3 million, producing 2,392 jobs and $92.1 million in payroll. [5]

If we think of the state general fund appropriation for research as "seed money," then we can calculate the return to the economy from that expenditure as the jobs and income created. Specifically the "bang per buck" for each $1 million of general fund appropriation for research in 2006 was 121 jobs and $4.7 million in payroll within the state.

There are indirect benefits to the university from research activities as well. World-class research adds prestige to the university, which in turn leads to a greater demand among potential students and an increased ability to attract quality faculty.[6]

The Product of University Research

The value of the output of private basic industry is reflected in the prices of their products, and their objective is profit for their shareholders. Increasing knowledge, productivity, and personal well-being are incidental to what they produce. In contrast, the objective of university research is new knowledge that can be applied to increase productivity in business and government and improve the well-being of households. These value added spin-offs, difficult to quantify, are a unique feature of university research—and an added bonus that other Alaska basic industries do not provide.

[5] Not counting the impact of the $13.1 million of reallocated indirect cost recovery.

[6] For example the research of Brian Barnes of UAF's Geophysical Institute has been highlighted on the cover of Science magazine. The first Rasmuson Chair in Economics was held by Dr. Vernon Smith, a Nobel Prize Laureate.

Comparisons With Some Other Alaska Basic Industries

Each Alaska basic sector industry has different features and characteristics. In this section we review some features of selected industries to provide some general comparisons with university research as an economic enterprise.

Each of these industries receives support from state government through a variety of mechanisms. These include the operating expenditures of government agencies for public resource management, tax incentives, capital grants, and loans. We have not attempted to quantify the support provided each industry to make any comparisons with our "bang per buck" calculation for university research, because such data is not readily available for most industries.

Metal Mining. The value of metal minerals production in Alaska--primarily zinc, gold, and silver--was $1.3 billion in 2005,[7] generating a payroll of $96 million and annual average employment of 1,298 in the mining sector[8]. Mining is very capital intensive (as reflected in the low ratio of payroll to value of production), high wage, resource dependent (subject to market price fluctuations and location-dependent), and environmentally sensitive. It generated $25.4 million in revenues to the state in 2005, as well as $12 million to local governments.[9]

Tourism. Non-resident vacationers spent $811 million in Alaska in 1998, directly generating 12,835 wage and salary jobs and 3,584 proprietor jobs for a total of 16,419 jobs. Wages were $249 million and proprietor income was an additional $65 million.[10] These jobs were concentrated in the lodging, restaurant, retail, and transportation services sectors of the economy. Tourism-related employment tends to be highly seasonal with a large non-resident share. Tourism is a rapidly expanding industry and the growth potential is significant for Alaska.

There has not been a comprehensive analysis of either the public expenditures or public revenues associated with the tourism industry in Alaska.[11] However, continued expansion of this industry will require substantial public investments in infrastructure, marketing, and other services.

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[7] Alaska's Mineral Industry 2005, Division of Geological and Geophysical Surveys, and Alaska Department of Labor.

[8] Alaska Department of Labor, Employment and Earnings.

[9] Alaska Mineral Industry 2005, op. cit. A Department of Commerce, Community, and Economic Development study reported mining industry revenues to the state in FY 2005 of $13.9 million compared to state expenditures related to mining of $1.8 million. See, "The Net Return to the State of Alaska from Timber, Tourism, Minerals, and Commercial Fisheries," March 21, 2006. An earlier study by Legislative Research in June 1996 however reported state revenues of $4 million and state expenditures related to mining of $8 million.

[10] Alaska Visitor Industry Economic Impact Study, 1999 Update, McDowell Group, 1999.

[11] "The Net Return to the State of Alaska from Timber, Tourism, Minerals, and Commercial Fisheries" reported state revenues from tourism in FY 05 of $49.8 million compared to state expenditures related to tourism of $29.2 million. However, half of revenues and expenditures consisted of state ferry operations but none of the fixed costs of the system were attributed to tourists. Similarly a large share of revenues were attributed to hunting and fishing licenses, but none of the costs of management of the state fish and game resources were included.

Seafood. The annual value of the Alaska seafood harvest exceeds $1 billion and after processing it has a wholesale value in excess of $2 billion. During 2000 45,550 people were engaged seasonally in commercial fishing and seafood processing from both Alaska waters and the adjacent federally managed waters. This was equivalent to 27,877 full time jobs, of which Alaskans held 36 percent. Total personal income generated was $437 million.[12] Taxes from fishing activity averaged $47 million in the 1990s, with about half going to local communities.[13] In FY 2005 state seafood revenues were reported to be $53 million.[14]

International Air Cargo. Employment associated with international air cargo operations at Ted Stevens International Airport in 2000 has been estimated to be 3,058 with a payroll of $126 million.[15] The operation is labor intensive and is part of a rapidly expanding industry. It is somewhat sensitive to environmental issues and the business cycle, as well as to technological developments that could affect the relative attractiveness of Anchorage as a location for air cargo services.

Air cargo operations produce revenues for the airport, but the amount of revenue generated for the state general fund has not been calculated. State expenditures in support of the industry have also not been specifically studied. They are probably modest, although the industry does enjoy a tax advantage on fuel sales.

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[12] Alaska Economic Performance Report 2002, Alaska Department of Community and Economic Development., 2003.

[13] Ibid. A 1996 analysis calculated state revenues of $67 million from commercial fishing and $21 million from sport fishing, compared to $102 million in fisheries-related state expenditures. See State of Alaska Natural Resource Revenues and Expenditures in FY 95, Legislative Research Series, June 1996.

[14] Alaska Economic Performance Report 2005, Alaska Department of Commerce, Community, and Economic Development, 2006.

[15] Ted Stevens Anchorage International Airport: Economic Significance 2000, ISER, 2001.