

**Office of the Senior Vice President for Research
(OSVPR)
Strategic Plan
FY2009–FY2013**

Table of Contents

List of Figures and Tables	3
Executive Summary	4
Research Vision and Mission	6
I. The Current Status of Research & Research-Related Services at Penn State	7
A. Status of Research at Penn State.....	7
B. Activities and Status of Service Units within OSVPR	18
1. Central Office	18
2. Technology Transfer and Economic Development Offices	19
a. Intellectual Property Office	19
b. Industrial Research Office	22
c. Innovation Park at Penn State.....	23
d. Ben Franklin Technology PARTners of Central and Northern Pennsylvania	23
3. Office of Sponsored Programs.....	24
4. Office for Research Protections	26
5. Animal Resource Program.....	27
6. Research Publications	28
II. Future Plans and Initiatives	29
A. The Path Forward for Research Initiatives at Penn State.....	29
1. The Institutes.....	29
a. Huck Institutes of the Life Sciences	30
b. Materials Research Institute	31
c. Penn State Institutes of Energy and the Environment.....	31
d. Social Science Research Institute/Children, Youth and Families Consortium.....	32
e. Institute for the Arts and Humanities	33
f. Institute for CyberScience	33
2. Signature Institute Initiatives	34
a. Construction of the Millennium Science Complex to House Materials and Life Sciences Research	34
b. Opening of the Center for Neural Imaging in Chandlee Laboratory.....	35
c. Advances in Energy.....	35

Table of Contents
(continued)

d. Developing the Smart Spaces Center	35
3. Hiring Strategies.....	36
4. Office of Military and Security Programs	36
5. Defense-Related Research Units	37
a. Applied Research Laboratory	37
b. Electro-Optics Center	38
6. Global Efforts	38
B. Infrastructure Support for the Research Agenda	39
1. Central Office	39
a. Large Proposal Support.....	39
b. Technology-Based Economic Development	39
2. Technology Transfer and Economic Development Offices	40
a. Intellectual Property Office.....	40
b. Industrial Research Office	41
c. Innovation Park at Penn State	41
d. Ben Franklin Technology PArtners of Central and Northern Pennsylvania	42
3. Office of Sponsored Programs.....	42
4. Office for Research Protections	43
5. Animal Resource Program.....	44
6. Research Publications	45
III. Beyond Just Research	46
A. Development.....	46
B. Supporting Enhanced Visibility of Penn State Faculty.....	46
1. Institute External Advisory Boards.....	46
2. Academic Awards and Honors	47
3. Campus Visits	47
 Appendices	
Appendix I Task Force on Globalization of Research and Graduate Education Excerpt; March 2008	48
Appendix II “Big Ideas,” Campaign “For the Future”	53

LIST OF FIGURES AND TABLES

Figure 1	OSVPR Organization Chart	8
Figure 2	Research Expenditures, FY1988-FY2007	9
Figure 3	Select Sponsor Expenditures, FY1988-FY2007	9
Figure 4	NSF Total Science & Engineering Research Expenditure Rankings, FY2006; Top Twenty Overall by NSF Fields & Subfields.....	10
Table 1	Top Twenty Institutions Reporting the Largest Federally Financed R&D Expenditures in Science & Engineering Fields, FY2006.....	11
Figure 5	Research Expenditures by Federal Agencies, FY2007	12
Figure 6	Expenditures of Organized Research, FY2007	12
Figure 7	Industry & Foundation Sponsor Expenditures, FY2001-FY2007.....	13
Table 2	Industrial Research Master Agreements, FY2000-FY2007	14
Figure 8	Foundation Support by CIC Institutions, FY2003-FY2006.....	15
Table 3	Target Foundations, Proposals & Awards, FY2004-FY2008.....	16
Table 4	Institutions with NSF-Funded Research Centers (CIC/PA Schools)	17
Table 5	Institutions with NSF-Funded Research Centers.....	17
Table 6	NIH Institutional Training Grants, General Clinical Research Centers, Clinical Translational Science Awards, Cancer Institutes, P01/P30/P50 Grants	18
Figure 9	Invention Disclosures Received, CY1986-CY2007	20
Figure 10	U.S. Patent Applications Filed, CY1988-CY2007	20
Figure 11	IPO Revenues, CY1989-CY2007	21
Table 7	Executed Licenses & Start-Up Companies, CY1990-CY2007	22
Figure 12	Innovation Park at Penn State Square Footage, FY1993-FY2008.....	23
Table 8	Ben Franklin Technology PARTners of Central & Northern PA Funding, FY2008	24
Figure 13	Number of Awards \$10,000 & More Processed by Sponsor Category	25
Figure 14	Number of Processed Contracts versus Gift/Grants.....	25
Table 9	IRB Protocols/IACUC, IBC, UIC Protocols, FY1996-FY2006.....	26
Table 10	Animal Resource Program Census Data by Species	27
Figure 15	OSVPR Institute Structure	29

Executive Summary

By many measures—the excellence of its faculty and students, the quality and quantity of its research products (including publications and other scholarly achievements and technology transferred to the public and private sectors), and the scale of its research expenditures—Penn State is a top-tier research university. The research portfolio of the University has expanded steadily for many years, and it is central to our institutional mission that both the scope and quality of research continue to grow.

The Office of the Senior Vice President of Research is responsible for facilitating the research enterprise by working with a broad range of units across the University. The research office at a major research university must also provide the infrastructure necessary to support the efforts of the faculty and to uphold the standards of conduct expected by governing bodies and which represent the values of the institution.

The strategic plan contained herein provides details on the status of research at Penn State, and sets out goals to continue to further develop the strength and quality of this extensive program. In summary, these goals are:

Promote Research

- The research institutes will focus activities in targeted areas where there are loci of strength, while continuing to support excellent programs across their portfolios. Each Institute has specific goals to meet these expectations. A subsidiary goal exploits cross-Institute collaborations in areas that would include, for example, cyber-biosystems, neuroscience, network science, and bioenergy.
- The Defense-Related Research Units will continue to grow through fruitful avenues of investigation for the Department of Defense and industrial sponsors, and will continue to expand their interaction with the academic colleges.
- In order to continue to grow industrial sponsorship for research, efforts will be made to increase the number of master agreements with selected corporations and to create new alliance partnerships.
- Emphasis will be placed on competing for and winning competitions to secure major center grants from agencies including National Science Foundation, National Institutes of Health, and Department of Energy.
- The intellectual climate will be nurtured to ensure that new and creative collaborations emerge.
- In a partnership among Institutes and Colleges, consideration will be given to cluster hiring strategies to bring to Penn State strong teams of researchers for the purpose of establishing preeminence in selected fields.

Promote Technology Transfer

- Actively encourage faculty, staff, and graduate students to participate in the intellectual property management and technology transfer process, the first step of which is the

disclosure of intellectual property with potential commercial value to the Intellectual Property Office.

- Aggressively seek high-quality licenses for Penn State intellectual property.
- Promote economic development through collaboration with the Commonwealth of Pennsylvania and by actively encouraging the formation of Penn State start-up companies.

Ensure High-Quality Research Infrastructure and Support

- Increase efficiency of services by improving the information technology features in all sectors of the unit and by continuously striving to ensure that service units are flexible and customer-friendly.
- Bring staffing to appropriate levels to support faculty needs.
- Retain necessary accreditation with both the American Association for Human Subjects Research Protection and the American Association for Laboratory Animal Care organizations.
- Develop educational and training programs to provide faculty, staff and students with the tools and knowledge to conduct research that is ethically sound, and safe and secure for all participants.
- Focus on resolving short- and long-term facilities and equipment needs; long-range plans for animal and plant growth facilities will be developed.
- Oversee the completion and opening of the Millennium Science Complex and establish key working groups of faculty who will begin to articulate the vision of that building.
- Open the Center for Neural Imaging in Chandlee Laboratory and coalesce working groups whose collaborations will lead to an area of strength in imaging and neuroscience.
- Continue to work toward the buildout/expansion of Innovation Park with emphasis on bringing more corporate/industrial partners to the Park.

Enhance Visibility for the Penn State Research Agenda

- Promote global research initiatives in select areas where the Penn State team and the international partner(s) will create a preeminent alliance. Affiliation with the Worldwide Universities Network will provide partnering opportunities for the University in this regard.
- Work collaboratively with Colleges and Central Development to promote research initiatives. Development will consider individual donors, corporate partners and foundations.
- Establish external advisory boards for Institutes to enhance visibility and to secure valued counsel.
- Work collaboratively with Colleges to promote faculty recognition through awards and honors.

Research Vision and Mission

Research is one of the central activities of the modern university. In addition to enhancing the human condition, research inspires and informs the other missions of teaching and service. The best research universities are those with a critical mass of faculty who are considered preeminent in their chosen fields; they are universities that are recognized as recipients of the most competitive and prestigious research centers sponsored by public and private funding sources; they are universities who are first choices for the best and brightest graduate students domestically and internationally; and they are universities whose research expenditures rank them among the top 10 to 20 institutions in the nation. By many measures, Penn State has achieved the status of a top-tier research university. That said, there are challenges that keep the institution on the cusp of that status. In this plan, we will examine the tangible evidence of the institution's stature and propose goals to help us continue to rise in quality.

The vision of the OSVPR is to create an environment that will enable the University to maintain and enhance its status as a premier research university based upon its accomplishments and its reputation.

The mission of OSVPR is two-fold: research development and infrastructure support. Through facilitating dialog among and providing insight to the Institute directors and academic deans, the OSVPR assists in selectively identifying key research areas that Penn State should pursue. Capitalizing on the broad view and mandate of the OSVPR, Penn State can strategically direct its research enterprise with cognizance of institutional strengths, national needs, and imperatives for a top-tier institution. The OSVPR also promotes interdisciplinary, intercollege, cross-campus collaborations by ensuring that communication is effective, by facilitating resource pooling and proposal development, and by aiding in the development of appropriate administrative structures to facilitate research initiatives. The OSVPR also provides the necessary services and infrastructure to allow realization of the University's research vision. These services must be user-friendly to internal customers, viz., college faculty and staff, and many of them must also provide appropriate flexibility to be attractive to external clientele. The execution of these services must ensure compliance with all regulatory and fiduciary requirements.

In this plan, we review the current status of research at Penn State, and what has been accomplished in recent years. We also describe the plans and goals for the next five years and discuss issues related to resources required for the continued success of these efforts.

I. The Current Status of Research and Research-Related Services at Penn State

Within Penn State, the OSVPR is the central administrative structure for facilitating the collective research enterprise through both service and oversight functions. The OSVPR organization chart is presented in Figure 1. Our unit has two major elements: the research arm, consisting of the Institutes and the Defense-Related Research Units; and the service arm, which consists of many different offices that provide the internal infrastructure to support the research mission and outreach functions needed to partner with external constituents through technology transfer and economic development. In section I.A. of this plan, we will review data specific to these two branches and present goals for the research entities and the metrics that will be used to measure success.

A. Status of Research at Penn State

In this section, we will provide an overview of research at Penn State. There are many ways in which research can be broadly evaluated and presented, but the breadth of the research activities at Penn State and the great heterogeneity of our efforts leads us toward an emphasis on fiscal measures in the present report. This approach should not be construed as undervaluing the many other elements of scholarly achievement that contribute to a university's stature. Rather it is intended to frame the conversation regarding the elements of this plan. Where appropriate, we also include other measures of research productivity, reputation, prestige, and impact.

One method of assessing research activity is by examining the pattern of research expenditures. As expenditures are a measure of faculty competitiveness they certainly tell part of the story. As can be seen in Figure 2, research expenditures have climbed nearly every year for the past 20 years. The slope of the curve was steepest between 1998 and 2004. Figure 3 shows the spatial changes in research expenditures from our three major federal sponsors and from industry. The National Science Foundation (NSF) funding has flattened while the Department of Health and Human Services (DHHS) funding has actually declined. Funding from the Department of Defense (DoD) continues to grow as does funding from industry sponsors. Figure 4 illustrates Penn State's research expenditure ranking as determined by the latest survey, the 2006 NSF Survey of Research and Development Expenditures at Universities and Colleges. In the aggregate, we ranked 13th among all public and private institutions in research expenditures. In the last decade Penn State has ranked as low as 9th to as high as 14th. Table 1 shows the top twenty institutions reporting the largest federal expenditures. Penn State ranked 18th in federally financed R&D expenditures in FY2006.

Figure 1 – Office of Senior Vice President for Research (OSVPR) Organization Chart

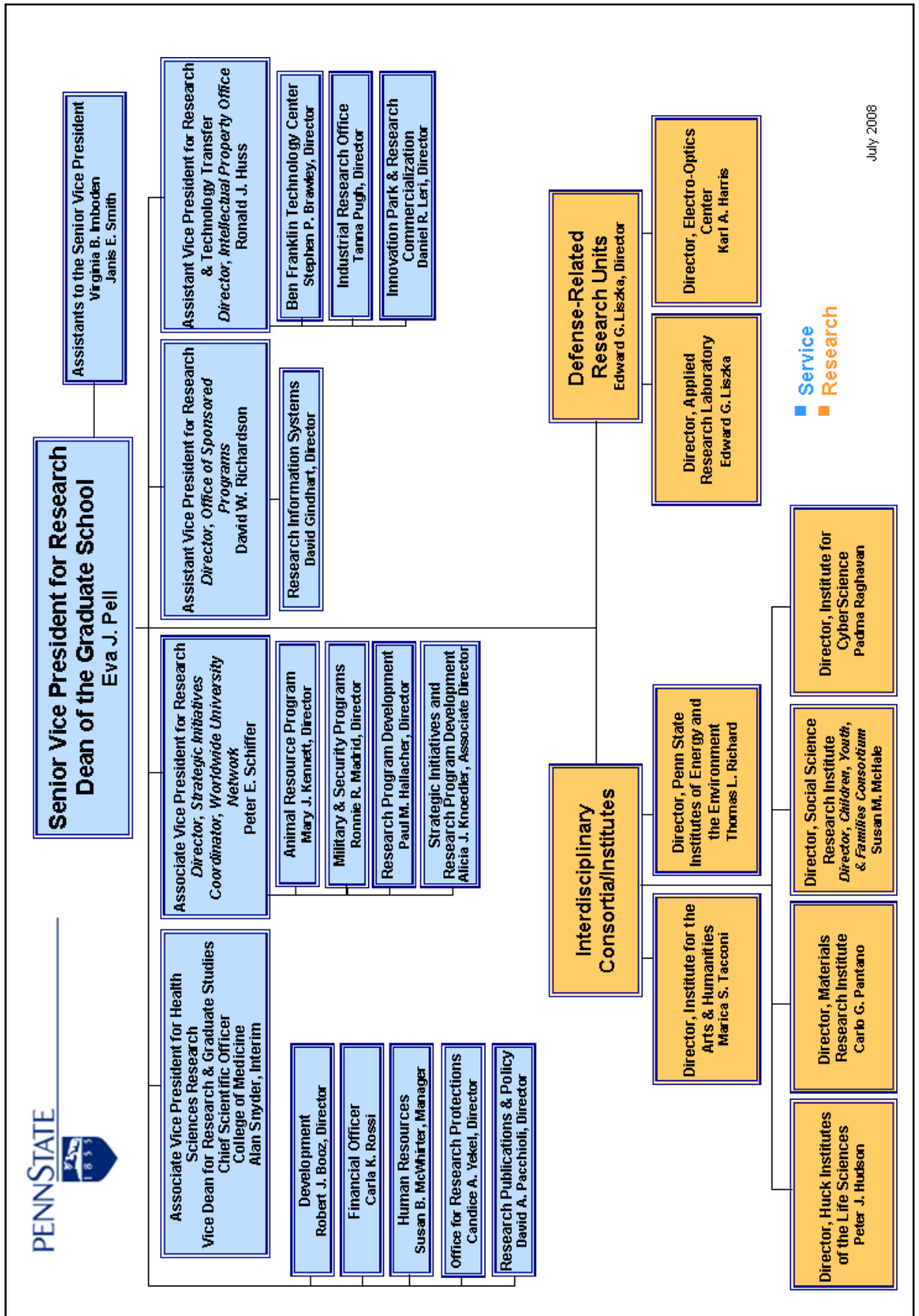


Figure 2 – Research Expenditures, FY1988–FY2007

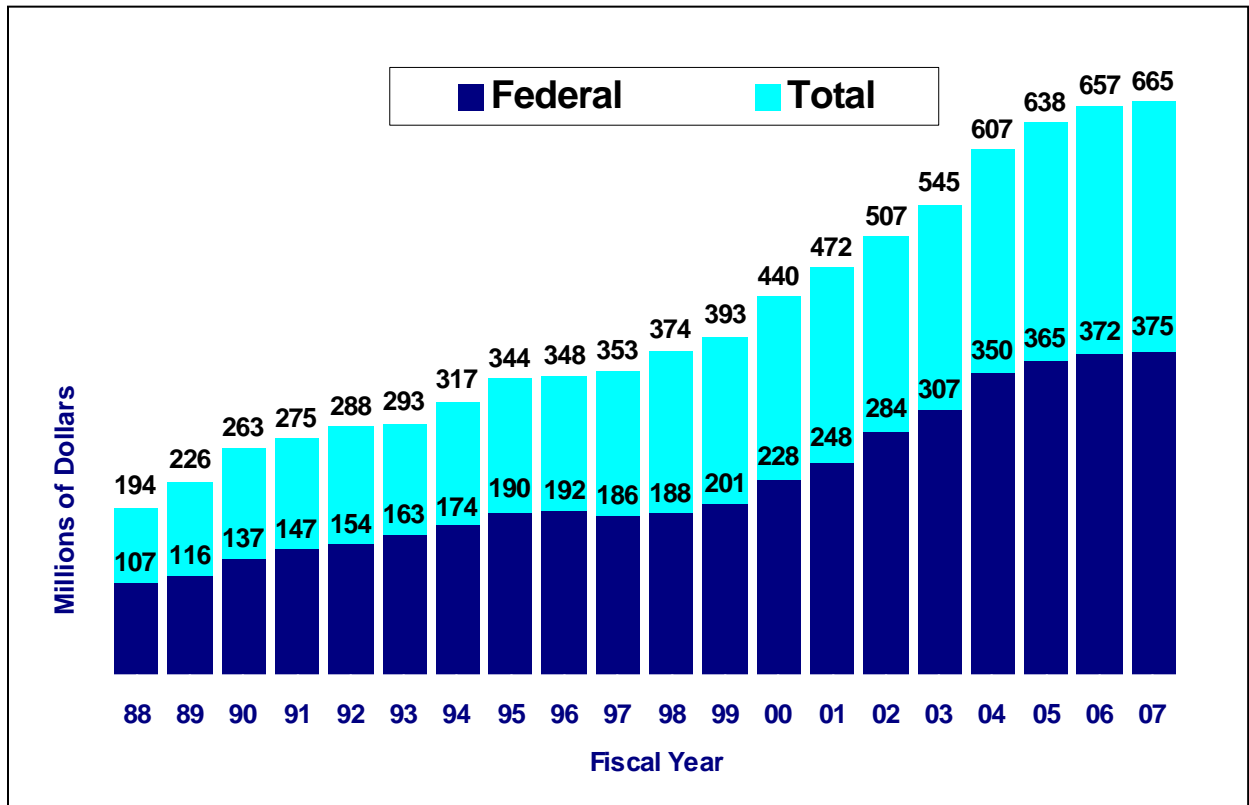
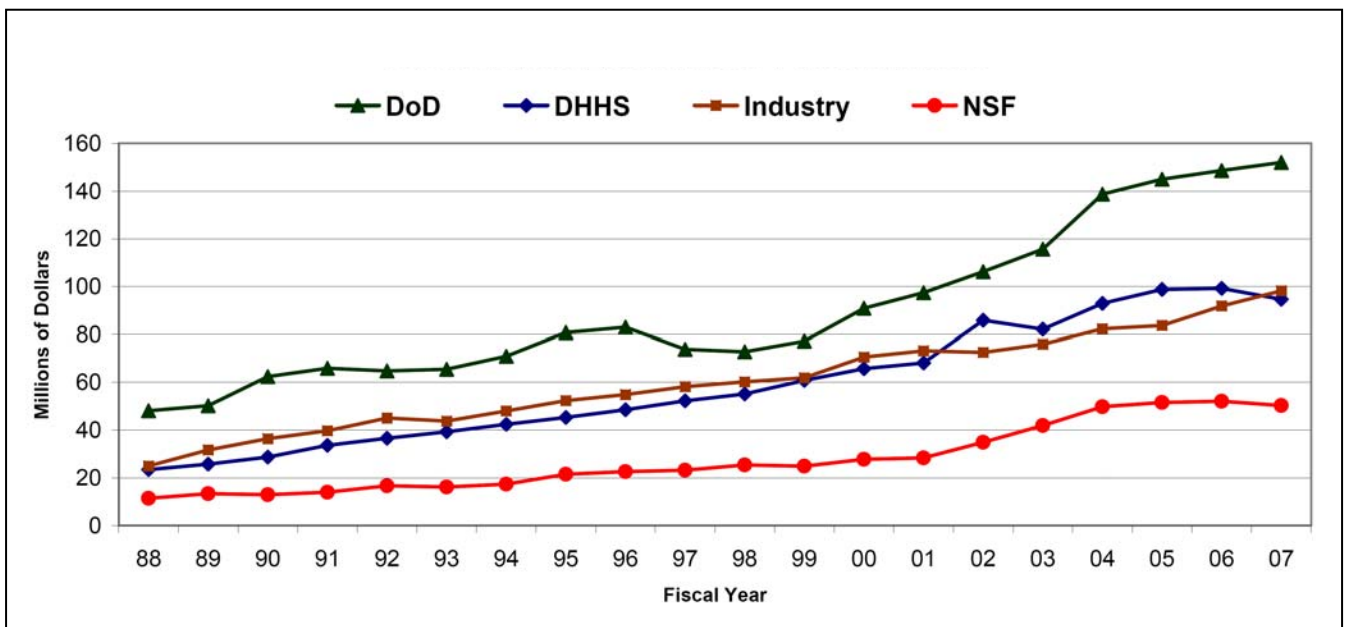


Figure 3 – Select Sponsor Expenditures, FY1988-FY2007



**Figure 4 – NSF Total Science & Engineering Research Expenditure Rankings for FY2006;
Top Twenty Overall by NSF Fields & Subfields**

	FY2006 Ranking	FY2005 Ranking	FY2004 Ranking	Industry	Total Engineering	Aero/Astro-Engineering	Bio-Engineering	Chemical Engineering	Civil Engineering	Eng - Electrical	Eng - Materials	Eng - Mechanical	Total Physical Sciences	Chemistry	Physics	Astronomy	Total Environmental Sci	Atmospheric	Earth Sciences	Oceanographic	Mathematical	Computer Science	Total Life Sciences	Agricultural	Biological	Medical	Psychology	Total Social Sciences	Economics	Political Science	Sociology	Number in Top Ten Fields/Subfields	
Johns Hopkins	1	1	1	24	1	1	3	15	21	1	67	1	3	35	4	2	16	17	67	23	2	4	2	4	2	4	3	42	82	65	87	39	13
Wisconsin	2	3	4	31	19	49	40	24	40	37	34	36	15	19	15	19	6	1	38	43	23	21	7	28	8	12	1	4	17	30	4	7	
UCLA	3	4	2	27	35	32	45	54	55	18	36	15	12	18	9	-	62	29	65	88	20	19	3	-	2	20	7	57	68	20	4	4	
Michigan	4	2	3	19	7	22	11	13	19	6	22	6	23	17	24	25	61	77	19	65	30	49	9	56	16	13	14	1	5	2	2	8	
UC San Francisco	5	5	5	11	175	-	-	-	-	-	-	-	41	4	-	-	160	-	-	-	-	-	-	1	72	1	164	172	-	-	-	3	
U. Washington	6	8	6	5	26	29	4	42	26	17	43	34	32	16	32	24	3	6	29	2	29	-	6	49	26	6	22	26	87	7	37	7	
UC San Diego	7	6	7	8	21	50	9	90	94	5	77	32	19	11	14	-	1	18	4	1	43	5	16	65	86	8	35	38	55	19	18	6	
Stanford	8	7	8	13	8	16	14	18	30	17	54	7	8	24	42	-	37	63	18	37	14	13	20	-	7	51	35	49	96	57	4	4	
Penn	9	9	10	9	61	71	20	38	90	66	25	55	33	23	20	-	137	-	-	-	44	50	5	60	5	9	54	10	43	6	14	5	
Duke U.	10	10	14	1	55	67	7	89	54	32	88	56	59	74	34	-	53	72	71	45	19	73	4	18	4	84	19	39	3	23	4	4	
Ohio State	11	12	15	2	10	31	47	7	36	22	3	39	37	31	28	66	80	26	69	5	10	21	17	28	21	57	5	1	28	10	9		
Cornell	12	13	11	30	24	18	71	40	34	26	44	84	6	13	5	9	80	91	40	52	42	12	14	6	30	18	59	12	16	36	45	4	
Penn State 2006	13	11	9	3	3	14	35	3	13	4	1	4	9	9	12	14	12	11	7	26	7	11	51	11	73	59	2	16	47	22	1	11	
MIT	14	14	12	4	4	4	1	1	22	13	7	8	5	21	3	7	27	23	22	31	35	6	65	-	10	-	116	67	32	26	90	11	
Minnesota	15	16	16	22	34	26	43	14	12	49	69	24	38	28	35	27	48	69	36	46	21	18	12	12	39	14	12	15	13	18	9	1	
UC Davis	16	17	17	23	30	54	6	20	10	44	74	26	45	50	62	-	29	45	42	40	41	44	13	2	14	35	105	22	19	31	63	3	
Florida	17	20	27	16	18	10	12	33	6	35	15	33	31	34	21	23	63	78	41	39	31	61	19	1	20	46	16	30	9	79	65	4	
Washington U.	18	19	19	47	113	-	-	-	-	-	-	-	61	48	53	-	90	97	44	77	-	48	8	-	6	11	58	78	97	63	21	2	
UC Berkeley	19	15	13	26	9	46	63	31	3	71	93	4	3	2	12	65	47	23	67	15	-	58	13	58	77	27	3	2	13	13	8		
U. Arizona	20	21	21	18	23	30	51	43	2	27	66	20	2	29	59	1	59	32	28	71	28	59	37	19	42	51	46	18	22	75	7	4	
Penn State 2005				2	3	20	35	1	11	4	1	3	9	9	11	11	12	13	10	8	31	6	11	50	9	78	58	2	16	45	18	1	12
Penn State 2004				2	3	12	33	4	7	4	1	3	9	5	12	11	14	11	7	33	8	8	8	48	8	72	61	2	16	47	17	1	14
Penn State 2003				3	4	20	29	3	4	5	1	4	11	10	10	12	10	10	5	41	14	15	50	7	76	63	2	13	53	13	1	14	
Penn State 2002				3	3	22	17	3	3	4	1	4	12	9	10	11	20	13	6	48	13	61	47	6	81	62	4	13	47	31	2	12	
Penn State 2001				3	3	24	28	3	3	4	1	5	10	4	12	8	24	15	5	48	14	49	48	6	81	66	2	16	34	33	2	13	

Table 1 – Top Twenty Institutions Reporting the Largest Federally Financed R&D Expenditures in Science & Engineering Fields, FY2006

Rank	Institution	2005 (Millions of Dollars)	2006 (Millions of Dollars)	Growth
	All R&D expenditures	29,191,369	30,033,156	2.88%
	Leading Top 20 institutions	9,668,847	9,910,208	2.50%
1	Johns Hopkins U., The ^a	1,277,292	1,307,453	2.36%
2	U. WA	606,317	650,394	7.27%
3	U. MI all campuses	554,516	565,739	2.02%
4	Stanford U.	574,675	540,069	-6.02%
5	U. WI Madison	477,582	491,810	2.98%
6	U. CA, Los Angeles	469,889	483,873	2.98%
7	U. PA	465,284	478,773	2.90%
8	MA Institute of Technology	457,235	476,362	4.18%
9	U. CA, San Francisco	438,988	464,660	5.85%
10	U. CA, San Diego	463,946	463,807	-0.03%
11	Columbia U. in the City of NY	453,188	451,187	-0.44%
12	U. CO all campuses	449,366	448,350	-0.23%
13	U. Pittsburgh all campuses	420,305	422,316	0.48%
14	Duke U.	376,568	414,419	10.05%
15	Washington U. St. Louis	400,699	408,402	1.92%
16	Harvard U.	395,906	403,458	1.91%
17	Cornell U. all campuses	365,694	390,043	6.66%
18	PA State U. all campuses	358,569	367,215	2.41%
19	Yale U.	332,702	348,500	4.75%
20	U. Southern CA	330,126	333,378	0.99%
	All other institutions	19,522,522	20,122,948	3.08%

^a Includes the Applied Physics Laboratory, with \$649 million and \$672 million, respectively, in total R&D expenditures in FY 2005 and FY 2006.

SOURCE: National Science Foundation/Division of Science Resources Statistics, Survey of Research and Development Expenditures at Universities and Colleges, FY 2006

NOTE: Because of rounding, detail may not add to total.

Our strength in research continues to be heterogeneous, as can be seen in Figure 5. While the DoD continues to be our leading sponsor, we enjoy significant research opportunities from many other federal and state agencies. Figure 6 illustrates the balance in research efforts among many of our colleges. The Defense-Related Research Units (Applied Research Laboratory and the Electro-Optics Center) constitute the largest research entity at the University, accounting for almost one out of every four dollars expended.

Figure 5 – Research Expenditures by Federal Agencies, FY2007

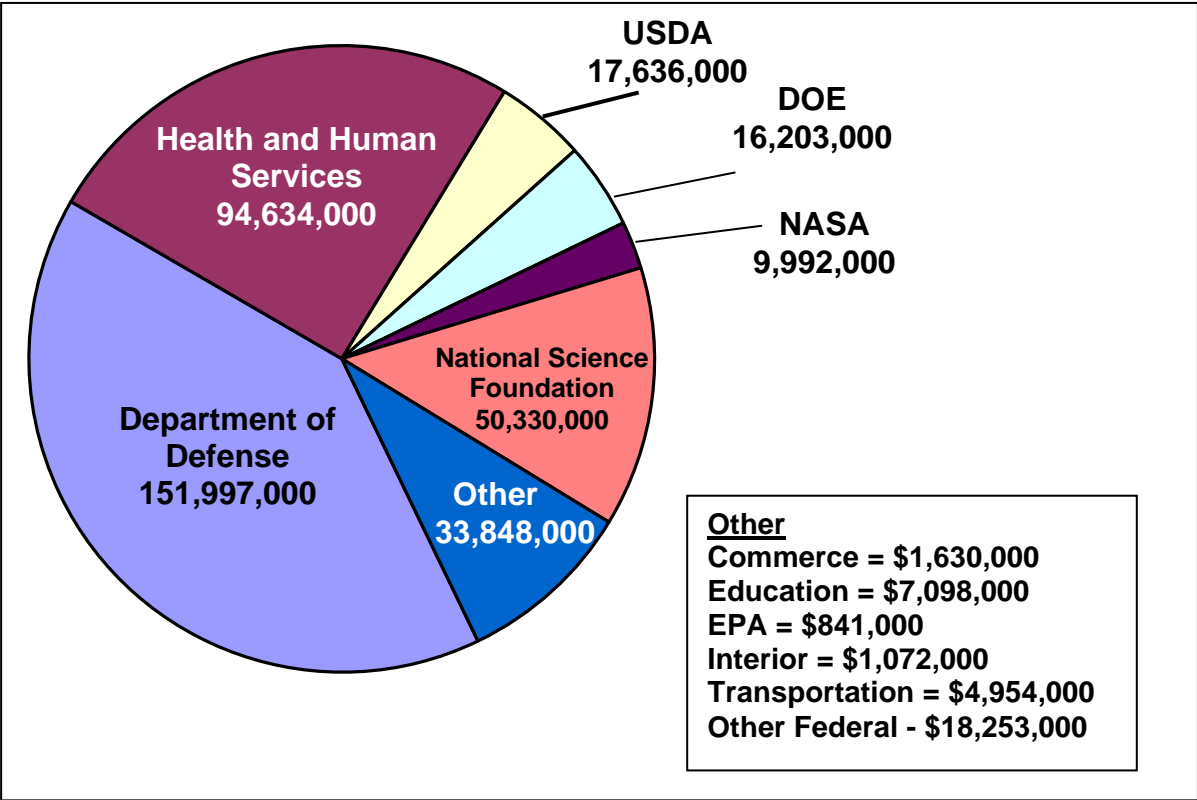
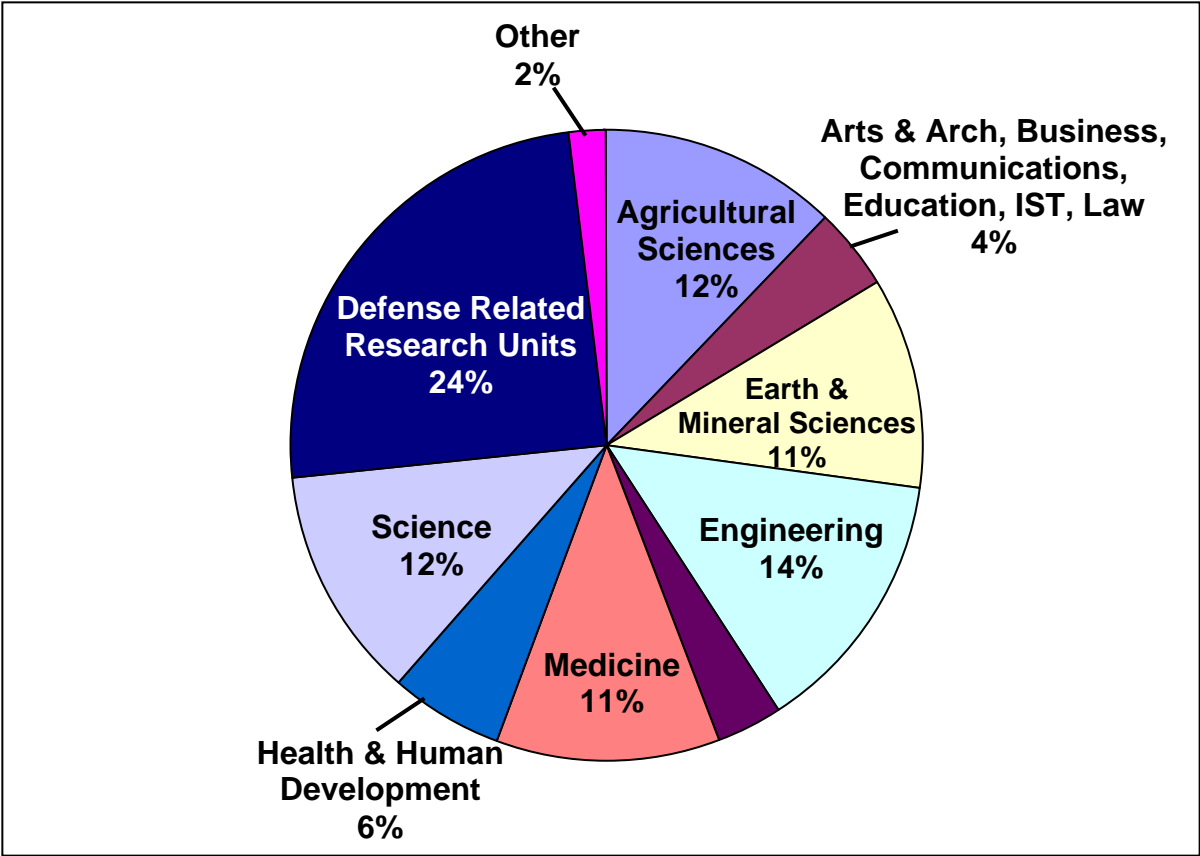


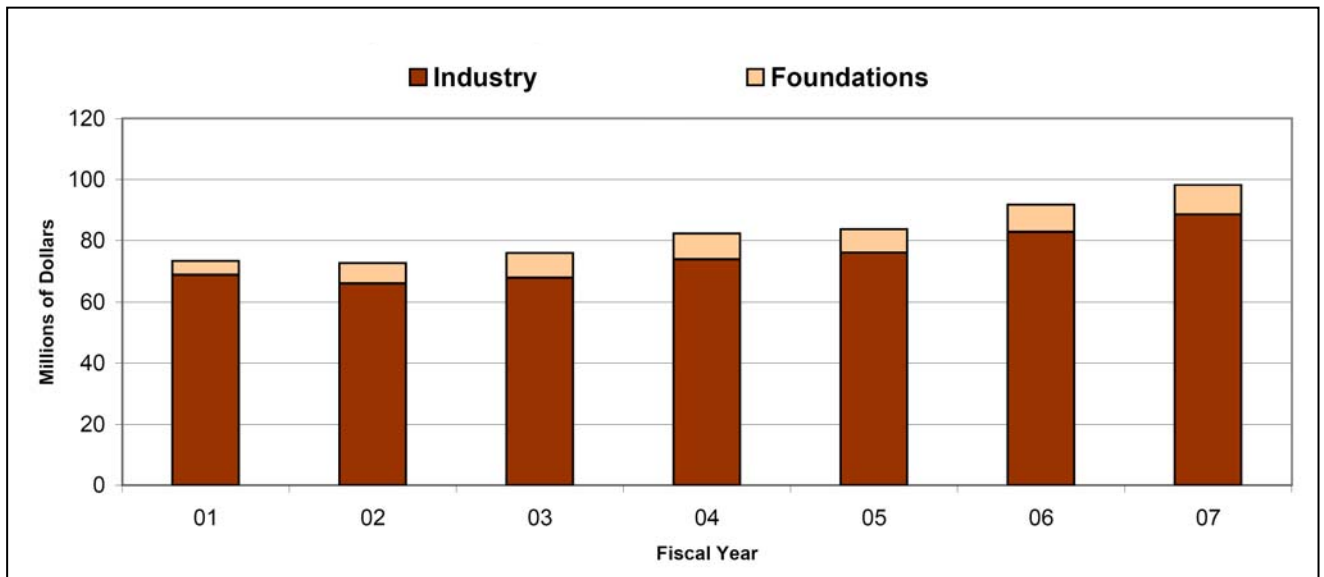
Figure 6 – Expenditures of Organized Research, FY2007



The current flattening of the expenditure curve parallels in part a similar reduction in growth of federal research opportunities. This is particularly true for the NIH, a part of DHHS, funding that has not seen significant increase since the completion of the doubling exercise during FY1998-FY2003. In the last 15+ years Penn State has hired faculty with the expectation that they would be very active in securing extramural funding and many have realized significant success, particularly in the single investigator-type proposal. In 2005, we took a snapshot of research activity of individual faculty in four research-intensive colleges. In that year, median research productivity (measured in total awards) ranged from \$80,000 to \$195,000. These data must be viewed with some caution but they do suggest that while our faculty have been productive, that productivity has not reached saturation. While continued increase in research expenditures will remain an institutional goal, it is clear that strategies for new growth will require diversification of effort.

Penn State has seen an increase in industry-sponsored research as illustrated in Figures 3 and 7. According to NSF expenditure data for 2006, Penn State ranks third behind Duke and Ohio State in this category. Duke has been ranked first for several years based on its role in clinical trials research. Ohio State has moved into the second position as a result of a State of Ohio program that matches all industry-sponsored research on a 1:1 basis. Penn State remains a national leader in this area, as evidenced by a five-year average of 849 unique industrial sponsors.

Figure 7- Industry and Foundation Sponsor Expenditures, FY2001-FY2007



The Industrial Research Office (IRO) currently has 22 active master industrial research agreements (Table 2). The most extensive of these agreements are considered Alliance Relationships, a notable recent example being the signing in 2007 of the Chevron Corporation Alliance agreement for \$17.5 million over five years to conduct research on clean coal technology. During the past two fiscal years, these master and alliance agreements have generated approximately \$7.6 million in direct industrial R&D awards. In addition, through these agreements, Penn State has been able to obtain subcontracts generating \$13.9 million in

awards. These relationships have also led Penn State to additional federal awards as outlined in Table 2, totaling \$41.2 million.

Table 2 – Industrial Research Master Agreements, FY2000-FY2007

Year Negotiated	Company	2000	2001	2002	2003	2004	2005	2006	2007	Total Industrial Dollars Generated from MA	Total Federal Dollars Leveraged
1997	Company A	881,907	936,191	750,353	125,098	171,000	135,000	100,000	447,251	3,546,800	7,671,840
2000	Company B										461,373
2001	Company C				63,280					63,280	223,497
2001	Company D	10,350								10,350	251,389
2001	Company E		55,000	84,735	194,265	40,000		211,000	197,745	782,745	776,959
2001	Company F		12,600	153,778	150,000	346,000	219,144			881,522	2,556,993
2001	Company G		25,000			24,000				49,000	108,264
2001	Company H			75,000		50,000	197,448	20,000		342,448	881,348
2001	Company I		15,000	132,133	807,470	636,875	62,500	401,080	832,885	2,887,943	5,717,957
2001	Company J				28,000					28,000	28,000
2002	Company K			50,291		88,269				138,560	138,560
2002	Company L		75,000		138,000		30,000			243,000	259,533
2003	Company M				300,000		150,000			450,000	450,000
2003	Company N					50,000	345,000	500,000	230,000	1,125,000	12,754,343
2003	Company O				165,000		40,000	363,951	887,427	1,456,378	590,000
2004	Company P					53,585				53,585	
2004	Company Q					29,527	24,411			53,938	191,989
2004	Company R					932,000				932,000	1,266,000
2004	Company S					953,791			650,000	1,603,791	1,191,291
2005	Company T							101,822	41,947	143,769	
2005	Company U										
2005	Company V						485,000		280,000	765,000	552,500
2005	Company W							204,996	300,000	504,996	2,605,068
2006	Company X							315,000	80,000	395,000	462,790
2006	Company Y							349,302	400,000	749,302	142,000
2006	Company Z										601,301
2006	Company AA							135,000	89,000	224,000	24,500
2006	Company BB							80,000	80,000	160,000	
2006	Company CC								20,000	20,000	
2006	Company DD							5,061	100,000	105,061	346,297
2006	Company EE								50,000	50,000	15,000
2006	Company FF							2,006	50,000	52,006	6,300
2006	Company GG										
2006	Company HH										
2007	Company II										252,465
2007	Company JJ								85,000	85,000	669,646
		\$ 892,257	\$ 1,118,791	\$ 1,246,290	\$ 1,971,113	\$ 3,375,047	\$ 1,688,503	\$ 2,789,218	\$ 4,821,255	\$ 17,902,474	\$ 41,197,203

Foundation support for research has risen in the last few years, but Penn State continues to lag behind many of the CIC institutions (Figure 8). This is partially due to geography, since foundations frequently prefer to support local institutions. On the other hand, the large foundations, e.g., Gates, Rockefeller, Ford, etc., provide major funding throughout the world, to universities that address issues they define as of central interest to them. This can be seen in

Figure 8 – Foundation Support by CIC Institutions, FY2003-FY2006

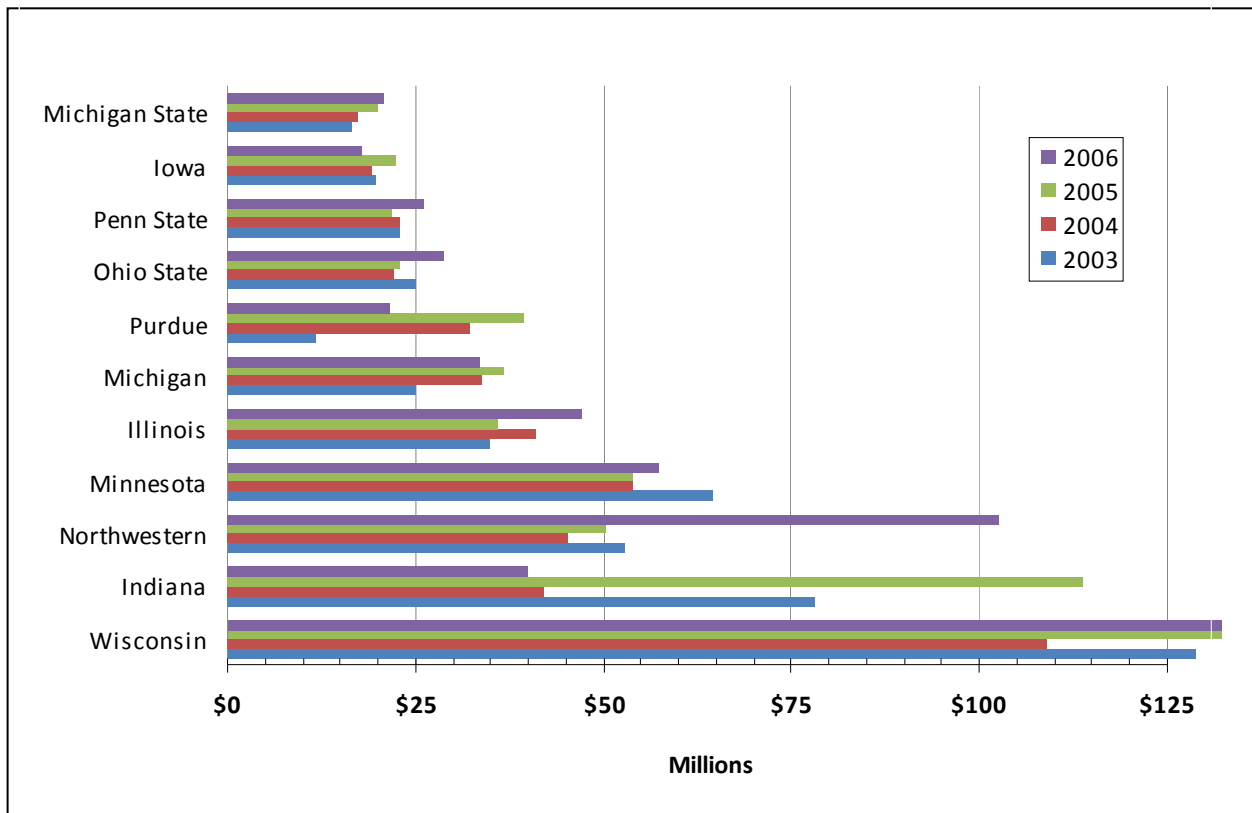


Table 3; while our success rate appears quite high at 73 percent, our effort could certainly increase. We have begun to develop a more strategic approach to working with the Office of Corporate and Foundation Relations and look forward to greater success as a result.

While much of our research activity is focused within the United States, Penn State research has been, and will continue to be, addressing more global themes and seeking participation with international partners. Notable examples of such efforts have been initiated through the colleges, e.g., the Alliance for Earth Sciences, Engineering, and Development in Africa (AESEDA) by the College of Earth and Mineral Sciences. This past year, a Task Force on Globalization of Research and Graduate Education was charged by the Senior Vice President for Research and Dean of the Graduate School and the Vice Provost for International Programs to assess several aspects of Penn State’s engagement in these arenas. Appendix I is an excerpt from the Task Force Report and can be accessed at: <http://www.gradsch.psu.edu/aboutus/stratplanandfrpts.html> . The Task Force noted that Penn State already has vast international engagement in research and graduate education, with efforts largely focused in Western Europe, followed by East Asia and Canada. A majority of these international efforts arise spontaneously through individual faculty members and are not centrally organized or initiated in a systematic fashion.

Table 3 – Target Foundations, Proposals & Awards, FY2004-FY2008

	Target Foundations	Support as of FY2005	FY04-FY08 Proposals	FY04-FY08 Awards	% of Dollars Awarded
1	Bill and Melinda Gates Foundation	\$ 1,566,809,082	\$ 100,000	\$ -	0%
2	Ford Foundation	\$ 515,157,652	\$ 1,598,383	\$ 400,000	25%
3	Robert Wood Johnson Foundation	\$ 346,606,381	\$ 16,198,872	\$ 16,742,899	103%
4	Atlantic Philanthropies	\$ 287,038,000	\$ -	\$ -	
5	Annenberg Foundation	\$ 273,414,830	\$ -	\$ -	
6	The Andrew W. Mellon Foundation	\$ 201,790,542	\$ 1,628,899	\$ 1,647,250	101%
7	Pew Charitable Trusts	\$ 198,477,867	\$ -	\$ -	
8	The William and Flora Hewlett Foundation	\$ 194,374,835	\$ 333,000	\$ 330,000	99%
9	W. K. Kellogg Foundation	\$ 181,279,130	\$ 4,118,613	\$ 2,964,671	72%
10	John D. & Catherine T. MacArthur Foundation	\$ 174,266,653	\$ 522,620	\$ -	0%
11	McKnight Foundation	\$ 109,216,852	\$ 198,039	\$ 263,040	133%
12	Carnegie Corporation of NY	\$ 91,437,470	\$ 718,581	\$ -	0%
13	Richard King Mellon Foundation	\$ 74,300,889	\$ 180,293	\$ 180,000	100%
14	The Wallace Foundation	\$ 67,434,336	\$ -	\$ -	
15	Doris Duke Charitable Foundation	\$ 62,691,247	\$ 955,007	\$ -	0%
16	W. M. Keck Foundation	\$ 62,612,262	\$ 62,000	\$ -	0%
17	William Penn Foundation	\$ 64,641,331	\$ -	\$ -	
18	Heinz Endowments	\$ 61,318,940	\$ -	\$ -	
19	Alfred P. Sloan Foundation	\$ 56,119,811	\$ 1,067,853	\$ 1,681,229	157%
20	Ewing Marion Kauffman Foundation	\$ 50,603,728	\$ 109,542	\$ 108,065	99%
21	John Templeton Foundation	\$ 41,893,755	\$ 2,871,278	\$ 736,420	26%
22	Henry Luce Foundation	\$ 35,235,693	\$ 297,889	\$ 311,938	105%
23	James S. McDonnell Foundation	\$ 15,815,410	\$ 432,987	\$ -	0%
24	Smith Richardson Foundation	\$ 16,781,745	\$ 306,870	\$ 125,000	41%
25	Spencer Foundation	\$ 14,705,050	\$ 2,413,634	\$ 1,418,493	59%
26	G. Harold and Leila Y. Mathers Foundation	\$ 10,100,270	\$ -	\$ -	
27	William T. Grant Foundation	\$ 13,955,131	\$ 3,308,544	\$ 804,981	24%
28	Russell Sage Foundation	\$ 4,872,502	\$ -	\$ -	
29	Whitehall Foundation	\$ 4,109,755	\$ 675,000	\$ -	0%
		\$ 4,797,061,149	\$ 38,097,904	\$ 27,713,986	73%

To continue to be successful and to improve our national standing will require a consideration of other measures of accomplishment. One such measure is the number of competitive centers of excellence awarded to an institution. A number of the funding agencies support such centers: NSF, for example, supports Engineering Research Centers, Science and Technology Centers, Nanotechnology Science and Engineering Centers, and Integrative Education Research and Training Programs; NIH supports Program Projects, Center Core Grants, Specialized Centers, and the new Clinical and Translational Science Awards. The Department of Energy also supports occasional competitions for high-level centers, as do many other agencies.

Tables 4 through 6 list NSF- and NIH-funded research centers by university. Penn State’s track record in these competitions is not as strong as our overall expenditure record might predict. In the case of NSF, we have had 11 unsuccessful attempts to win a key center during the past ten years, and one success. In the case of NIH over the same time period, we submitted 35 training grant proposals and received eight awards; we submitted nine center proposals and received one award. Our lone NSF success, the Materials Research Science and Engineering Center, established in 2000, illustrates the important ripple effects of such an award. Aside from the benefits to the research sponsored directly by the Center grant, the resulting close collaboration across departments and colleges has paid considerable dividends including numerous multi-investigator interdisciplinary grants, industrial projects, and outreach efforts. It is imperative that we improve our track record in competing successfully for these entities.

Table 4 – Institutions with NSF-Funded Research Centers (CIC/PA Schools)

	LEAD NSF ERC As of 9/07	PARTNER NSF ERC As of 9/07	LEAD NSF STC Active	PARTNER NSF STC Active	All NSF NSEC Centers	MRSEC	Total Lead Center	Total Partner w/Center	NSF IGERT Inactive & Active (of 150)
BIG TEN SCHOOLS									
U of MI	2						2		5
U of MN	1					1	2		4
U of Wisconsin-Madison					1	1	2		3
Purdue		2						2	3
Northwestern		1			1	1	2	1	2
Penn State				2		1	1	2	2
U of Illinois Urbana-Champaign		1			1		1	1	2
Ohio State University				1	1		1	1	1
Michigan State		1						1	1
U of Iowa		1						1	
PA SCHOOLS									
Carnegie Mellon	1	1		1		1	2	2	
U of PA					1	1	2		
							15	11	23

Table 5 – Institutions with NSF-Funded Research Centers

	LEAD NSF ERC As of 9/07	PARTNER NSF ERC As of 9/07	LEAD NSF STC Active	PARTNER NSF STC Active	All NSF NSEC Centers	Active NSF MRSEC	Total Lead Center	Total Partner w/Center
Arizona State				1	1		1	1
Boston University		1	1				1	1
Brown University						1	1	
California Institute of Tech		2		3		1	1	5
Case Western Reserve University			1				1	
Clemson	1						1	
Colorado State University	1	1	1				2	1
Columbia U						1	1	
Cornell		1	1	1	1	1	3	2
GA Tech	1	1		3			1	4
Georgia State University			1				1	
Harvard					2	1	3	
Johns Hopkins	1	1				1	2	1
Northeastern	1				1		2	
Oregon Health & Science University			1	1			1	1
Princeton	1					1	2	
Rensselaer Poly		1			1		1	1
Rutgers	1						1	
Stanford		1		3	1		1	4
Stanford/IBM ARC/UC Davis/UC Berk						1	1	
U of Alabama						1	1	
U Buffalo	1						1	
U of Arizona			1	1			1	1
U of CA Berkeley	2	1	1	4	1		4	5
U of CA Davis		1	1				1	1
U of CA Los Angeles		1	1	2	1		2	3
U of CA Santa Barbara				1	1	1	2	1
U of CA Santa Cruz		1	1				1	1
U of Chicago				1		1	1	1
U of Colorado				2		1	1	2
U of Hawaii			1				1	
U of Kansas	1		1				2	
U of MD		1				1	1	1
U of MA Amherst	1				1		2	
U of Nebraska						1	1	
U of North Carolina Chapel Hill			1				1	
U of Oklahoma / U of Arkansas		1				1	1	1
U of SO CA		2		2				4
U of So CA LA	1						1	
U of South Carolina					1		1	
U of Southern Mississippi						1	1	
U of Washington	1	1	1	1		1	3	2
VA Poly	1						1	
Vanderbilt	1	1		1			1	2
William Marsh Rice University					1		1	
Yale						1	1	

Table 6 – NIH Institutional Training Grants, General Clinical Research Centers, Clinical Translational Science Awards, Cancer Institutes, P01, P30, & P50 Grants

Institution	Training	NIH GCRC	NIH CTSA	NIH Cancer Centers	NIH P01 Research Program Project Grants	NIH P30 Center Core Grants	NIH P50 Specialized Centers
U of MI, Ann Arbor	69		X	X	22	9	10
U of Wisconsin	49			X	9	4	5
U of Minnesota, Minneapolis	37	X		X	8	5	3
Northwestern University	32	X		X	7	3	4
U of Iowa	29		X	X	9	3	7
U of Illinois	25				14	6	2
Ohio State University	12	X		X	3	2	1
Pennsylvania State University	10	X			3	1	1
Indiana University	8	X		X	0	0	0
Michigan State	7				1	0	0
Purdue	4			X	4	1	0
	282				80	34	33

Sources: NIH website, <http://grants.nih.gov/>

CRISP website, Computer Retrieval of Information on Scientific Projects, <http://crisp.cit.nih.gov/>

One centralized effort that has led to significant research opportunities is Penn State’s participation in the Worldwide Universities Network (WUN). As a member, Penn State has access to potential collaborations with 16 major research universities around the world. This network has sparked joint activity in areas including: weathering and sustainable land use, paleoclimatology, deep ocean geochemistry, biology and climate, spintronics, security and counterterrorism, poverty studies, green chemistry, and plant stress biology. Opportunities to build on the WUN’s success will be discussed briefly in section II.6.

B. Activities and Status of Service Units within OSVPR

1. Central Office

The central office of the SVPR organizes the selection of topics and researchers when a call for proposals includes a limit to the number of institutional submissions. The office also coordinates and assists colleges in securing proposal matching funds from the Provost’s Office. In the last three years the office handled on average 35 limited submissions and 54 match requests annually, with the number of limited submissions increasing steadily. While the process of securing matching funds has been systematized for some time, in 2007 the OSVPR, with the help of several associate deans for research, prepared a systematic procedure for internal down-selects of teams or researchers for limited submissions across Penn State. This procedure provides a more predictable process for faculty, as well as a more efficient process for administration. Faculty are now receiving feedback on all pre-proposals, which should facilitate the development of future proposals.

The central office is also responsible for managing relationships with state agencies to ensure that the University fulfills its role in economic development within the Commonwealth. The office staff annually manages the development and submission of approximately \$5 million of economic development-related research proposals to the Pennsylvania Department of Community and Economic Development (PA DCED). The office staff are also actively engaged in negotiating larger scale agreements with foundations and corporations, and especially at the nexus between corporate- and government-sponsored research. Annually, the office staff manages the development and submission of approximately \$20 million of research proposals to state and federal agencies in partnership with industry. Senior staff also represent Penn State in Washington, DC, at major funding agencies and with national research organizations.

2. Technology Transfer and Economic Development Offices

A goal of university research is to transfer knowledge to society for an array of applications. Transitioning technology to commercial application can be an important driver of economic development locally and nationally. This outcome is viewed favorably at the state and federal levels and is consistent with the land-grant mission of the University. Technology transfer at Penn State is facilitated by OSVPR through several means, including industry-sponsored research (discussed above), intellectual property management, and direct support of local industry through Innovation Park and the Ben Franklin Technology PArtners of Central and Northern PA (BFTP/CNP), each of which is discussed briefly in this section.

a. Intellectual Property Office (IPO)

Intellectual property management and technology transfer is one means through which university research benefits society. Licensing of university intellectual property can also provide a revenue stream to support further research. Over the last ten years Penn State has developed a systematic and business-like process for managing our intellectual property portfolio.

Figures 9 and 10 show the invention disclosure and patent activity histories for the University.

Figure 9 – Invention Disclosures Received, CY1986-CY2007

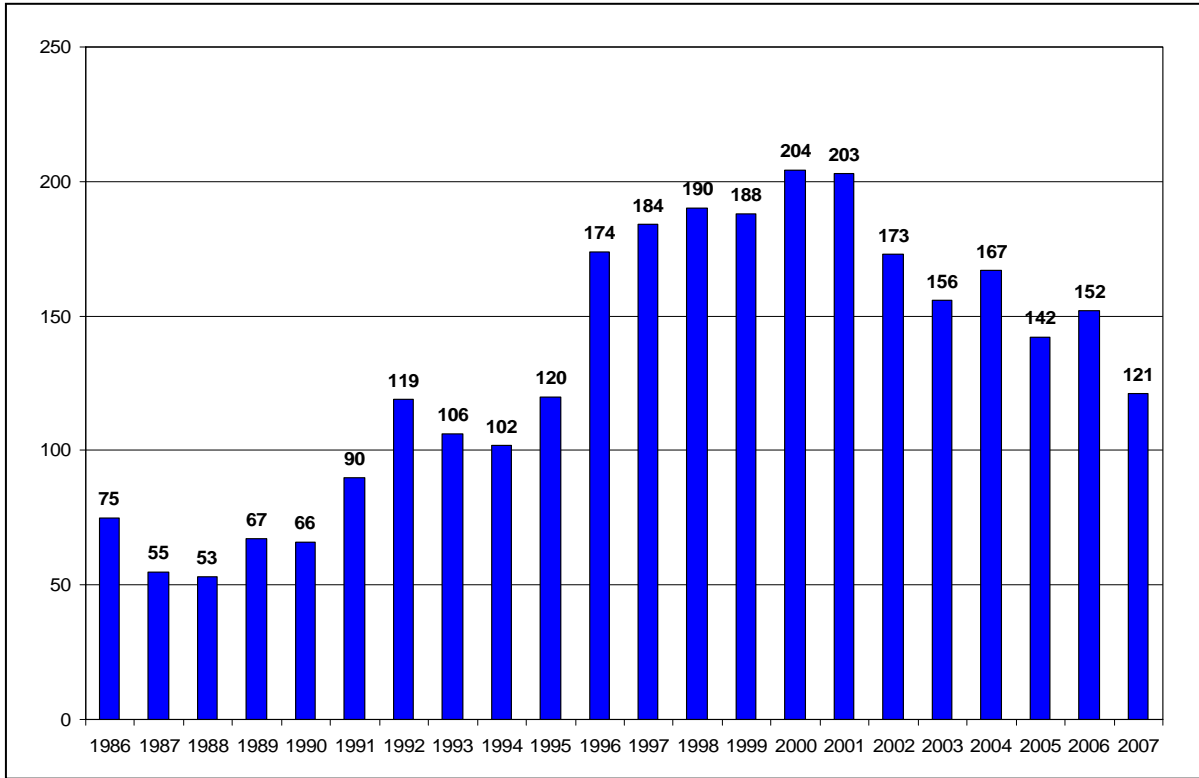


Figure 10 – U.S. Patent Applications Filed, CY1988-CY2007

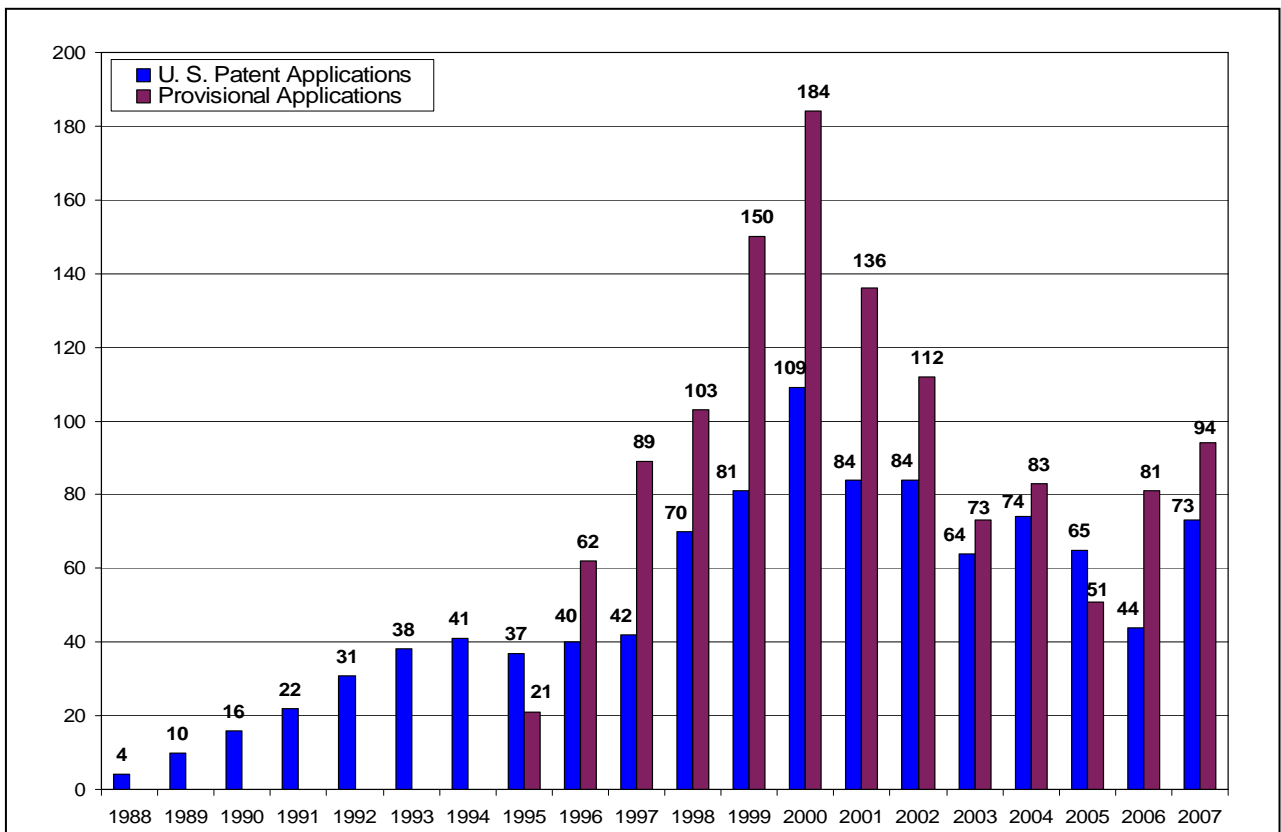
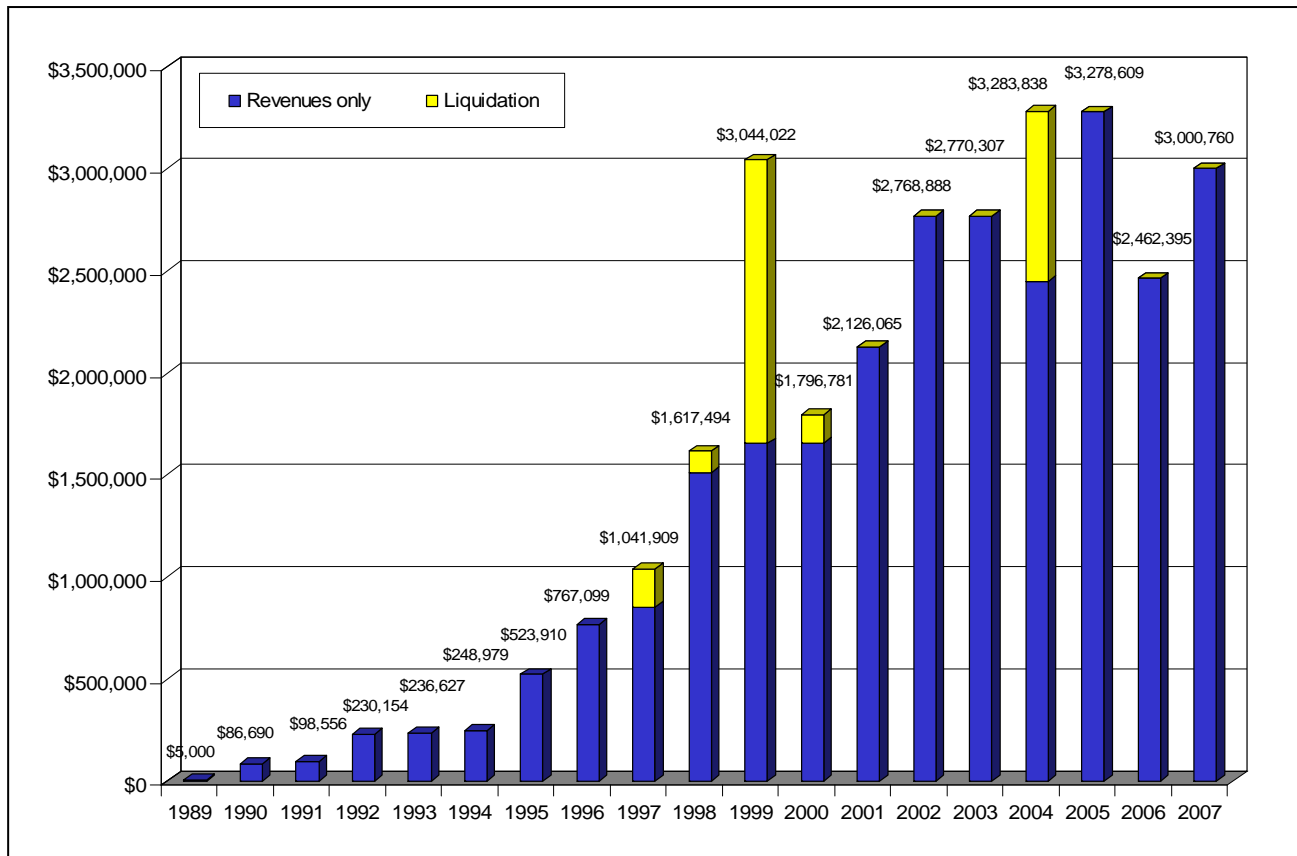


Figure 11 shows the total revenue history, which consists of licensing fees and royalties, the liquidation of equity, material transfer fees and the reimbursement of out-of-pocket patent expenses. Disclosures reached a peak in 2000 (Figure 9), coinciding with the peak of overall patent activity. Not shown are the dramatic increases in out-of-pocket patent expenses during this time period after it became obvious that this high level of overall patent activity was not fiscally sustainable. Several corrective measures were instituted including: 1) establishing a goal for the reimbursement of 75 percent of out-of-pocket patent expenses by optionees and licensees (later reduced to a more workable level of 65 percent), 2) formation of a Patent Review Committee to assist in the selection of those provisional patent applications not yet been optioned or licensed which have the highest potential for commercial success. (Applications thus selected account for the 35 percent of patent expenses incurred by The Penn State Research Foundation (PSRF)), and 3) establishing a process for selecting preferred providers of legal/patent services which included cost of services as a selection criteria. (It is possible that the decline in disclosures received by the IPO occurred as an unintended result of this practice.)

Figure 11 – IPO Revenues, CY1989-CY2007



While the number of licenses has actually declined in recent years (Table 7), we note that the quality of licenses obtained is substantially better than that achieved by earlier efforts. Today most licenses will include upfront fees, milestone payments, and sometimes a combination of royalty payments and equity positions.

Another measure of success in technology transfer is the number of start-up companies (Table 7) derived from University intellectual property. Most states, including Pennsylvania, view such start-ups as an important economic engine associated with universities. We have had some success to date but are limited by a combined lack of faculty interest and suitable management. A related challenge is finding “bridge” resources to allow technologies to advance from basic research to proof of concept, at which time private investment capital can be identified.

Table 7 – Executed Licenses & Start-Up Companies, CY1990-CY2007

	Total Licenses	PSRF-Held Equities	Start-Up Companies
1990	5		
1991	11		2
1992	14		0
1993	7		1
1994	7		0
1995	15		3
1996	8	1	2
1997	14	1	6
1998	15	1	4
1999	21	0	2
2000	17	4	4
2001	27	8	5
2002	27	6	7
2003	16	3	2
2004	16	5	5
2005	15	0	3
2006	15	2	4
2007	11	2	3
TOTAL	261	33	53

Our strength as a research institution significantly outstrips our success in technology transfer. There are various explanations for this. Historically, we have been seriously engaged in technology transfer for only the last 10 to 15 years. There is always a significant lag between initiation of technology development and potential for monetary yield. The low financial gain has necessitated maintenance of a relatively small licensing staff, which impacts the magnitude of effort possible.

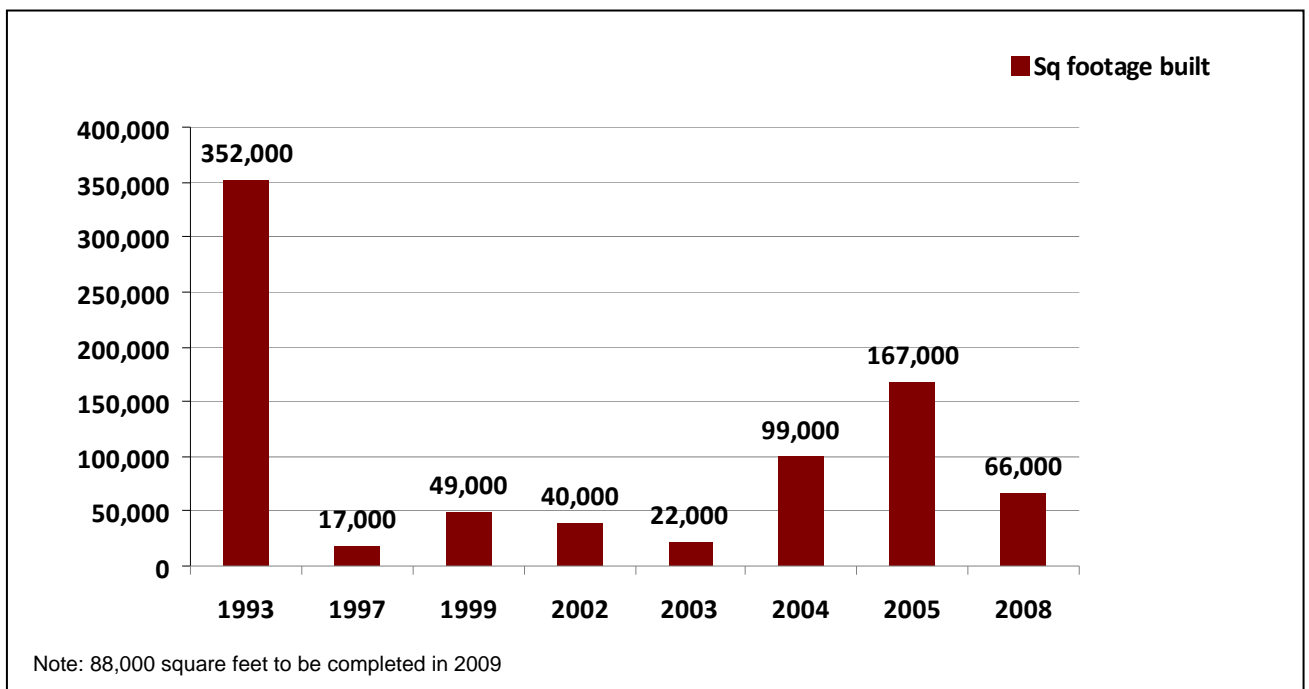
b. Industrial Research Office (IRO)

The IRO is responsible for promoting industry-sponsored research at Penn State, and in particular for helping faculty interface with corporations which have strong research interests. As discussed above, industrial research is an important component of our research portfolio both for its economic and social impacts and for the resources such research brings to the University. The IRO both markets the research capabilities of Penn State to corporations and facilitates the process of creating long-term relationships and master agreements.

c. Innovation Park at Penn State

Innovation Park is a 118-acre parcel being developed by Penn State to create an environment where University and business partners can collaborate to take the research and technology resources developed within the University to market. In partnership with the Office of Finance and Business, the OSVPR is charged with oversight of this enterprise. To date, forty-six acres and 750,000 square feet of buildings have been developed, with another 150,000 square feet currently under development (Figure 12). The Park has sixty tenants with approximately 1,200 employees in residence. Innovation Capital Partners, a private developer, has been retained to develop the remainder of the Park.

Figure 12 – Innovation Park at Penn State Square Footage, CY1993-CY2008



d. Ben Franklin Technology Partners of Central and Northern Pennsylvania (BFTP/CNP)

This organization, one of four regional entities funded by the Commonwealth's Ben Franklin Technology Development Authority, provides financial support, technology, and management experience to early-stage Pennsylvania companies, and provides linkages to public, private, and education resources to strengthen the high-technology components of the state's economy. The BFTP/CNP is operated by Penn State for the Commonwealth of Pennsylvania, and the OSVPR is charged with oversight of the organization. The BFTP/CNP has historically been successful in its mission, and Table 8 summarizes the sectors funded by the Partnerships and demonstrates Penn State's strong commitment to supporting its work.

Table 8 – Ben Franklin Technology PArtners of Central & Northern PA Funding, FY2008

Program Area	BF Dollars	BF Dollars to Penn State	% to Penn State
Research and Development*	\$ 3,545,400	\$ 121,057	3.4%
Entrepreneurial Support	\$ 1,431,361	\$ 1,286,361	89.9%
Business & Technical Assistance	\$ 765,780	\$ 765,780	100.0%
Centers of Excellence	\$ 463,884	\$ 463,884	100.0%
Plastics Initiatives	\$ 291,608		
Special Initiatives	\$ 145,000		
Incubators	\$ 139,100		
Total	\$6,643,033	\$2,637,082	39.7%

*The majority of these funds go directly to PA companies

3. Office of Sponsored Programs (OSP)

The OSP is responsible for negotiating all research grants and contracts with the exception of those that flow from the College of Medicine and the Defense-Related Research Units. Figure 13 shows the growth in number of federal- and industry-sponsored research awards greater than \$10,000 over the past twenty years. Penn State's sponsored portfolio continues to evolve from being dominated by grants to nearly equal parts grants and contracts (Figure 14). This is not surprising given the growth and size of our industrial portfolio. The trend is significant for research administration, as contracts require an average of 26 days to negotiate, or 2.5 times longer than a grant. This additional effort is reflective of the time needed to review non-standard terms, negotiate options, and find areas of compromise. The same gradual trend toward more contracts and fewer grants is also occurring within our federal portfolio. On average, a federal contract requires 19 days to negotiate, or about 2.5 times longer than a federal grant. Even with federal contracts being governed by the standard Federal Acquisition Regulations (FAR), we often expend a significant amount of time negotiating the removal of inappropriate FAR clauses that were incorrectly prescribed for institutions of higher education. Contracts frequently bring publication restrictions, foreign national restrictions, and export control restrictions; these are problems we rarely encounter with grants and they compound the complexities of contractual negotiations. Adding to the demand on negotiation time is the growing portfolio of Commonwealth of Pennsylvania sponsored projects. The State agreements require an average of 26 days to negotiate, just as long as our industrial agreements. While we have experienced some relief as a result of a master agreement negotiated with the Commonwealth, not all state agencies honor the use of the master agreement for their awards.

Figure 13 – Number of Awards \$10,000 & More Processed by Sponsor Category

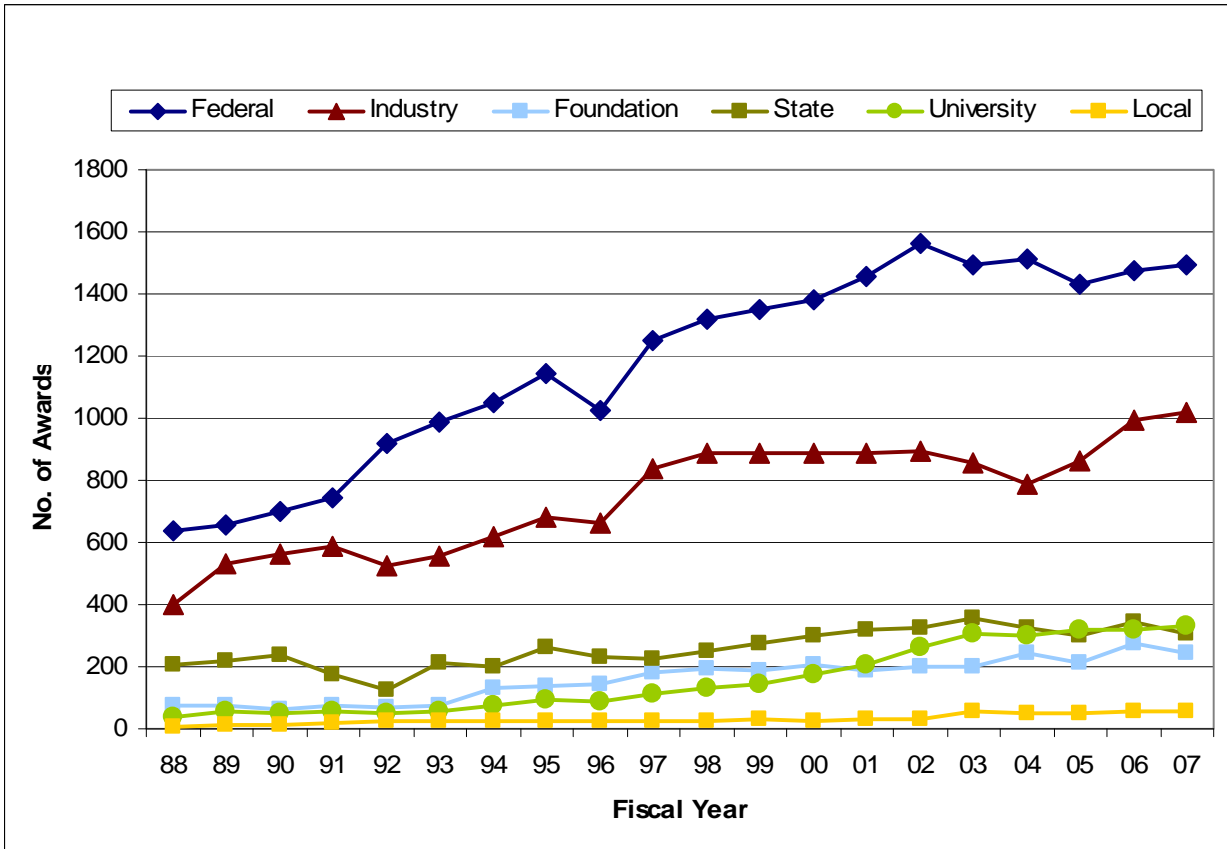
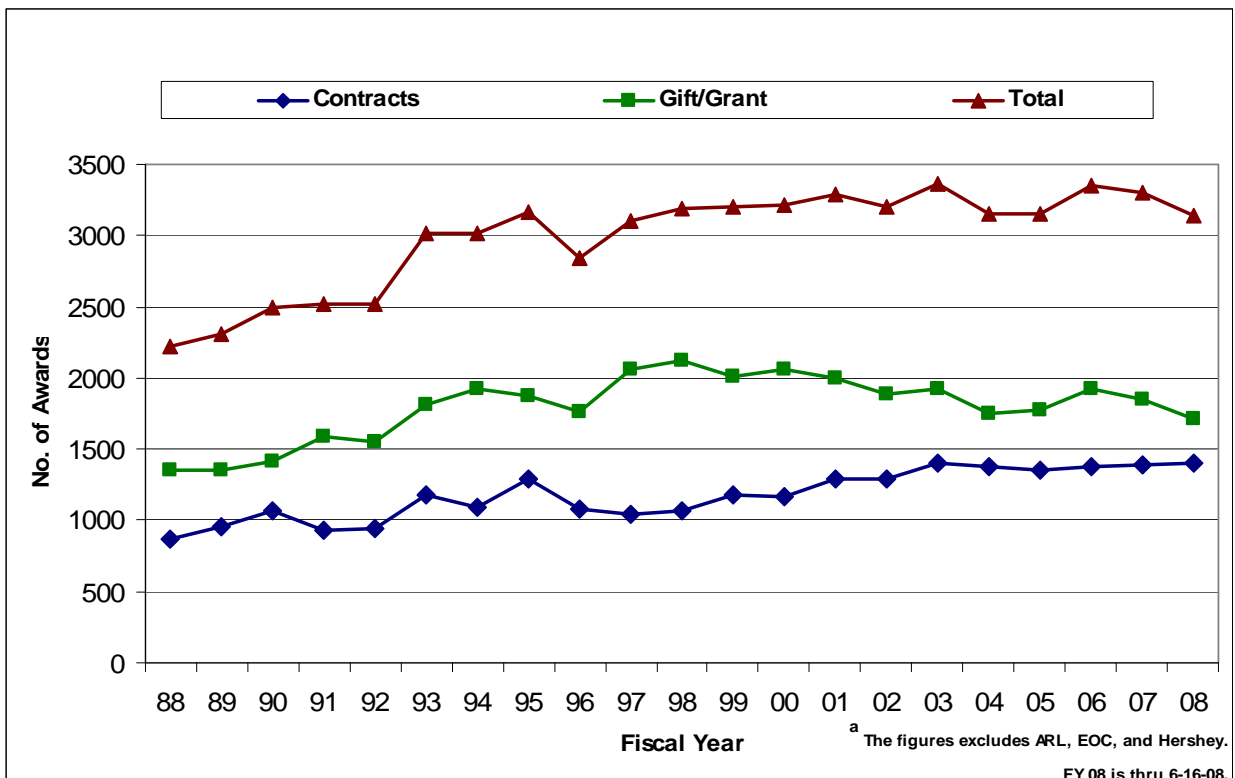


Figure 14 – Number of Processed Contracts versus Gift/Grants ^a



4. Office for Research Protections (ORP)

The ORP is responsible for overseeing research compliance at Penn State with regard to human and animal subjects, toxic substances, and environmental hazards. The ORP is also responsible for oversight of conflict-of-interest policies as they pertain to research, and the director serves as the research integrity officer and staff person for the Senior Vice President for all research misconduct cases. This office also oversees all training programs relating to responsible conduct of research. The University is accredited by the Association for the Accreditation of Human Research Protection Programs (AAHRPP) and the Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC). This office oversees the accreditation process for the entire University in the former case and for all University locations except Hershey in the latter case. As can be seen in Table 9, the number of protocols has increased by 12 percent in the aggregate and from nine to 67 percent across the different categories. The training and monitoring aspects of the ORP mission are labor-intensive, and the office has worked well to efficiently utilize its available human resources. At Penn State, we have 808 human participant protocols reviewed per full-time employees (FTE); in a survey of a number of our peers, we learned that they had between 259 and 737 protocols reviewed per FTE. Similarly, we have 1,049 animal care and use, biosafety, and isotopes protocols reviewed per FTE compared with 190 to 436 for our peers.

Table 9 – IRB Protocols/IACUC, IBC, UIC Protocols, FY1996-FY2006

Year	Institutional Review Board (IRB) Protocols					Institutional Animal Care and Use Committee (IACUC), Institutional Biosafety Committee (IBC), and University Isotopes Committee (UIC) Protocols						Total ORP Protocols
	Social Science	Biomedical	Total # of IRB	# of IRB Personnel		Total # of IACUC	Total # of IBC	Total # of UIC	Total # of IACUC, IBC & UIC	Total # of IACUC, IBC & UIC Personnel		
				Professional	Staff					Professional	Staff	
1996	1642	314	1956	1	1	406	72	-----	478	1	1	2434
1997	1590	333	1923	2	1	446	116	74	636	1	1	2559
1998	1665	338	2003	2	1	409	123	51	583	1	1	2586
1999	1735	279	2014	2	1	342	160	88	590	1	1	2604
2000	1739	348	2087	2	2	460	121	64	645	1	2	2732
2001	2037	382	2419	2	2	463	76	68	607	1	2	3026
2002	2113	496	2609	2	2	400	162	69	631	1	2	3240
2003	2369	442	2811	3	2	443	301	60	804	1	2	3615
2004	2712	610	3322	4.5	2	473	325	77	875	1	2	4197
2005	3052	637	3689	4.5	2	487	341	81	909	1	2	4598
2006	2967	669	3636	4.5	2	571	386	92	1049	1	2	4685

Notes:

1996: There was only 1 professional position (Compliance Coordinator) that reviewed all 4 areas of research (IRB, IACUC, IBC, and UIC).

1997 - 2001: The Compliance Coordinator was promoted to Director on 4/29/97 and a new compliance coordinator was hired. The Compliance Coordinator & Director were both involved all 4 areas of research (IRB, IACUC, IBC, and UIC). The Director reviewed protocols for all 4 areas of research and the Compliance Coordinator reviewed IRB protocols and participated in meetings only for the IACUC, IBC, and UIC.

2001: Two additional Compliance Coordinators were hired in January 2001. One position served as the Compliance Coordinator for the IACUC, IBC & UIC. The other position served as an IRB Compliance Coordinator. The existing Compliance Coordinator was also assigned to only review IRB submissions. The Director was no longer involved in the day-to-day reviews of the 4 areas of research.

2003: A third IRB Compliance Coordinator was hired in April 2003.

2004: An Associate Director was hired in February 2004. A fourth IRB Compliance Coordinator was hired in October 2004. Because of the overwhelming need, the Associate Director reviews all of the Full Review IRB submissions and reviews other levels in high volume times.

2007: Obtained approval to hire one standing IRB Compliance Coordinator and one fixed term IRB Compliance Coordinator for two-years. The fixed term position will relieve a current IRB Compliance Coordinator of her protocol reviews so that she can work on the University's CTSA proposal to be submitted in October 2008. The fixed term IRB Compliance Coordinator has been hired. The standing position is still vacant and the search is ongoing.

5. Animal Resource Program (ARP)

The ARP is responsible for the care and well-being of laboratory animals at all University locations with the exception of Hershey. The ARP supports continued growth in the development of biomedical and interdisciplinary research by providing state-of-the-art animal facilities and husbandry, proper veterinary care, and assurance that all procedures involving animals are successfully performed and monitored. Most experiments are conducted with laboratory mice and rats. However, the use of non-rodent models is increasing. Over the last ten years, the laboratory animal census has grown significantly (Table 10), and the number of care days has more than quadrupled. There are currently eleven animal housing facilities across the University Park location with two additional facilities in the design stage; this contrasts with seven facilities in 1998. In 1998, the ARP had seven caretakers and eight other staff for a total of 15 FTE. Currently, the ARP has 24.5 FTE, so although the program workload has more than quadrupled, the staff has not even doubled.

Table 10 – Animal Resource Program Census Data by Species

Species	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008
Mice	2,277 ^a 831,105 ^b	3,934 1,435,910	6,923 2,526,895	10,477 3,824,105	9,107 3,324,055	8,801 3,203,564	8,503 3,103,595	9,452 3,449,980	10,398 3,795,270	10,900* 3,978,500
Rats	244 89,060	232 84,680	98 35,770	160 58,400	225 82,125	372 135,780	471 171,915	547 199,655	338 123,370	350* 127,759
Rabbits	13* 4,745	16* 5,840	14* 5,110	4* 1,460	2* 730	5* 1,825	54 1,620	19 570	22 660	130* 3,900
Chicks	5* 1,825	5* 1,825	2* 730	4* 1,460	2* 730	5* 1,825	80 2,400	67 2,010	158 4,740	80* 2,400
Chickens	0	0	0	0	0	0	24 900	0	0	0
Hamsters	6* 2,190	6* 2,190	6* 2,190	6* 2,190	5* 1,825	4* 1,460	0	6 180	22 660	6* 180
Tamarins	0	0	0	0	0	0	0	14 5,110	14 5,110	14 5,110
Pigs	1* 365	0	0	0	0	0	2* 4	6* 12	15* 40	26* 50
Finches	0	0	0	0	0	0	0	0	24 8,760	24 8,760
Sparrows	0	0	0	0	0	0	0	0	0	40 3,600
Total Number of Care Days	929,290	1,530,445	2,570,695	3,887,615	3,409,465	3,344,454	3,280,434	3,657,517	3,938,610	4,138,249 (overall 445% increase)

^a = average number housed per month

^b = number of care days per year

* Numbers are estimated (based on per diems)

Data shown for mice, rats, finches, and tamarins are average monthly census numbers, followed by number of care days per year. Other species (which are not housed continuously) are shown as total annual numbers followed by number of care days per year. Please note that care days for non rodent species are much more labor intensive that those for rodent species

6. Research Publications (RP)

The RP office provides a prime mechanism by which Penn State communicates with various interested publics about the research accomplishments of the institution. In the last few years the Office has developed a tripartite strategy. Two print documents per year are published, viz., the annual print magazine (<http://www.rps.psu.edu/>) and the annual report (<http://www.research.psu.edu/about/annualreports.html>). These documents are mailed to individuals (print magazine=37,500; annual report=5,000) each year, with many more distributed by staff during key visits from and to a variety of constituencies. While the print medium provides the opportunity for targeted outreach, the web makes the research successes at Penn State more widely accessible to audiences worldwide. To that end, two years ago Research Publications shifted from a print-centric publication strategy to a web-first model. In that time vehicles like the weekly Probing Question feature (<http://www.rps.psu.edu/probing/more.html>) have become very popular. Distributed via the Penn State Newswire, Probing Questions directly reaches a potential audience of over 300,000 subscribers, and is routinely picked up by external science-news websites. In 2007, the RP site averaged 60,500 page views per month, up from 53,000 in 2006. Since 2003, Research Publications has also hosted the Research Unplugged conversation series, featuring faculty discussing their research in a downtown State College setting. This program, patterned after Café Scientifique (an international grassroots outreach initiative), provides an opportunity for communicating the relevance of Penn State research to the local community). It has enjoyed excellent attendance ranging from 35-60 people weekly, and podcasts are made available on the web.

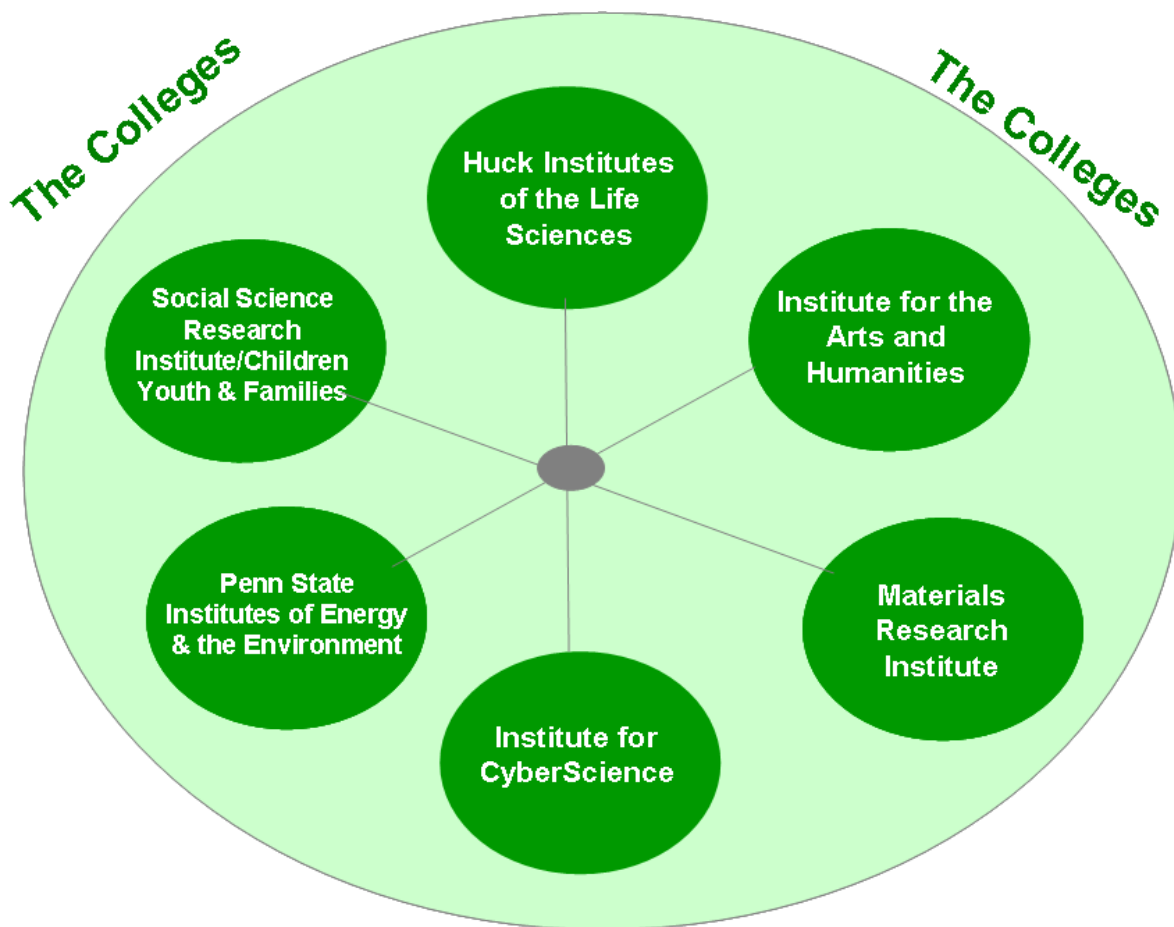
II. Future Plans and Initiatives

A. The Path Forward for Research Initiatives at Penn State

1. OSVPR Institutes

The current OSVPR institute structure is a national model for how to conduct interdisciplinary/intercollege research. The six Institutes, viz., the Huck Institutes of Life Sciences, the Materials Research Institute (MRI), the Penn State Institutes of Energy and the Environment (PSIEE), the Social Science Research Institute (SSRI), the Institute for CyberScience (ICS) (formerly the Institute for Computational Science), and the Institute for the Arts and Humanities (IAH), form a network of interactions that support the broadest goals of the individual colleges. Figure 15 depicts the connectivity and collaboration among the Institutes and reflects the role they play as they are embedded inside a circle surrounded by the colleges whose efforts they support.

Figure 15 – OSVPR Institute Structure



In recent years, the various Institute directors have developed a continuing dialog that has helped identify promising emerging themes for research initiatives. This plan will not be comprehensive enough to articulate all the possible areas of growth within each Institute. Below is a brief summary of some of the key areas each Institute hopes to tackle in the next five years. The website for each Institute contains a more in-depth Institute strategic plan.

a. Dorothy Foehr Huck and J. Lloyd Huck Institutes of the Life Sciences

<http://www.huck.psu.edu/>

The Huck Institutes have created a number of centers of excellence, clustered together as institutes, which are contributing to the University's emerging preeminence in basic and applied life sciences. In the next five years, we expect to see significant growth in the following research areas:

- Cyber-biosystems: apply modern computational technology and techniques (particularly network science) to handle data and enhance insight into health and biological systems
- Bioinformatics and Genomics: develop tools and approaches that will make Penn State become a “go-to place” for analysis of genomic data
- Biomedical and Health Sciences: build a comprehensive program in health sciences incorporating colleagues in the medical and social sciences
- Infectious Disease: develop a new initiative in pathogen evolution that will examine the dynamics of drug resistance and leaky vaccines and seek evolution-proof solutions
- Plant Biology: develop an integrated approach to stress tolerance
- Neuroscience: develop strengths in neuro-engineering and foster a systems approach in close collaboration with SSRI

Organizationally, the Huck Institutes also plan to pursue a number of initiatives including:

- Enhancing the relationship with the Institute of Diabetes and Obesity by strengthening links across colleges and University locations
- Supporting the development of an Institute of Clinical and Translational Science in close collaboration with the College of Medicine
- Supporting the Cancer Institute in its strategy to obtain National Cancer Institute designation
- Developing infrastructure to support state-of-the art facilities: We will identify strategies for pooled management agreements, develop a mechanism for support of facilities, and create a strategic approach to purchasing replacement equipment
- Attracting high-quality graduate students with training-grant support
- Improving the quality and cohesion of our Institutes with center grants

b. Materials Research Institute; <http://www.mri.psu.edu/>

The MRI combines historical strengths in many aspects of materials science that span the University, with core faculty in the colleges of Engineering, Earth and Mineral Sciences, and Science. The Applied Research Laboratory has great strength in materials science as well, and it is this strength coupled with the efforts of the academic colleges that gives Penn State its top position in research expenditures in this field of study annually. The MRI couples its investment in co-funded faculty with investment in core facilities. The emphasis has been, and will continue to be, on providing facilities that enable interdisciplinary materials research. The Millennium Science Complex (MSC), which is described in more detail in section II.2.a., will be the cornerstone of this function. The strategic drivers for the MRI will include opportunities associated with neural engineering, bioengineering, nanobiology, nanomedicine, solar energy, and energy storage.

The strategic priorities for MRI include expansion of our strengths in the following areas:

- Electronic materials, devices, and systems: Clustering of state-of-the-art facilities and faculty in the MSC will vertically integrate our capabilities to enable research in nanoelectronics, electronics for the body, thin-film devices, microelectromechanical systems (MEMS), and devices for energy conversion/storage.
- Nanoscience, nanomaterials, and nanostructures: the Center for Nanoscale Science will continue to be our center of gravity for the study and discovery of physical phenomena at the nanoscale level, and of their exploitation in strain-enabled multiferroic nanostructures, semiconducting/superconducting and magnetic nanowires, photonic crystals and fibers, and metamaterials.
- Optical materials and photonics: Electro-optical materials and phenomena, materials and technology to further enable biomedical ultrasound and MRI imaging, methods for ultra-fast laser imaging in general, and biophotonics to study cell biology will be pursued.
- Functional polymers: Electronic, optical and electro-active polymers will be developed for energy, sensors, and medicine; the MSC will enable the integration of these materials and devices with the more historical Penn State presence in electroceramics, ferroelectrics, and wide-bandgap semiconductors.

A further priority will be to sustain and nurture our existing NSF-supported Materials Research Science and Engineering Center–Center for Nanoscale Science, and to pursue opportunities presented by the new DOE Office of Science Energy Frontier Research Center program, and Mid-Atlantic Nanotechnology Alliance (MANA).

c. Penn State Institutes of Energy and the Environment

<http://www.environment.psu.edu/default.asp>

Strategic plans for PSIEE incorporate issues dealing with the interrelated areas of energy and the environment. PSIEE is comprised of a consortium of college-based institutes and centers including the Earth and Environmental Systems Institute, Environmental and Natural Resource Institute, Engineering Environmental Institute, the EMS Energy Institute, the Rock Ethics

Institute, the Hydrogen Energy Center, and the Biomass Energy Center. In the next few years PSIEE, in collaboration with the academic colleges, will hire 24 new faculty in the energy area and will plan and coordinate the replacement of hires in the environmental area as faculty who have been associated with this activity retire. This represents an opportunity to shape the direction for these two critical areas. The strategic priorities for PSIEE include:

Environmental Opportunities:

- Climate Change, understanding the risks and impacts on earth systems from agroecosystems to coral reefs and arctic ice
- Hydro-geo-ecosystem integration, developing cyber-sensing and modeling tools for the critical zone of life
- Integrated regional assessment, focused on the human dimensions of natural resources and the environment
- Health and the Environment, transforming the sciences of molecular toxicology and carcinogenesis

Energy Initiatives:

- Clean carbon, integrating carbon sequestration with advanced conversion strategies for fossil fuels
- Future fuels, e.g., cellulosic, solar, wind, and nuclear
- Energy storage, including electrochemical batteries and new chemical fuels
- Water and Energy, investigating the complex interactions of these critical resources
- Energy efficiency, ranging from fuel cells and hybrid vehicles to net-zero-energy building systems

PSIEE will also be focused on further integrating the efforts of diverse researchers across Penn State whose interests are relevant to the PSIEE mission, as well as developing and coordinating its central user facilities.

d. Social Science Research Institute/Children Youth and Families Consortium
<http://www.ssri.psu.edu/>

Penn State's social science research serves as a bridge between biology and behavior. The Institute is comprised of three centers of activity, i.e., the Children, Youth and Families Consortium (CYFC), which addresses the complexities of human behavior, health, and development in diverse populations of youth and families; the Population Research Institute (PRI), which fosters multidisciplinary research in the population sciences; and the Survey Research Center (SRC), which provides high-quality, cost-effective research services to Penn State social scientists. In the next five years the SSRI will focus its activities in several key areas:

- Preventing Problems/Promoting health and development in children and families
- Biological bases of behavior, health and development—gene environment interactions; neuroscience
- Social change—with emphasis in the areas of immigration and smart spaces (refer to II.2.d.)
- Innovative methods development—new measurement and analytic methods and models

e. Institute for the Arts and Humanities
www.research.psu.edu/iah

The IAH is funded by the OSVPR in collaboration with the colleges of the Liberal Arts and Arts and Architecture. Building on its many successes, including the National Endowment for the Humanities (NEH) Challenge Grant awarded in 2002, the Institute has added three new funding opportunities (the Short-term Distinguished Visiting Professorship, Bridging the Classroom, and Dissertation Fellowships) to its five other highly effective competitions (Team Teaching across the Disciplines, Individual Faculty Grants, Faculty Residencies, Summer Graduate Student Residencies, and Interdisciplinary Groups). The Institute has also added two high profile initiatives (Medal for Distinguished Contributions to the Arts and Humanities and Moments of Change) to its three other programs (Recognizing Pennsylvania Black Art and Artists, the Summer Seminars for High School Teachers, and Public Humanities Scholars), as well as an IAH Book Series in collaboration with Penn State University Press.

The IAH will further its goals by:

- hosting nationally and internationally recognized scholars and artists
- supporting international research and travel, hosting scholars and artists with an international/global perspective, or presenting symposia or other initiatives that launch dialogues fostering a better understanding of underrepresented groups
- launching the IAH Book Series with Penn State University Press, including edited collections of essays related to the Moments of Change initiative
- expanding opportunities to participate in lectures, concerts, performances, and exhibits through IAH podcasts, web postings, television broadcasts (WPSU, C-NET), compact disc recordings, and other easily and widely accessible venues and formats
- leading the formation of a CIC Arts and Humanities Consortium, aimed at bolstering artistic and humanistic study at sister institutions and creating new funding or exchange opportunities for faculty and graduate students of participating institutes

f. Institute for CyberScience (ICS)
<http://www.research.psu.edu/ics/index.html>

Recognizing a tremendous potential in the area of computational science well beyond what a single department, college, or institute could tackle, in 2007 Penn State established an Institute for Computational Science funded through the OSVPR and contributions from many of the colleges. The ICS was visualized as a net overarching the major research Institutes with arms to all the colleges. While the initials have stayed the same the unit has recently been renamed the

Institute for CyberScience. The mission of ICS@PSU is to enhance Penn State's national and international presence and stature in computational cyberscience, by growing its foundational core and advancing its frontiers in Energy and the Environment, Life Sciences, Materials, and Social Sciences. ICS@PSU will promote this enterprise by developing core initiatives involving complex networks, metamodels, and cyberdiscovery systems, as well as frontier initiatives that will couple the core with strategic issue-centric thrusts. Examples include:

- applying complex networks to the study of
 - infectious disease dynamics, with a link to the Huck Institutes' Cyber-BioSystems thrust (Huck, Science)
 - energy generation and distribution (PSIEE, Engineering)
 - virtual communities for learning (SSRI, IST)
- linking metamodels to
 - SSRI's innovative-methods thrust to develop real-time personalized therapies (SSRI, HHD)
 - computational materials design and discovery (MRI, EMS, Engineering)
 - Cyber-enabled critical zone observatories (PSIEE, EMS, Engineering, IST)
- Developing cyberdiscovery systems for Penn State research branding in bioinformatics, cyber-education, materials, and environmental sciences

As of this writing, funding for ICS has been secured for a three-year probationary period. The expectation is that this Institute will succeed both in facilitating research across a broad spectrum and in securing significant external resources for cyberscience-related research. Such success will lead to continued, and possibly, enhanced support for ICS.

2. Signature Institute Initiatives

While this plan does not delve into the details of all of the planned Institute activities, several larger initiatives deserve to be highlighted because they are expected to have a major impact on the direction and success of the Institutes, individually and collectively.

a. Construction of the Millennium Science Complex (MSC) to House Materials and Life Sciences Research

With completion of the MSC, we will have a building designed around the central themes of materials research with connections to cutting-edge research topics in the life sciences. The faculty who populate this building will work together on large collaborative projects with emphasis in areas including nanobiology/nanomedicine and energy research. In addition, the building will be home to key shared facilities accessible to faculty all over campus. The life science wing of the MSC will be the third building associated with the Huck Institutes, and the first in which Huck researchers are put into direct contact with researchers from materials science and engineering. Success with this venture will be measured by the genesis of crosscutting collaborations among life scientists, material scientists, and engineers that lead to

new grants and contracts, large-scale research projects that receive external funding, and eventually intellectual property that transitions from the University to the commercial sector.

b. Opening of the Center for Neural Imaging in Chandlee Laboratory

Through a partnership among SSRI, the Huck Institutes, several colleges, and central administration offices, Penn State is purchasing a 3 Tesla functional Magnetic Resonance Imaging (MRI) machine. The instrument is being installed in Chandlee Laboratory and will become the home and centerpiece of an initiative in neuroscience that will bring together life science and social science approaches to understanding brain function and behavior. While Penn State's profile in neurosciences has not traditionally been viewed as very strong, there are pockets of excellence. For example, kinesiology faculty are studying topics such as the neural processes responsible for coordinating mechanics of the musculo-skeletal system, and language researchers are using bilingualism as a window into brain plasticity. Furthermore, recent faculty hires that cross between engineering and medicine, with strength in cognitive science, offer the ingredients for significant growth in aspects of neuroscience. Success of this initiative will be measured by initiation of collaborations that lead to new grants and eventually to large-scale research projects that receive external funding. By the end of this strategic planning cycle we should begin to see several areas of neuroscience at Penn State developing visibility nationally.

c. Advances in Energy

As mentioned above, Penn State is investing in 24 new positions in energy-related areas, coordinated by PSIEE. As a result of these hires, we expect to build upon existing strengths and become a center of excellence in several areas. Complementing these hires, we expect to see the Chevron relationship in clean coal technology blossom with multiple task orders against the master alliance agreement. If this relationship proves successful, Chevron will consider investing in other fields of energy-related research at Penn State. A promising new initiative is the BioEnergy Bridge, a program that will take biofuels from the field to motorized vehicles. Realizing its full potential will require funding from industry, foundations, and the government, and all of these will be pursued. Success will also entail the funding of a DOE Center should federal funding for such centers be appropriated. Additional significant industrial relationships should develop, as should long-term formal relationships with the National Laboratories.

d. Developing the Smart Spaces Center

Under the auspices of the SSRI, and with financial support of several colleges in addition to the OSVPR, we have initiated a three-year experiment titled Smart Spaces. This is a program aimed at bringing together social science, medicine, engineering, and information technology to conduct interdisciplinary research that will provide solutions to issues related to living spaces for aging populations. The success of this program will be measured by initiation of major cross-disciplinary projects, some of which will secure external funding within the next three years. This funding will most likely come from a combination of federal agencies as well as foundations or other not-for-profit entities.

3. Hiring Strategies

In preparation for the execution of the strategic plan, the SVPR hosted a retreat for the Institute directors and members of the University Park Council of Academic Deans. The objective of this retreat was to explore the loci of research the directors were planning to pursue, with emphasis on the crosscutting areas, and determine areas of intersection with the interests of the academic colleges (two such areas of intersecting interest were neuroscience and networks). In the next five years other areas will emerge, and from a strategic point of view it is probably less important to anticipate all of those areas than it is to develop a cross-University strategy to address opportunities as they arise.

The retreat participants agreed that one approach to developing such research areas would be strategic cluster hiring. Historically, the filling of positions at each of the Institutes was guided by specific areas of interest defined in conversations between the relevant deans and director. This was followed by a competition, which led to searches for prescribed numbers of faculty each year. As the Institutes reach steady state, this approach will no longer be as fruitful and a different strategy will need to be employed. Under a cluster hiring strategy, all units (Institutes and colleges) interested in a particular area would be identified. A finite number of positions would be identified as available to support an area. Searches would proceed to find the best individuals to fill the niche, independent of direct ties to particular departments. Once the best candidates were identified, discussions would commence regarding the home(s) for the individual. The possibility for a combination of Institute sponsorship through co-funding coupled with joint appointments across colleges and departments would be negotiated. While such a process brings with it some uncertainty, it would also create an intellectual potential for prospective faculty members that is likely to be very appealing. Variants on this strategy could be considered when launching a given set of searches, depending upon the nature of the field under consideration.

To test this alternate approach, our plan for the next one to two years is to initiate an experiment to recruit in one cluster area. Success of these faculty recruits would be measured by both their demonstrated leadership roles in seeking and securing large prestigious awards which require collaboration, and their ability to bring in research dollars to support their teaching and research enterprises.

4. Office of Military and Security Programs (OMSP)

The OMSP (formerly the Marine Corps Research University), has existed since 1999 with the goal of facilitating and supporting large DoD contracts for various units within Penn State. Awards under these contracts have totaled \$104 million. The performers have been primarily the Defense-Related Research Units (DRRU), but also have included the colleges of Agricultural Sciences, Business, Engineering, Health and Human Development, Information Sciences and Technology, and the Liberal Arts, as well as Penn State Fayette, and Outreach. The current staffing of the OMSP consists of three personnel including an administrative assistant.

The OMSP has also managed the Homeland Security Initiative at Penn State, which has coordinated proposal development for the Department of Homeland Security and the Pennsylvania Office of Homeland Security. Nationally, funds for Homeland Security research have been scarcer than expected over the past several years, however, we believe that establishing and maintaining Penn State's stature in this field is strategically the correct choice and that there will be significant funding opportunities in the future.

The OMSP has primarily worked by arranging indefinite delivery/indefinite quantity contracts, which make up the majority (> 80 percent) of funding from supported research at the DRRU. The primary goal of the OMSP is to expand the number of DoD contracts for non-DRRU sectors of Penn State while maintaining and improving the level of support for the DRRU. The Office plans to secure at least one new additional multi-year, multi-million dollar sole source contract with a DoD sponsor in the next three years.

5. Defense-Related Research Units (DRRU)

The DRRU are comprised of the Applied Research Laboratory and the Electro-Optics Center, two interdisciplinary units under the oversight of the OSVPR. In 2007, these units accounted for \$168 million in research expenditures. Success for the DRRU will be measured by the maintenance and growth of research contracting; growth in research collaborations with the academic colleges; successful transitioning of research products to the public and private sectors for the intended purposes; and support for students, graduate and undergraduate, as they represent the workforce of the future.

a. Applied Research Laboratory (ARL)

ARL's broad range of technical capabilities serves to develop and transition a diverse set of technologies needed to support the increasingly complex battle space. Increased emphasis on Joint Service programs that leverage multi-service technology developments will be much more prevalent in the future. The ARL leadership expects significant new DoD investments in information, surveillance, and predictive technologies in addition to traditional battle space technologies. Over the next five years, there will be significant opportunities for ARL to provide technical support in the following areas.

- New Navy ship classes (DDX, LCS and SSGN); unmanned vehicles technologies; maritime domain awareness; fluid dynamics applications; undersea systems
- Intelligence applications; communication systems; information systems and data fusion (with the College of Information Sciences and Technology and the Computer Science and Engineering department)
- Materials applications; composite materials (with the Materials Research Institute and the College of Engineering)
- Biomedical (with the College of Medicine and the Bioengineering department)
- Space systems (with the Eberly College of Science and the College of Engineering)
- Power and energy (with the Colleges of Engineering and Earth and Mineral Sciences and the Penn State Institutes of Energy and the Environment)

New opportunities for basic and applied research will arise from collaborations across University centers and industry partnerships that will lead to technology transition and transfer. One challenge will be to secure sufficient space to allow the hiring of personnel needed for the new research opportunities that are anticipated. Ongoing facilities planning will provide short-term relief with leased space to be available in 2009 and plans for a new building at Innovation Park for long-term needs.

b. Electro-Optics Center (EOC)

The EOC was established in 1999 as a Navy Electro-Optics Manufacturing Technology (ManTech) Center of Excellence under a five-year contract with the Office of Naval Research, and was managed by Penn State's Applied Research Laboratory. In 2004, the EOC became a separate research unit within Penn State in recognition of its growth in research activity and its critical role across a broad spectrum of defense electro-optic applications. The EOC facilitates connections between businesses, identifies new technologies and needs to the government, coordinates solutions for governmental technical problems, and supports/contributes to education and workforce development. The EOC has established an Alliance of over 400 companies, universities, and government laboratories across the country to achieve its goals. The EOC goals include:

- Pursuing strategic relationships with new sponsors with a goal to win at least three Indefinite Delivery/Indefinite Quantity/Broad Agency Announcements contract awards
- Broadening its sponsor base by building on existing internal capabilities to attract funding for at least two new internal technology capabilities
- Building upon collaborations with other Penn State entities and other universities leveraging EOC capabilities; teaming with no less than one Penn State entity to bid and win at least two projects totaling \$10 million
- Strengthening ties to Penn State Outreach to leverage workforce development programs and resources while continuing to leverage existing education and workforce development partnerships; collaborating with Penn State Outreach to bid and win a minimum of two workforce development grants totaling \$500,000 supporting western Pennsylvania needs
- Maintaining a high level of excellence of on-site operations (contracting, subcontracting, property, information technology, accounting, time-keeping and program management systems) while implementing continuous improvement; completing a model property tracking system and an enterprise management system

6. Global Efforts

The OSVPR will work closely with the Office of the Vice Provost for International Programs to further develop the global reach of Penn State's research enterprise. In particular, the two offices will work together to identify those Penn State programs that might naturally benefit from partnerships with WUN. Those programs should then be incentivized to develop funded research efforts with colleagues at these institutions and others that might naturally link to create strong and lasting alliances.

B. Infrastructure Support for the Research Agenda

1. Central Office

a. Large Proposal Support

A major institutional goal is to increase success in securing large, prestigious, externally funded awards. In the coming years, the OSVPR will provide the infrastructure needed to support these efforts and to systematize the process by which Penn State pursues such opportunities. This initiative will have the ancillary benefit of providing a framework through which the broad University-wide experience base and resource pool can be coordinated to facilitate major grant proposal-writing efforts. In June 2008, a new staff member was added to the OSVPR central office staff to play a coordinating role in proposal preparation. This person will develop a broad knowledge of Penn State faculty, research, contacts, and resources, and will then be able to help principal investigators make connections with support personnel for non-technical aspects of proposals. This person will also coordinate the writing of the proposal (i.e., making sure that the proposal addresses all aspects of the solicitation and that the writing process adheres to a schedule) and will also arrange for internal reviews of the proposal, so as to optimize it before submission. Initially, this person will coordinate a team of research-support staff from across the University, who will work together to support large proposal efforts. If this role is effective, the effort will be enhanced in partnership with other units at Penn State under the coordination of the OSVPR.

In addition to enhancing support of proposal development, the OSVPR will work closely with the Institutes and colleges to more aggressively support the proactive formation of teams and selection of principal investigators so that Penn State teams are already in place in anticipation of solicitations from funding agencies. This activity is important because the scale of expectations for large proposals is so extensive that the preparation of even a preliminary proposal requires months of coordinated effort. If the proposal is not already substantially underway by the time the agency issues a formal solicitation for proposals, the University may be too late to prepare a successful proposal. OSVPR will coordinate efforts to learn about solicitations early by regular polling of groups with connections among the faculty (i.e., the University Research Council).

A metric for success for these efforts will be a higher rate of funded proposals for competitive, large grants. A small number of center-type grants, such as the current NSF-supported Center for Nanoscale Science, can have an outsized effect on the institution; therefore, successfully capturing as few as two or three of these grants over the next five years will be a significant accomplishment.

b. Technology-Based Economic Development

The OSVPR will continue to promote technology-based economic development by assisting and coordinating efforts across all Penn State locations, engagement with researchers throughout the Penn State research enterprise, and facilitating government-university-industry partnerships at both the state and federal levels. In particular the office will help academic units develop proposals to support partnerships for innovation through the Keystone Innovation Zones, the Keystone Innovation Starter Kits, the Department of Community and Economic Development's

Ben Franklin Technology Development Authority's university grants program, the NSF Partnerships for Innovation, Grant Opportunities for Academic Liaison with Industry (GOALI) programs, and others. Specific objectives for the next five years include 1) continuing to promote technology-based growth of new and existing companies in the three-county I-99 Corridor region; 2) creating and sustaining partnerships for technology-based economic development in two to three additional regions (e.g., North Central, Southeastern, Berks-Lehigh Valley); and 3) developing and submitting proposals for new state, federal, and industry research funding leveraging regional economic development partnerships.

2. Technology Transfer and Economic Development Offices

The RTTO is committed to insuring that research is made accessible to society to solve problems and contribute to economic development. Each office within RTTO focuses on a dimension of that commitment.

a. Intellectual Property Office (IPO)

The IPO is committed to identifying intellectual property that is mature enough to be transferred from the bench to the market and to assist in achieving that goal. Over the next five years, IPO will:

- Maintain the number of invention disclosures submitted by faculty at a level commensurate with Penn State's research expenditures. Per the FY2005 Association of University Technology Managers' Licensing Survey the average invention disclosure rate for reporting U.S. universities is one invention disclosure per \$2.5 million of research expenditures. IPO's goal is to achieve a commensurate rate, taking into account that the Applied Research Laboratory and the Electro-Optics Center disclose inventions at a much lower rate.
 - Although a strict interpretation of the Penn State Intellectual Property Agreement suggests that faculty have the responsibility to submit invention disclosures, in reality faculty participation is discretionary. The IPO encourages faculty participation by:
 - satisfaction with the intellectual property management, patenting and licensing process
 - financial returns to inventors of licensed technologies
 - communication and education regarding the benefits of technology transfer
- Increase the quantity and maintain the quality of licensing activity as measured by the number of license agreements executed and the amount of revenue generated.
 - Each fully trained Technology Licensing Officer should achieve five licenses/options per year.
- Develop a mechanism for promoting the movement of technology out of the University, specifically:
 - Identify early-stage technologies that would most benefit from commercially-focused R&D to advance the technologies to a commercially significant "go/no go" decision point.

- Formulate an R&D program that is achievable with the resources available at manageable cost.
- Increase the number and quality of Penn State start-up companies. Part of this effort may include developing an “executive in residence” program, through which entrepreneurial executives would be invited for several-month visits to Penn State to both advise Penn State faculty and staff and participate in commercialization of Penn State technologies.

b. Industrial Research Office (IRO)

IRO is committed to catalyzing new research partnerships and alliances between Penn State and industry. The following strategic goals for IRO are written in accord with Penn State’s dual objectives of maintaining national preeminence in the level of industrial funding for its research while also being a spur to technology-based economic development in the region and Commonwealth:

- Increase IRO-generated research awards. We will seek to complete three to six additional master agreements per year and to create from these at least two additional Alliance Partners.
- Increase federal funding through leveraged industrial relationships. As an outgrowth of the master agreement relationships and the formal request-for-proposals process adopted by increasing numbers of our partners, the opportunity to collaborate on joint proposals to federal sponsors is a natural fit. We will continue to leverage partnerships leading to increased federal funds and to provide support for industrial participation in NSF Engineering Research Centers, NSF Science and Technology Centers, and other large-center proposals.
- Increase awareness of the University’s technical capabilities and understanding of how industry has benefited by partnering with Penn State. Create a marketing plan that aligns with OSVPR, the colleges, and the Institutes.

c. Innovation Park at Penn State

In conjunction with Innovation Park owners and developers, strategic goals for the period FY2008–FY2013 include:

- Designing, constructing, and leasing 240,000 square feet of additional space
 - Implementing marketing activities that are consistent with the research strengths of the University. Activities will include collaboration with Penn State Research Park Developers, Inc. and Innovation Capital Partners in their marketing effort, maintenance of an updated web site, and partnering with the IRO and Pennsylvania’s Department of Community and Economic Development (DCED) on lead generation and closing.
 - Utilizing the PA DCED, federal programs, and other sources to leverage funding for tenant attraction and retention.

- Maintaining a 90-percent occupancy rate in Park multi-tenant buildings.
- Providing services to tenants that will facilitate strong University relationships and provide business-support assistance, utilizing the services of the Penn State RTTO.

d. Ben Franklin Technology PArtners for Central and Northern Pennsylvania (BFTP/CNP)

The goal of the BFTP/CNP over the next few years will be to grow successful businesses and create new jobs in Central and Northern Pennsylvania. Specific activities will include:

- Working to create a funding program to increase the utilization of Penn State expertise by small- to medium-sized Central Pennsylvania companies.
- Creating a second-stage capital function at the Center to facilitate angel and venture investment in Central Pennsylvania start-up companies.
- Increasing the coverage of College Business Plan contests to reward and support university-based entrepreneurship across the 34-county Ben Franklin service territory.
- Establishing a model for support of translational research to increase local commercialization of Penn State Intellectual Property and expertise, initially focused on the renewable-energy sector.
- Assisting in leveraging at least \$1 million per year in additional external support to Ben Franklin and Penn State economic and technology development programs.

3. Office of Sponsored Programs (OSP)

The OSP and the Office of Research Information Systems (ORIS) are committed to providing timely service that ensures the integrity of research proposal processing and grants and contracts negotiations.

OSP short-term goals include:

- Implementing processing guidelines for OSP negotiators for the various types of award actions. Setting standards of processing of three, 10, and 20 business days. Using the negotiator status report to ensure that award actions are meeting the goal.
- Publishing a robust statistical summary via the intranet that includes a data matrix detailing historical data trends of proposals, awards, and expenditures including the comparative data detailed in the NSF expenditure survey. Providing access to the secure site to appropriate research administrators.
- Developing a formalized personnel training plan customized for all Sponsored Programs positions. The training plan would be initiated upon employment with Sponsored Programs, with the responsibility for implementation and adherence endowed upon the supervisor.
- Synchronizing end-of-year proposal and award reporting among all Penn State locations. Coordinating with the College of Medicine to reconcile the fiscal year awards within five business days of the end of the fiscal year.

OSP long-term goals include:

- Processing 95 percent of contracts and grants within 28 days by end of fiscal year 2011. Reviewing all award-processing operations to eliminate inefficiencies by advocating automation and standardization of processing. Reviewing award-negotiator status reports weekly to ensure that negotiations continue to move forward.
- Processing 100 short-form industrial agreements a year by the end of calendar year 2012. Promoting the use and adoption of the revised short-form for non-federal projects. Working with the Research Coordinators to identify projects that qualify for the use of the form.
- Establishing a negotiator team to exclusively manage the industrial research-intensive departments. Formalizing the operations of the team to include oversight of master agreements, confidentiality agreements, and teaming agreements. This team will interface with and support the efforts of the Industrial Research Office and the Intellectual Property Office.
- Graduating 200 participants from the ACOR Certification and Education Series by the end of fiscal year 2011. Successfully promoting nominations for and participation in the program and recruiting 40 new participants per year. Exploring alternative means to allow for satellite-campus instruction via a live on-the-air format.

4. Office for Research Protections (ORP)

The ORP is committed to providing timely service and quality education to ensure that Penn State supports the spirit of research protection and ethics and maintains the highest level of compliance standards.

The ORP has several critical goals:

- Reducing administrative burden for investigators conducting human subjects research
 - ORP will introduce two new programs within the human subjects protection area; both designed to decrease the administrative burden on investigators while maintaining the highest ethical standards for the protection of human subjects. The first will extend the approval period for non-federally funded, expedited-level research from one to three years. This program was developed and piloted by the University of Michigan. Penn State will be the second CIC institution to pilot test this program. The second will provide a new category for non-federally funded, non-invasive, stimuli-based social science research to be reviewed at the exemption level. After Penn State development and testing, other CIC institutions will further test this program.
- Protocol Review and Approval Management System (PRAMS): PRAMS development (e.g., eApplications) and deployment has slowed in recent years due to other commitments (AAHRPP) and limited IT staff available to program and develop systems. We need to develop new applications and tracking mechanisms to assist us in implementing and managing new areas of compliance (e.g., conflict of interest) and inquiries and investigation into allegations of research misconduct. Additionally, we must have an efficient and effective system for education registration and tracking,

particularly as some programs will become mandatory or involve a participation requirement. eApplications for human subjects' submissions will be deployed by January 2009. Timelines or further development in PRAMS will be set in the near future. Click Commerce, a data management system and an eApplication package for conflicts of interest, will be purchased by September 2008 and implemented by January 2009.

- Compliance Programs: ORP's compliance programs continue to grow in protocol numbers as well as the level of complexity of the reviews as expected by accrediting organizations (AAHRPP and AAALAC) and federal expectations. We must fully implement the Institutional Conflict of Interest Policy (RA21) and the Individual Conflict of Interest Policy (RA20) by December 2009.
 - ORP will fully implement an education program in Responsible Conduct of Research (RCR) for graduate students by September 2009. This effort will align with the mandate in 2008 federal legislation that all students funded by the NSF receive RCR training. The program will be developed in conjunction with academic colleges with the expectations that all students will participate regardless of funding source.
 - Conflict of Interest has received a great deal of recent attention. There is every expectation that there will be increased scrutiny of federal funds related to financial conflict of interest. We must increase community awareness of conflicts of interest issues, monitor in a systematic way for potential conflicts, and support the mitigation of such conflicts.

5. Animal Resource Program (ARP)

The ARP is committed to providing a variety of training for investigators and their staffs, and where appropriate assisting with protocols and animal-model development. The ARP is also committed to complying with all regulations applicable to the use of animals in research and achieving the highest standards in animal care. Priorities over the next five years will be to:

- Provide cost-effective animal resources by maintaining operational and program efficiency, infrastructure support, and information transfer and responsiveness. As part of this effort, the ARP will develop a charge-out rate for animal care and use that is sustainable from the perspective of the institution and the investigator.
- Assure adequate facilities and equipment to support all animal-use activities. The facilities for ARP will require considerable upgrades in the coming years, including:
 - Central cage-wash facility: develop a plan to secure funding for an additional cage-wash area with a tunnel washer. The CBL central cage-wash services all of the campus animal facilities except the Life Science Building 1 (LSB1) barrier. If this equipment breaks down there is no feasible back up if long term (> 2-3 days) shutdown is required. While there are other small cabinet-type washers on campus they cannot handle the current 3,000-4,000 cage-per-week load. In addition, due to program growth the central cage-wash facility is experiencing increasing demands on equipment and will require additional staffing and possible night shifts as new facilities come on line.
 - Animal Facilities for West/Central Campus: a moderately sized 8,000-12,000 GSF animal facility should be planned for the next major research building on

West/Central Campus. This facility should support conventional animal research with several species including rodents, birds, dogs, cats, and fish. It should contain a full cage-wash area to support West Campus and parts of Central Campus. The Noll animal facility (and possibly the EES animal facility) should be closed when this is completed. It is not recommended that Noll be renovated as it is too small to be a viable animal facility.

- Future Life Science Buildings: several of our animal facilities (Mueller, South Henderson, South Frear, Henning and Research D) are aging and will need major renovation and maintenance over the next five to 10 years to meet required standards. Unfortunately these small facilities do not allow for future expansion of animal research programs, and careful consideration should be given to consolidating facilities when possible.

6. Research Publications (RP)

Research Publications will continue to build the strength of a diverse 21st-century communications portfolio with individual vehicles tailored to reach key audiences. Specifically, the office will:

- Retain print anchors, including the Annual Report and the annual print magazine.
- Tactically exploit the evolving possibilities of Web communication, including multimedia and emerging push and social-networking technologies.
- Continue to experiment with cost-effective (essentially, cost-free) marketing for the Web site and our other vehicles.
- Continue to promote research in the local community through outreach via the Research Unplugged series and community collaborations with WPSU.

In the next few years we hope to develop a much more integrated collaboration with the Department of Public Information. This office has greater access to multimedia approaches to communications and also has staff dedicated to pushing research news out of the University. There will be three steps to enhance that collaboration, which include:

- Launching a Research Communications Council co-chaired by leadership in Research Publications and University Public Information, with membership from research colleges across the University and the goal capturing more of the “right” stories for release to the public in a timely and highly visible way.
- Co-locating the science writers in University Public Information and the Research Publications staff in order to create further synergy among these groups.
- Exploring the benefits of merging the science writers in University Public Information with the Research Publications staff once co-location has been accomplished.

III. Beyond Just Research

A. Development

With the challenges facing federal support for research it is imperative that the University seek support in a more deliberate way through philanthropy, both through foundations and through private giving. We are committed to developing a more coordinated approach to working with the Office of Corporate and Foundation Relations to identify ten foundations annually that will be targeted for campaigns to secure funding. This process was initiated during the past year and we will work to double our foundation support over the next five years.

The major research Institutes supported by the OSVPR have been successful for several reasons. Clearly, the administrative structure and central involvement of the Deans and colleges have ensured that the goals of the Institutes are the goals of the University. But the success can also be attributed to excellent leadership provided by a number of outstanding faculty/directors. The recruitment of these directors is always a challenge. To ensure that we continue to have excellent leadership it will be important to endow the director positions. Such funds will provide resources needed to attract researchers with leadership capacity. We want leaders who are excellent researchers and for them to allocate time away from their research will take resources that ensure continuity in their research activities. Furthermore, endowments within the Institutes will allow these Institutes to continue to experiment with new approaches and ideas. The estate gift of J. Lloyd and Dorothy Foehr Huck will ensure the long-term stability of the Huck Institutes for the Life Sciences. Similar successes will be needed for the other Institutes. The “Big Ideas” being promoted by “Campaign For the Future” is an effort to support this strategy (Appendix II). In the next five years, we expect to tackle all of the big ideas and will strive to gain some traction in half of them. This effort will be a partnership with the respective colleges where prospective donors are aligned.

B. Supporting Enhanced Visibility of Penn State Faculty

As has been stated early in this plan, reputation plays a part in the success of an institution. Penn State has an excellent reputation, both nationally and internationally, but there is room for considerable improvement. The OSVPR plans to undertake specific steps to enhance the visibility and reputation of the Penn State research enterprise.

1. Institute External Advisory Boards

The four major research Institutes, viz., HUCK, MRI, PSIEE, and SSRI, will work with the SVPR to form external advisory boards. In addition to providing advice, board meetings will expose members to the best of Penn State research in each field. The boards should include leaders from state and federal agencies with relevant interests as well as from prestigious universities, foundations, and corporations.

2. Academic Awards and Honors

The number of Penn State faculty who are members of the National Academies and recipients of major national and international prizes is probably not commensurate with the overall caliber of our faculty. The OSVPR has been tracking major national awards and prizes and attempting to promote top faculty for as many of these as possible. In the next five years we will enhance our efforts and continue to work closely with the colleges, focusing on the most prestigious of these awards.

3. Campus Visits

While many national research leaders visit Penn State, these visits are often arranged and managed by individual faculty, and thus the visitors are not always exposed to the breadth of the Penn State research enterprise. The OSVPR will make a concerted effort to invite additional research leaders to Penn State and will also offer to assist with scheduling and advertising high-profile visitors being hosted by other units.

Appendix I

Task Force on Globalization of Research and Graduate Education Final Report Excerpt: March 20, 2008

Task Force Members:

Collins O. Airhihenbuwa, Department Head and Professor, Biobehavioral Health

Deanna M. Behring, Director for International Programs

Michael J. Chorney, Professor of Microbiology, College of Medicine

Robert G. Crane, Professor of Geography, Director of AESEDA

Keith J. Crocker, Professor IRE, The William Elliott Chaired Professor of Insurance and Risk Management, Smeal College of Business¹

Negar C. Davis, Director, International Student Services

Norman Freed, Associate Dean, Eberly College of Science

Austin J. Jaffe, Director of International Programs

Soundar Kumara, Allen E. & Allen M. Pearce Professor of Industrial Engineering, College of Engineering

Tiyanjana Maluwa, Associate Dean for International Programs

Gunalan Nadarajan, Associate Dean for Research and Graduate Studies, College of Arts and Architecture²

Spencer G. Niles, Department Head/Professor

Anthony Olorunnisola, Department Head/Associate Professor

Brian Orland, Interim Associate Dean for Research and Graduate Studies, College of Arts and Architecture

John L. Selzer, Associate Dean for Graduate and Undergraduate Studies, The College of the Liberal Arts

Ping Werner, Administrative Fellow to Eva J. Pell; Professor of Engineering, Penn State Dubois

Peter E. Schiffer, Co-Chair, Associate Vice President for Research

Regina Vasilatos-Younken, Co-Chair, Senior Associate Dean, The Graduate School

Vision Statement and Guiding Principles

The Task Force agreed upon a proposed vision of guiding principles for the University regarding globalization; this vision forms a context for its recommendations. The vision recognizes that there are three distinct motives for international activity which reflect the three missions of the university: 1) To enhance the quality of the scholarship in Penn State's research activities; 2) To broaden the educational experiences of our graduate students who will live and work in an increasingly connected world; and 3) To reach out to other parts of the world and offer the benefits of our expertise and capabilities to all citizens of the globe. Based on these three motives, the proposed Vision Statement is as follows:

¹ Note – Dr. Jaffe fell ill and was replaced on the Task Force by Dr. Crocker

² Note – Dr. Nadarajan took another position and left the University before completion of the Task Force report, and was replaced on the Task Force by Dr. Orland

GLOBAL VISION STATEMENT

To be an institutional leader within a global network of research universities that integrates research, scholarship, education and service to advance knowledge, address complex challenges and educate responsible global citizens. The Guiding Principles should be:

- *Collaboration and Incorporation of Diverse Perspectives and Indigenous Scholarship*
- *Free Movement of Scholars and Scholarship*
- *Sensitivity and Openness*

Surveys of international activities and Memoranda of Understanding:

The Task Force used a web-based survey to query individual faculty members as to their international activities. This survey was created by the IT staff of the Graduate School and was announced to all research and graduate education units at Penn State, via unit leaders for distribution, with numerous reminders. The survey yielded 695 responses, which is estimated to constitute approximately 23-46% of the faculty at Penn State that were invited to complete the survey. These responses are summarized in Appendices I, II, IV, VII, VIII but the highlights are given below:

- The largest concentration of international activities is focused in Western Europe, with relatively little concentration in any other part of the world.
- Outside of Western Europe, the next largest concentration of international activities is distributed across Canada, China, Australia, and Japan. We appear to be most active in the countries with the strongest research programs.
- Even within given countries, Penn State efforts are rather diffuse. The international university with the most activities, University College in London, had only eleven Penn State faculty participating in research or graduate education activities of any sort. The next highest total at a single institution is seven distinct faculty activities.
- The most common international research activities involve coauthoring of publications, followed by both informal collaborations (not resulting in publications) and sponsored research programs.
- The most common international graduate education activities involved international graduate students working in Penn State research groups.

The Task Force also queried all of the colleges which participate in graduate education and research as to the existence of Memoranda of Understanding (MOUs) between their units and institutions abroad. Responses were received from eleven colleges, which probably included the most active of the Penn State units in this arena. These responses are summarized in Appendices III, V, and VI, but the highlights are as follows:

- The eleven colleges were aware of a total of 100 MOUs. These went by many names and seemed to take many forms. There appears to be no standard template for an MOU.
- Europe was the region of the world with the highest concentration of MOUs, with a total of 61 out of 100.
- France was the single best-represented country with 19 MOUs.

- Most colleges appeared to have no well-coordinated records of all of their MOUs, and some seemed to have no method of recording agreements into which their departments might be entering.

Specific recommendations for actions:

- ***Penn State should increase its visibility and identity outside the U.S. through mechanisms that target strategic graduate education partnerships.*** Viable graduate program models to consider for partnerships include:
 - Certificate offerings specifically designed to meet needs of partner institutions.
 - Integrated baccalaureate/masters and masters/doctoral programs with institutions outside the U.S.
 - Concurrent degrees with strategic institutions outside U.S.
 - Educational-research partnerships with international institutes. For example, students might complete PSU coursework and preliminary research activities, but conduct an extensive portion of research at a partner research institution outside the U.S.; or students might receive a PSU graduate degree but have membership of select faculty from the research institute who have adjunct appointments at PSU on their doctoral committee. Also, the reverse of this (sandwich programs) might be possible where students in degree programs at institutions outside the U.S. conduct a significant portion of their research with faculty at Penn State and then return to their home institution.
 - Integration of online graduate programs and courses with a global enrollment, together with resident education, can significantly enrich the educational experience for all students by providing diversity of student perspectives and interactions. It may also provide a mechanism for students outside the U.S. to take courses while still in their home country, before traveling to the U.S. for the more research-intensive portion of a Penn State degree.
- In addition to the above graduate education models, ***the Task Force supports an approach already initiated at PSU that integrates faculty research and student learning and community development or outreach wherever appropriate to the disciplinary field and faculty research interests and expertise.*** This approach is exemplified by The Alliance for Earth Sciences, Engineering and Development in Africa (AESEDA), as well as by the Department of Landscape Architecture in the use of “Student Service-Learning” in addressing the needs of heritage landscapes in collaboration with NGO partners in the Czech Republic. As paraphrased by Orland *et al.* (2004), “Service-learning situations provide an environment where (student) judgment can be exercised and refined, not only with feedback and evaluation by the professor but with the insights and multiple perspectives of community members. ...The expected benefits of active learning—deeper insights and engagement with the topic—are dramatically heightened in the study abroad/service learning situation. In a new environment the inclination to learn is layered with empathy for the host community and a deepened interest in learning and working for positive change.
 ...Bringing (an institutional research focus) to a real application as a vehicle for learning and service accomplishes an integration of the three components of the mission of the University—Teaching, Research and Service. In a time when Universities are widely

criticized for their disconnect from the “real” world, such studies represent a powerful response. ... (The) explicitly interdisciplinary, intercultural and international elements of (service-learning provide) the potential for truly transformative learning experiences for students.”

- Additional mechanisms recommended to promote partnerships with institutions outside the U.S. are adjunct faculty positions and joint research laboratories in areas of strength at Penn State and prospective partner institutions. An example of the latter exists in the College of Agricultural Sciences with the Joint Laboratory in Root Biology between faculty in Horticulture and South China Agricultural University. This joint laboratory provides visibility for each institution and is likely to enhance success in joint funding ventures from national and international research sponsors, as well as potentially lead to jointly funded faculty. In the latter case, for example, faculty might spend a month at the partner university, teaching short courses or portions of courses and conducting research. Establishing a consistent and productive presence at the reciprocal campuses creates trust, which is a prerequisite to long-term successful international collaborations. Institutional incentives could include providing a month of summer salary and travel funds to faculty.

- The Task Force discussed increasing Penn State’s global presence by establishing a physical (i.e., “bricks and mortar”) campus to provide instruction in residence outside the U.S. It was acknowledged that a number of highly visible private institutions are pursuing this route, which has positioned these institutions for significant financial benefits, e.g., in select countries in the Middle East. In other locations, such an approach may preferentially capture a significant portion of the international student market that is otherwise becoming increasingly more difficult and competitive to attract (e.g., China). However, it was also recognized that such ventures represent considerable challenges and potential short and long-range problems and liabilities. For example, substantial expense for buildings and specialized facilities on site; operating within the laws and legal system of another country, which requires investment in local assets such as legal counsel, regulatory and taxation experts, etc.; investment in duplicated institutional administrators and staff to oversee and support the distant location; and very significantly, the problem of identifying faculty who would deliver and sustain programs outside the U.S. The reputation of a research I university is grounded in the scholarly reputations of research-active, tenure-line faculty. Such individuals, especially those of national and international prominence, would be unlikely to participate (in a sustained manner) in teaching and conducting their research/scholarship at such locations. Over time, these campuses would necessarily be supported by the equivalent of fixed-term and adjunct faculty, and assurance of academic quality and program integrity are concerns. Significantly, the tradition of educating international graduate students in the U.S. who then return to their native countries is recognized as contributing to appreciation for a democratic-based society, individual freedom and diverse views, women’s rights, etc., and increasing acceptance of U.S. partnerships in other ways. These would consequently be lost by bringing programs to students outside the U.S. In addition, curriculum might be compromised if religious or societal restrictions in the region required a course to be modified in a way that failed to reflect the university’s standing regarding diversity and inclusiveness. In the long-term, it was recognized that this approach, if truly successful in its educational mission, could undermine the very competitiveness we currently hold as a

“preferred provider” by establishing and enabling our own replacement institution and training its future faculty.

Thus, while the University should remain open to an exceptional opportunity should one arise, *developing physical campuses outside the U.S. is not considered a strategic priority nor recommended at this time.*

Further Ideas to Promote Globalization

The following suggestions may not be appropriate for broad adoption across the University, but should be considered by individual units desiring to expand their global reach.

1) Pursue institutional consortia for some research/graduate education opportunities (e.g., CIC consortium; consortium of Ag Experiment Stations around specific research themes with partner institutions outside the U.S.; WUN institutions; other?).

2) Increase international diversity of faculty by encouraging broad faculty searches to include qualified candidates outside the U.S.

3) Encourage graduate programs to reconsider second language acquisition as an important asset for scholars in an increasingly global context for research and scholarship (e.g., preferred approach to meeting communications requirement). The Language Institute in Liberal Arts can help graduate students with no second language skills to learn new languages (ten different languages are now offered) during the summer months.

4) Encourage graduate programs and faculty to support international experience in the context of research/scholarship for their graduate students through as many means as possible and appropriate, including support for attendance at international meetings relevant to their discipline; research opportunities with a collaborator outside the U.S.; travel to and scholarly activities at an international entity (e.g., museum collection; international performance venue; etc.); and incentives to encourage such activities such as the College of Agricultural Sciences “Tag Along Fund.” This fund allows graduate students and faculty (as well as staff) who have never traveled to accompany seasoned faculty on international research projects to gain understanding to the workings of international research (see <http://www.cas.psu.edu/docs/international/TAGALONGFundDescription.htm>).

APPENDIX II

Big Ideas

Energy and the Environment

The Penn State Institutes of Energy and the Environment (PSIEE) is the central coordinating structure for energy and environmental research at The Pennsylvania State University. Affiliated with ten colleges and a host of institutes and centers throughout the University, the PSIEE is the articulation of President Spanier's vision to make Penn State a preeminent university for leadership in advances in energy and environmental research.

The PSIEE encompasses researchers from forty-one departments within the colleges of Engineering, Earth and Mineral Sciences, Agricultural Sciences, Health and Human Development, the Liberal Arts, the Eberly College of Science, Capital College, the Dickinson School of Law, and the College of Medicine, among others. Research centers are focused on a range of initiatives encompassing everything from hydrogen and bio-electricity production to clean coal, bio-based jet fuels, and solar power. In addition, the PSIEE is committed to studying the ethical dimensions of energy and the environment and includes researchers at the intersection of the technological and social sciences.

Problems of energy and the environment are among the most critical facing every aspect of life on this planet. In pursuit of the newest frontiers of energy and environmental research, the PSIEE encourages cooperation across disciplines and the participation of local, federal, and international stakeholders. Penn State aims to increase the visibility and stature of its programs, consolidate existing research efforts, and expand capacity through the hiring of new researchers.

Materials

The Penn State Materials Research Institute (MRI) is the gateway to world-class materials science and engineering at the University. It coordinates, supports, and sponsors advances in the applications of materials for communications, computers, energy, manufacturing, medicine, and transportation.

MRI includes more than 200 faculty members, 800 graduate students, and 200 post doctoral researchers in the colleges of Agricultural Sciences, Earth and Mineral Sciences, Engineering, Medicine, and Science who have made Penn State a top-ranked university in materials research funding nationally. MRI helps support equipment purchases, research, seed grants, and faculty co-funding. MRI research teams encompass traditional fields like ceramic science as well as new fields such as nanotechnology, and its products comprise a wide range of offerings from biomaterials to sensor technology to metamaterials.

MRI's mission is to create an environment that cuts across traditional academic R&D boundaries, enables discovery and scientific exploration through creative cross-fertilization, and benefits science, industry, and society. Through its creation of interdisciplinary groups and centers, MRI is dedicated to addressing the complex problems our country faces in health, the environment, energy, and national security.

Children, Youth, and Families

The Institute for Children, Youth, and Families will promote research and teaching with an emphasis on outreach and community collaboration to address critical social issues facing our society. Its initiatives will run the gamut from the development of strategies to enable families to prevent substance abuse among the young to early childhood interventions in school readiness to studies of the role of poverty in influencing family dynamics.

The colleges of Health and Human Development, Education, Agricultural Sciences, and the Liberal Arts, as well as the Dickinson School of Law all contribute research toward the prevention and solution of such problems as violence, teen pregnancy, malnutrition, illiteracy, and family dynamics, in concert with Penn State's community based outreach programs such as Cooperative Extension and The Milton S. Hershey Medical Center.

The Institute will encourage and develop faculty expertise and promote interdisciplinary collaboration so as to maintain and expand Penn State's position of national and international leadership in addressing critical social issues and serving community needs.

Institute on Aging

The Institute on Aging will coordinate the research efforts of the College of Health and Human Development, the Social Science Research Institute (SSRI), College of the Liberal Arts, Dickinson School of Law, and Milton S. Hershey Medical Center.

The Institute will encompass a broad program of aging research, including the development of new environments for aging individuals. Specific research will be conducted through academic departments such as psychology, sociology, biobehavioral health, human development and family studies, nursing, communication sciences and disorders, health policy and administration, kinesiology, and nutritional science. It will also serve as the collaborative home for research on aging drawing on the departments of neurology, orthopaedics, ophthalmology, psychiatry, neurosurgery, and dermatology, as well as the Gerontology Center and the Heart and Vascular Institute.

The Institute will capitalize on the expertise of Penn State's laboratory scientists, social scientists, and its artists and architects to address critical issues facing our aging population. It will stimulate communication among scholars of different disciplines and foster applied research that improves the quality of life and promotes the welfare of adults of all ages.

Center for Infectious Disease Dynamics

From proteins to pandemics, the Center for Infectious Disease Dynamics (CIDD) is comprised of scientists from a range of complementary disciplines conducting innovative infectious disease research.

CIDD is a virtual center coordinating the collaborative work of researchers from the College of Agriculture, the Eberly College of Science, the Huck Institutes of the Life Sciences, and the Penn State Institutes of Energy and the Environment (PSIEE). It integrates genetic, immunological,

ecological, and other studies to understand how disease processes work and how they inter-relate from the sub-cellular to the meta-population level on a range of time scales. Researchers concentrate on host-pathogen interactions; infectious disease dynamics; and viral, bacterial, and parasitic pathogenesis. They conduct basic disease work at the molecular and epidemiological levels and applied research with plants, animals, and people.

The interdisciplinary approach, combined with the diversity of expertise in CIDD, ensures the productive study of the development of disease agents within hosts to the prediction of their spread through populations in time and space. Its findings will continue to have an immense impact on our understanding of human health, agriculture, conservation, bio- and agro-terrorism, and epidemic control.

Children's Hospital

Penn State's Children's Hospital at The Milton S. Hershey Medical Center is the only children's hospital in central Pennsylvania and the region's only pediatric trauma center. It treats more than 125,000 patients each year. Design and programming are currently underway for a new state-of-the-art, free-standing facility that will include a pediatric cancer pavilion as well as patient rooms and amenities designed to increase comfort and privacy for young patients and their families. The facility will both increase the number of pediatric inpatient beds and enhance efforts to recruit world-class pediatric specialists and researchers to Hershey.

The Children's Hospital is a leader in several specialties including neonatal care, pediatric oncology, pediatric cardiology, pediatric surgery, and pediatric trauma. The Pediatric Intensive Care Unit (PICU) recently received the highest rating for its care in medical, surgical, and trauma patients by the Pediatric Intensive Care Unit Evaluations, ranking the PICU among the top in the country. The Children's Hospital also ranks in the top 10 percent of children's hospitals nationwide in inpatient patient satisfaction.

In addition to its commitment to educating health-care professionals, the Children's Hospital has enhanced the quality of life in Pennsylvania through health education, patient care, community activities, and applications of research. Its services extend from the prevention of illness and maintenance of health through primary medical care to the highly sophisticated patient care expected at one of the nation's premier academic medical centers.

Center for the Performing Arts

With a mission to engage and enrich the University and the surrounding communities through inspiring cultural experiences, what would become Penn State's Center for the Performing Arts was established nearly 50 years ago.

The Center for the Performing Arts is part of the College of Arts and Architecture at Penn State, but it has partnered with such entities as the Rock Ethics Institute, the Institute for Arts and Humanities, the Palmer Museum of Art, and the Department of Integrative Arts. It has featured performances by such musical luminaries as Mstislav Rostropovich, Arthur Rubinstein, Itzhak Perlman, Beverly Sills, and Dave Brubeck. Dance performances by Martha Graham and Paul

Taylor have been featured as has the spoken words of Robert Frost, e.e. cummings, and Dr. Martin Luther King, Jr. It has featured large performances by the Vienna Boys Choir and the Pittsburgh Symphony as well as well as unconventional musicals and folk and jazz festivals.

Through its performances and Speaker's Series in the Schwab Auditorium and the Eisenhower Auditorium, the Center for the Performing Arts is one of Pennsylvania's major cultural resources and continues to receive national and international recognition as a major commissioner of new works.

The Institute for the Arts and Humanities

With wide-ranging, inclusive programming, the Institute for Arts and the Humanities is a leader on issues of multidisciplinary relevance and importance in the arts and humanities.

The Institute stimulates and supports innovative, interdisciplinary work across the College of the Liberal Arts and the College of Arts and Architecture, including individual and group performances as well as lectures, symposia, and exhibitions. Established in 1966 and one of the first of its kind in the nation, the Institute was designed to be a center for advanced studies in the arts and humanities. Its initiatives include "Moments of Change" in collaboration with the Africana Research Center. In addition, a generous National Endowment for the Humanities Challenge Grant has made possible the Medal for Distinguished Contributions to the Arts and Humanities and two outreach programs: "The Summer Seminars for High School Teachers" and "Public Humanities Scholars."

The Institute heightens the visibility of the arts and humanities at Penn State on both the national and international scene and recognizes the importance of public outreach by serving the needs and interests of local and regional communities in central Pennsylvania through programs of civic and educational outreach.

School of International Affairs

The School of International Affairs was established on July 1, 2007, and will begin enrolling students in the fall of 2008. It will emphasize the practical applications of knowledge for solving complex social problems and the importance of high ethical standards.

The School is a collaborative effort between Penn State's Dickinson School of Law and scholars from the colleges of Agricultural Sciences, the Liberal Arts, Earth and Mineral Sciences, Communications, Education, and Information Sciences and Technology, as well as the Smeal College of Business. The School offers a highly interdisciplinary professional master's degree in international affairs with concentrations in diplomacy and international relations; international economics; multi-sector and quantitative analysis; development and civil society; nonprofit organizations; and major transnational policy challenges.

The School highlights the importance of a global perspective for Penn State students and recognizes the value of international experiences in areas from health to education to business. It is part of a host of new international initiatives at Penn State, including expanded curricular and

study-abroad opportunities for Penn State students, the increased presence of international students and scholars at the University, and enhanced collaborations between Penn State and key universities in other countries.

President's Leadership Academy

The President's Leadership Academy is designed to nourish a cadre of selected Penn State undergraduates with significant potential for future leadership. The Academy seeks to educate students to understand issues broadly, to appreciate the complexity and variability of world matters, decisions, and life's circumstances. The Academy will promote and cultivate values that are critical to the full development of Penn State's undergraduates, including civility, philanthropy, respect for diversity, and student engagement. It represents an investment in both the classroom and the out-of-classroom experience.

The Academy will provide integrated coursework, host leadership seminars, sponsor field trips, and promote civic engagement through volunteerism and community participation.

The Academy's collaborative education will prepare students to impact society through leadership training and problem solving. A key feature of this initiative is the direct involvement of the President who will personally oversee and meet with Academy students.