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INSTITUTE FOR DEFENSE ANALYSES

Assessment of the Defense Experimental Program To Stimulate Competitive Research (DEPSCoR): Final Report

Volume II—Supporting Material

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Preface

This document was prepared for the Office of the Deputy Under Secretary of Defense, Laboratories and Basic Science (ODUSD(LABS)) under the "Assessment of the Defense Experimental Program to Stimulate Competitive Research Program" task. Technical cognizance for this report is assigned to Dr. Robin Staffin, Director for Basic Research, ODUSD(LABS). The Institute for Defense Analyses (IDA) point of contact (POC) is Dr. James Silk.

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Executive Summary

The Defense Experimental Program To Stimulate Competitive Research (DEPSCoR) was created by Congress in the Fiscal Year (FY) 1991 Department of Defense (DOD) appropriation and legislatively authorized in 1994 (National Defense Authorization Act for Fiscal Year 1995, P.L. 103-337, §257; Oct. 5, 1994, 108 Stat. 2705).

This report is Volume II of a two-volume set of documents. It provides supporting material for a DEPSCoR program assessment conducted by the Institute for Defense Analyses (IDA), a Federally Funded Research and Development Center (FFRDC) in Alexandria, Virginia. The purpose of this assessment was to determine the effectiveness of the DEPSCoR program. The assessment responds to a requirement in Section 241 of the FY 2008 National Defense Authorization Act (P.L. 110-181, §241, Jan. 28, 2008, 122 Stat. 3). That Section includes six specific charges for the assessment:

1. A description and assessment of the tangible results and progress toward the objectives of the program, including—
    a. An identification of any past program activities that led to, or were fundamental to, applications used by, or supportive of, operational users
    b. An assessment of whether the program has expanded the national research infrastructure
2. An assessment of whether the activities undertaken under the program are consistent with the statute authorizing the program
3. An assessment of whether the various elements of the program, such as structure, funding, staffing, project solicitation and selection, and administration, are working effectively and efficiently to support the effective execution of the program
4. A description and assessment of past and ongoing activities of state planning committees under the program in supporting the achievement of the objectives of the program
5. An analysis of the advantages and disadvantages of having an institution-based formula for qualification to participate in the program when compared with the advantages and disadvantages of having a State-based formula for qualification to participate in supporting defense missions and the objective of expanding the Nation’s defense research infrastructure

6. An identification of mechanisms for improving the management and implementation of the program, including modification of the statute authorizing the program, Department regulations, program structure, funding levels, funding strategy, or the activities of the state committees.

The six sections of this document correspond to the legislative charges. Four appendixes provide additional supporting material.

Section 1.
A Description and Assessment of the Tangible Results and Progress Toward the Objectives of the Program

The Department of Defense Experimental Program to Stimulate Competitive Research (DEPSCoR) is a program that has, since 1993, funded 729 research grants to investigators in eligible states. This section describes DEPSCoR results to date and examines available evidence to assess whether DEPSCoR has had an impact on three potential outcomes of interest:

1. Long-term growth in competitiveness for federal research and development (R&D) funds by institutions in DEPSCoR-eligible states
2. Transition of findings or technologies to operational use
3. Expansion of the national research infrastructure.

The Institute for Defense Analyses (IDA) compiled several datasets to facilitate analysis. The most important are described in the next section, and Appendix A provides a comprehensive data compilation of the DEPSCoR awards. Appendix B contains a list of source materials. Additional information regarding analytic methods is provided with the corresponding results.

A. Databases and Methods

1. DEPSCoR Awards

The Department of Defense (DOD) does not maintain a centralized database of awards from which information on the DEPSCoR awards could easily be extracted. To compile the full dataset, it was necessary to build a database of all DEPSCoR research awards funded between the FY 1993–1994 and FY 2008 competitions from the annual DOD news releases announcing the winners. IDA then standardized the names, departmental affiliations, and universities of the winners using a combination of manual updates (for different spellings of the same item) and Internet searches. The dataset for DEPSCoR awards in Appendix A is believed to be complete.

As described below, the database is incomplete in some areas. Since DEPSCoR is an experimental program, it would have been advantageous for this analysis if the collection of important data had been required as a criterion for program implementation and participation.

2. Multidisciplinary University Research Initiative (MURI) and Defense University Research Instrumentation Program (DURIP) Awards

Again relying primarily on DOD news releases, IDA compiled a list of MURI and DURIP awards for the FY 1996–2008 competitions. The MURI program funds multiinstitutional and multidisciplinary research teams, and the DURIP program supports the purchase of equipment to facilitate defense research. Where available, service databases (Army Research Office (ARO) and Office of Naval Research (ONR)) were used to supplement the dataset. The IDA-generated MURI and DURIP datasets have two potential limitations:

1. **Not all services are included for all years.** The MURI dataset includes only Army and Navy awards for FY 2000, and the DURIP dataset is limited to Army and Navy awards for FY 1999–2000.
2. **MURIs are generally multiuniversity awards.** While the lists of lead institutions were generally available, the availability of teaming institutions was less consistent.

3. Other R&D Funding for DEPSCoR Institutions

In March of 2008, IDA conducted searches using the RaDiUS database[1] to identify all federal awards associated with the 64 institutions appearing in the IDA DEPSCoR database after FY 1994. Data were compiled for awards made between FY 1993 and FY 2007. These searches are believed to be complete, subject to the limitations of the RaDiUS database.

In September 2008, IDA conducted searches of the National Science Foundation (NSF) awards database (http://www.nsf.gov/awardsearch/) to identify all awards made between January 1, 1990 and September 2008 to principal investigators (PIs) in 25 DEPSCoR-eligible states, as well as Puerto Rico.[2]

4. NSF Survey Data

The NSF survey (Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions) was used as an alternate source of information on federal funding by institution. The following data were obtained for all available FYs (1992–2005):

- All federal funding, by university

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1 RaDiUS aggregates information on R&D awards provided by federal agencies. Formerly maintained by the RAND Corporation (https://radius.rand.org), the RaDiUS database is no longer operational (as of July 2008); therefore, the information in the searches were not used in the final assessment.

2 Missouri (only DEPSCoR-eligible in 1993–1994) and the Virgin Islands (no DEPSCoR awards) were not included in the analysis.

- All DOD funding, by university
- DOD research funding,[3] by university.

5. WebCASPAR Data

The NSF WebCASPAR data system (http://webcaspar.nsf.gov/index.jsp) was searched to identify the number of Masters and Doctoral degrees in science and engineering (S&E) fields[4] granted between 1996 and 2005 at the 64 DEPSCoR institutions.

6. Other Structured Datasets From ARO and ONR

In addition to providing specific spreadsheets and papers as described in Appendix B, ARO and ONR provided supplementary databases that were used in the DEPSCoR assessment:

- **ARO database of applications and awards by investigator, 1980–2008.** This database contains all applications made (including those awarded and not awarded). Information includes ARO record number and title, PI name, organization name, award status, start date and end date (for funded awards), and funding level (for funded awards).
- **ARO database of publications from DEPSCoR awards.** This database contains a list of publications from DEPSCoR awards, which, for each record, include ARO record number, award title, date of publication receipt, document type, and document title. It contains 439 publications from 73 Army-funded DEPSCoR awards.
- **ARO database of patents from DEPSCoR awards.** This database contains information on patents and patent applications from the 15 Army-funded DEPSCoR awards where patenting-related information was provided to ARO. For each award, the database includes ARO record number; title; award status, number of patent applications submitted, and number of patents received.

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3 NSF, for the survey, defines research as "Research is systematic study directed toward fuller scientific knowledge or understanding of the subject studied. Research is classified as either basic or applied according to the objectives of the sponsoring agency. In basic research, the objective of the sponsoring agency is to generate knowledge of the underlying foundations of phenomena and of observable facts without specific applications toward processes or products in mind. In applied research, the objective of the sponsoring agency is the creation of knowledge or understanding necessary to determine the means by which a recognized and specific need may be met." http://www.nsf.gov/statistics/nsf07333/content.cfm?pub_id=3795&id=4. The survey's definition of "research," therefore, includes both 6.1 basic and 6.2 applied research.

4 The following degree types were included in the search: Aerospace Engineering; Chemical Engineering; Civil Engineering; Electrical Engineering; Mechanical Engineering; Materials Engineering; Industrial Engineering; Other Engineering; Unspecified Engineering; Astronomy; Chemistry; Physics; Other Physical Sciences; Unspecified Physical Sciences; Atmospheric Sciences; Earth Sciences; Oceanography; Other Geosciences; Unspecified Geosciences; Mathematics and Statistics; Computer Science; Agricultural Sciences; Biological Sciences; Medical Sciences; Other Life Sciences; Unspecified Life Sciences; Science Technologies; Engineering Technologies.

- **ONR database of awards by institution, 2003–2008.** This database contains information on awards made by ONR between 2003 and 2008, including the ONR record number, the DOD program element, recipient, type of award program, and dollars awarded.

7. Text-Based Document Archives

IDA assembled an archive of program documents, a full list of which is included in Appendix B. The documents that proved most central to the assessment include

- DEPSCoR program spreadsheets showing funding by competition and state
- All DEPSCoR news releases, beginning with the 1991 competition (Coalition of Experimental Program To Stimulate Competitive Research (EPSCoR)/Institutional Development Award (IDeA) states 1991–1995 competitions, DefenseLink for 1996–2008 competitions))
- DEPSCoR Broad Agency Announcements (BAAs) (Coalition of EPSCoR/IDeA states 1995–1996, 1999–2001, 2003, 2004, 2006, 2007; DEPSCoR program 1997–1998, 2002; http://www.grants.gov/ 2005, 2008)
- Program announcements for capacity-building programs similar to DEPSCoR (IDA Internet searches, July 2008)
- Success stories ("nuggets") collected by the Coalition of EPSCoR/IDeA states for DEPSCoR.

B. Long-Term Growth in the Competitively Awarded Financial Assistance That Institutions of Higher Education in Eligible States Receive From the Federal Government for S&E Research

1. Time Trends for DEPSCoR States Combined

NSF surveys of federal S&E R&D funding to universities were used to address the question of whether DEPSCoR states are achieving more success in competing for federal research dollars than they have previously. Given the focus of this assessment on *defense* research and the likely greater role that other agencies' EPSCoR programs will play (relative to DOD's EPSCoR program) in enhancing the competitiveness of universities in DEPSCoR states competing for federal research funds, this section considers the changes in funding levels only for *DOD* S&E R&D funds.[5] Table 1-1 and Figure 1-1 show the result of the linear regression models of the

[5] As described in Section 6, the NSF and National Institutes of Health (NIH) EPSCoR programs are approximately one order of magnitude larger than the DOD EPSCoR program.

Table 1-1. Linear Regression Models of the Share of DOD University S&E R&D and S&E Research Funding to States DEPSCoR Eligible in One or More Years 1995–2008, 1992–2005

Model	Adjusted R-Squared	Constant	Time Trend Slope (% Increase/ Year)	95% Confidence Interval for Time Trend	Significance Level (%)
1. DOD Science and Engineering R&D: Adjusted to Remove DEPSCoR Program Funds	0.80	0.068	0.66	0.46–0.86	1
2. DOD Science and Engineering Research: Adjusted to Remove DEPSCoR Program Funds	0.54	0.082	0.49	0.23–0.75	1

Source: IDA analysis of NSF Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions

Note for Table 1-1: *Significance level is defined as the probability of making a decision to reject the null hypothesis (in this case that the time trend = 0) when the null hypothesis is actually true.*

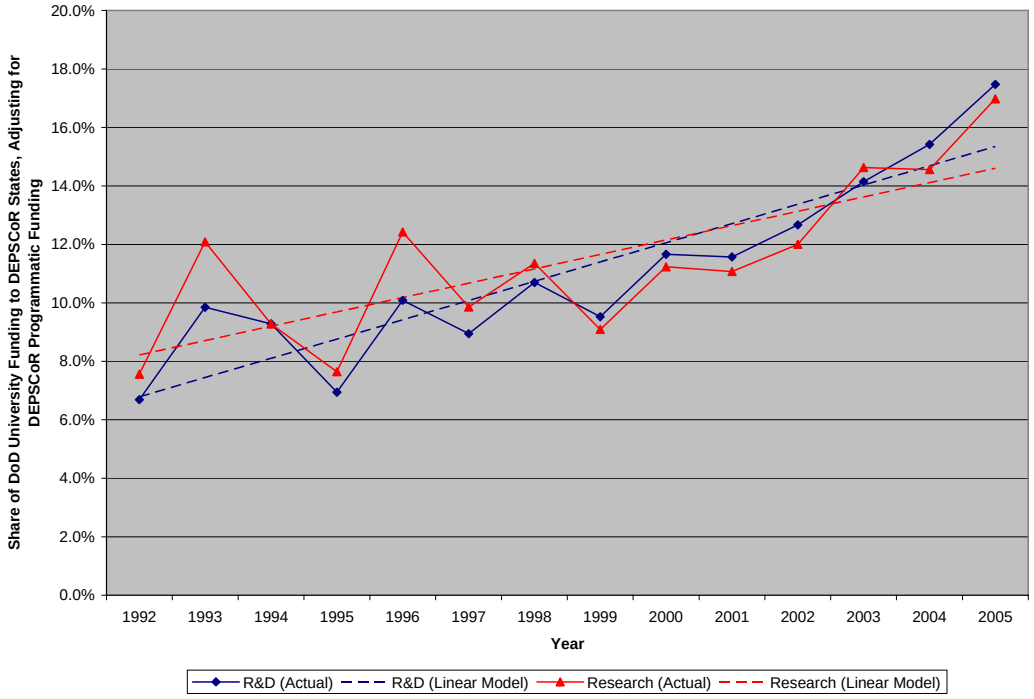

Figure 1-1. Results of Linear Regression Models of the Share of DOD University S&E R&D Funding to DEPSCoR-Eligible States, 1992–2005

Source: IDA analysis of NSF Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions

share of defense R&D and research funding to universities in DEPSCoR states against time.[6] Table 1-1 only shows a correlation and, by itself, does not demonstrate that the DEPSCoR program was the cause of any change.

Table 1-1 shows that a positive time trend was detected for the DEPSCoR states (all states that were DEPSCoR eligible in one or more years between 1995 and 2008)—both for all university-performed DOD R&D and for all university-performed DOD 6.1 and 6.2 research—when the years 1992 (the year before the first DEPSCoR research awards) and 2005 (the most recent year of data available) are considered. Figure 1-1 graphs the actual shares of R&D and research of the DEPSCoR states and the linear relationship predicted by the regression models. The figure shows substantial variance around the linear trend, with the DEPSCoR states' share of R&D (and research) relatively high in some years (e.g., 1996, 2005) and lower in other years (e.g., 1992, 1995). The findings shown in Table 1-1 and Figure 1-1 are explored in greater detail in Appendix C, which tests a range of alternative hypotheses and explanations.

2. Trends for Individual States

Figure 1-1 indicates that the share of DOD funding awarded to DEPSCoR-eligible states almost doubled from approximately 7% in 1992 to 17% in 2005. If each 25 eligible jurisdictions in 2005 had been at the 1.2% funding level, their share would have been 30%. However, research funding is provided to individual universities and states rather than to the entire group of DEPSCoR states. Subsequent descriptive analysis of the share of DOD S&E R&D or research funding awarded to universities in DEPSCoR-eligible states identified substantial differences among the individual states.

Figure 1-2 shows the share of DOD S&E R&D funding awarded to groups of states that appear to share similar funding share trajectories. Four distinct groups of states were identified:

1. Six states near or above the DEPSCoR eligibility threshold[7]
2. Nine states with low shares of R&D in the early 1990s whose shares were rising fast[8]

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6 The data used in the regression models have had DEPSCoR program funds removed from both the numerator and the denominator of the percentage share calculation to ensure that DEPSCoR funding is not skewing the results. Matching funds are never included in the NSF data.

7 Alabama, Hawaii, Louisiana, Mississippi, New Mexico, and South Carolina.

8 Alaska, Idaho, Kentucky, Maine, Montana, Nebraska, Nevada, North Dakota, and South Dakota.

3. Six states with middling levels of R&D whose shares remained roughly static between 1992 and 2005.[9]
4. Six states and territories with low shares of R&D in the early 1990s whose shares have been lagging[10]

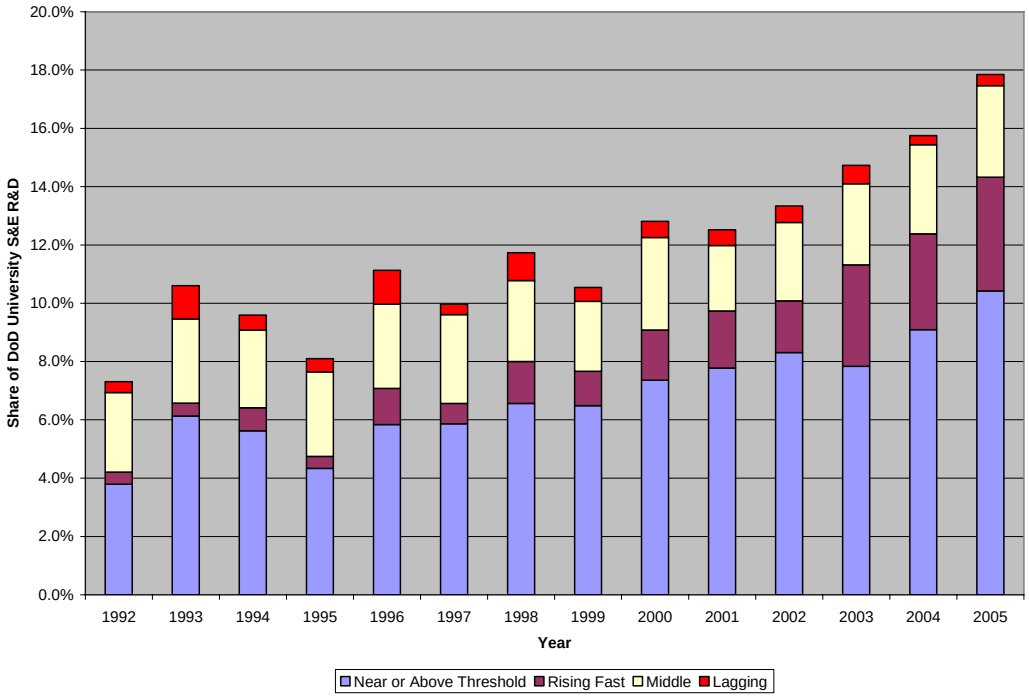

Figure 1-2. Summary of Descriptive Time Trend Analyses: Shares of DOD S&E R&D to Universities Across All Groups of DEPSCoR-Eligible States, 1992–2005

Source: IDA analysis of NSF Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions

Figure 1-2 indicates that more than half (15 out of 27 or 56%) of the DEPSCoR jurisdictions improved their competitiveness significantly based on their share of DOD university S&E R&D funding from 1992 to 2005. The other half showed essentially no improvement in competitiveness. The set of states that were near the threshold at the start of the program increased their competitiveness by approximately 2.5 times. The group of nine states that increased their funding share most significantly from a low level saw it rise approximately by a factor of 10. However, these states are, on average, still only one-third of the way to the 1.2% goal.

9 Arkansas, Delaware, Kansas, Oklahoma, Rhode Island, and Tennessee.

10 New Hampshire, Puerto Rico, Vermont, Virgin Islands, West Virginia, and Wyoming.

Another way to determine whether competitiveness increased in DEPSCoR-eligible states is to look at how the number of eligible states changed over time. Nineteen states were eligible in 1995, 18 states were eligible in 2001, and 22 states were eligible in 2008. More states are eligible now than were eligible at the start of the program. Of the 19 states and territories originally eligible in 1995, only two—Alabama and Mississippi, which were near the 1.2% threshold at the beginning of the program—were not eligible in 2008.

Significant improvement in competitiveness, as measured by funding share in the DEPSCoR-eligible states that initially were receiving shares far below the 1.2% threshold, was concentrated in 9 (33%) of the states. However, these high-growth states, with an average share of approximately 0.4%, are currently still far below the threshold. Although these increases occurred after the inception of the DEPSCoR program, these data alone are insufficient to determine whether DEPSCoR activity actually caused them. The next section delves into greater detail of funding trends in individual states to examine correlations between DEPSCoR funding and changes in non-DEPSCoR S&E R&D funding to universities in DEPSCoR states.

3. DEPSCoR Funding as a Percentage of All DOD Funding to Eligible States

Figure 1-3 shows DEPSCoR funding as a percentage of all DOD funding disbursed to universities in DEPSCoR-eligible states between 1993 and 2005. This figure suggests that DEPSCoR has declined in importance as a source of funding for eligible institutions since 2000.

Accounting for the possible differences among states in the percentage of total DOD funds from the DEPSCoR program is useful for identifying correlations between the DEPSCoR program and increases in DOD funding. Figure 1-4 shows the number of DEPSCoR awards won by state. Each affected state has superimposed on it a pie chart that details the average percentage of DOD funds awarded through DEPSCoR.[11] DEPSCoR accounted for more than 60% of DOD S&E R&D funding to universities in Vermont and Wyoming, more than 30% in Montana and West Virginia, and more than 20% in 5 other states (Idaho, Kentucky, Nevada, New Hampshire, and Puerto Rico).

Table 1-2 presents the data shown in Figure 1-4 differently, showing the percentage of funds awarded to each state accounted for by DEPSCoR for two periods: 1993–2000 and 2001–2005. For those states near the threshold of eligibility, the percentage of R&D funding accounted for by DEPSCoR awards was relatively low. Only in South Carolina for the 1993–2000 period did DEPSCoR funding exceed 10% of the state's DOD university R&D funding.

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11 The calculation includes only those years in which a state was DEPSCoR eligible.

Figure 1-3. Ratio Between DEPSCoR Funding and DOD Awards to DEPSCoR-Eligible States, 1993–2005

Sources: IDA analysis of NSF Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions and the DEPSCoR program database of funding totals by state and year

Eight of the nine "Rising Fast" states were eligible for DEPSCoR beginning with the program's inception, with Alaska becoming eligible in 2001. In seven of these states (all but Alaska and Maine); DEPSCoR funding represented a large percentage of the states' total DOD R&D funding during the 1993–2000 period but a small percentage during the 2001–2005 period. The difference was 30% or higher in all these states.

Among the "Lagging" states, Vermont, Wyoming, and West Virginia are notable for having a high percentage of their R&D funding provided by DEPSCoR in both periods. The "Middle" states are split between those that were eligible throughout, where DEPSCoR accounted for between 10% and 25% of funds (Arkansas, Kansas, Oklahoma), and those that became eligible after 2001, where DEPSCoR accounts for a small percentage of their R&D funding (Delaware, Rhode Island, and Tennessee).

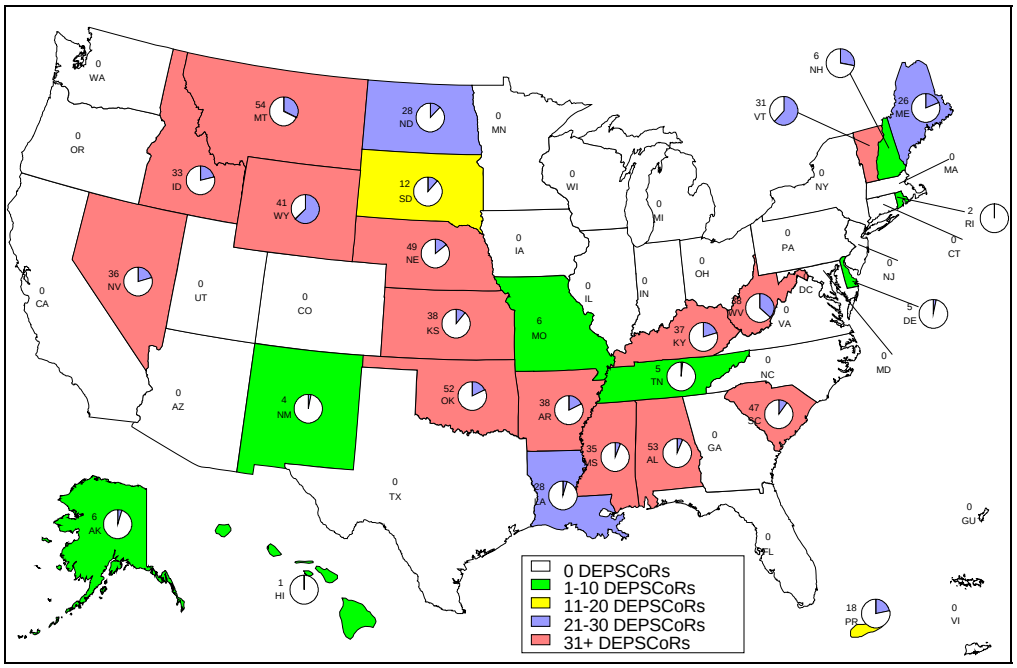

Figure 1-4. Percentage of State Funds (During DEPSCoR-Eligible Years) Through the DEPSCoR Program, 1993–2005

Sources: IDA analysis of NSF Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions, the IDA DEPSCoR database, and the DEPSCoR program database of funding totals by state and year

Note for Figure 1-4: *Average calculated as total DEPSCoR funds during eligible years divided by total DOD funds during eligible years.*

Table 1-2. Ratio of DEPSCoR Funding to Total DOD R&D Funding During Eligible Years, 1993–2005

Group	State	Ratio of DEPSCoR Funding to Total DOD Funding 1993–2000 (%)	Ratio 2001–2005 (%)	Difference Between Column 1 and Column 2 (%)
Near or Above Threshold	Alabama	9	4	5
	Hawaii	Not eligible	0	N/A
	Louisiana	5	Not eligible	N/A
	Mississippi	9	3	7
	New Mexico	Not eligible	4	N/A
	South Carolina	12	7	5
Rising Fast	Alaska	Not eligible	5	N/A
	Idaho	46	8	38
	Kentucky	43	9	34
	Maine	26	14	13

Table 1-2. Ratio of DEPSCoR Funding to Total DOD R&D Funding During Eligible Years: 1993–2005 (Continued)

Group	State	Ratio of DEPSCoR Funding to Total DOD Funding 1993–2000 (%)	Ratio 2001–2005 (%)	Difference Between Column 1 and Column 2 (%)
Rising Fast (Continued	Montana	51	21	30
	Nebraska	39	5	33
	Nevada	62	12	50
	North Dakota	41	4	37
	South Dakota	40	7	34
Lagging	New Hampshire	Not eligible	28	N/A
	Puerto Rico	39	3	36
	Vermont	63	61	2
	Virgin Islands	Not eligible	N/A	N/A
	West Virginia	29	60	-31
	Wyoming	49	85	-36
Middle	Arkansas	23	11	11
	Delaware	Not eligible	3	N/A
	Kansas	12	11	2
	Oklahoma	16	21	-5
	Rhode Island	Not eligible	0	N/A
	Tennessee	Not eligible	2	N/A

Sources: IDA analysis of NSF Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions and the DEPSCoR program database of funding totals by state and year

Note for Table 1-2: *States not eligible in all years were coded "Not eligible." Virgin Islands is shown as "N/A" because the territory received no DOD R&D funding during the period.*

4. DEPSCoR State to Non-DEPSCoR State Comparisons

The previous sections (with more detail provided in Appendix C) identify a positive trend in the share of DOD university R&D funding awarded to DEPSCoR states. Although the share of R&D funding is a zero-sum measure (i.e., if DEPSCoR states are increasing their share, then the share of others must be decreasing), some changes in non-DEPSCoR states must also be considered in the context of this assessment. As shown in Table 1-3, in 1992, four states (Maryland, Massachusetts, California, and Pennsylvania) received more than half of DOD university S&E R&D funding. Although the absolute funding received by these four states increased between

Table 1-3. Shares of DOD S&E R&D Funding, by Year and Group of States

State Group	S&E R&D (1992, B$)	S&E R&D (2005, B$)	Increase 1992–2005 (B$)	Share of S&E R&D (1992) (%)	Share of S&E R&D (2005) (%)	Change in Share 1992–2005 (%)	Percentage Change in R&D Share 1992–2005
Four Largest Non-DEPSCoR	0.72	0.95	0.23	55.0	38.1	-16.9	-31
DEPSCoR	0.09	0.44	0.35	6.7	17.5	10.8	161
Other non-DEPSCoR	0.50	1.11	0.51	38.3	44.5	6.2	18
Total	1.31	2.49	1.18	100	10	0	0

Sources: IDA analysis of NSF Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions and the DEPSCoR program database of funding totals by state and year

Note for Table 1-3: *Excludes DEPSCoR funding. Totals may not sum to 100% because of rounding.*

1992 and 2005, the overall share of these four states declined between 1992 and 2005, accounting for 38% of the total in 2005. While DEPSCoR states received most of the corresponding increase in share, other non-DEPSCoR states also increased their share of DOD university S&E R&D.

Regression analyses (shown in Appendix C) were used to identify whether a statistically significant time trend existed for both the DEPSCoR and other non-DEPSCoR states and whether the rate of change for one group of states was larger than that for the other group. The regression analyses show that the time trends for both groups are significant and that the hypothesis that no difference existed between the two groups' time trends could not be rejected. Sufficient evidence did not exist to demonstrate that the DEPSCoR states were increasing their share of DOD R&D at a different rate than the other non-DEPSCoR states. This does not necessarily mean that no difference exists but only that if a difference exists, it was not large enough to be identified as statistically significant.

All the regression analyses use state-level funding data as dependent and independent variables, which is one measure of whether states and institutions can "develop, plan, and execute science and engineering research that is competitive under the peer-review systems used for awarding federal research assistance"—one of the objectives stated in the 1995 DEPSCoR authorizing legislation. Identifying a variety of other definitions as meaningful in the context of the DEPSCoR program and the potential for programmatic influence for each of those definitions will be addressed at the close of this section.

C. Identification of Any Past Program Activities That Led To or Were Fundamental To Applications Used by or Supportive of Operational Users

As will be described in greater detail in Sections 2, 3, and 6, the DEPSCoR legislation does not include as a programmatic goal the transition of the knowledge gained from funded research to operational use. Also, the DEPSCoR program is not operated by the services to maximize the likelihood that research will be applied to warfighter needs. The program is operated by the basic research funding offices of the services rather than by applied research laboratories, although this is not a statutory requirement. The DEPSCoR BAA review criteria do not emphasize applications of knowledge to operational use, and no programmatic requirements specify collaboration with potential users of knowledge gained, such as industry or military applied research laboratories. Any basic research funded through the DEPSCoR program that transitioned to operational use would be an unanticipated benefit of the program.

The assessment of "operational use" requires the identification of the initial outputs of DEPSCoR research (e.g., published research findings, scientific principles established), followed by the identification of whether those research outputs were translated into technologies suitable for inclusion in weapons systems or other support to the warfighter. Because a full operational use analysis could not be performed for all 729 DEPSCoR research projects, IDA implemented a triaging procedure.

As described in the methods section (I.A.), the coalition of EPSCoR/IDeA states periodically collects success stories (referred to as "nuggets") from member states. More than 100 success stories from 20 different DEPSCoR states were provided to IDA.[12] These "nuggets" were heterogeneous in form, length, and level of detail. Some describe a single DEPSCoR project, while others aggregate findings across multiple DEPSCoR awards. IDA staff members who have experience in identifying the ultimate impacts of DOD basic research activities used the success stories to triage the DEPSCoR projects into groups by likelihood of transition to operational use. For the awards deemed to be most likely to transition to operational use, IDA followed a snowball interviewing procedure to trace the results of the work, beginning with telephone contact of DEPSCoR PIs and continuing with follow-on discussions as appropriate. Secondary literature reviews were also performed, as required.

[12] DEPSCoR program managers from ARO and ONR also provided a small number of "nuggets." A total of 230 of the 729 (32%) DEPSCoR awards were matched to a provided nugget.

Thirty-seven awards have been identified as likely to have transitioned to operational use.[13] The 37 awards went to 29 investigators in 11 of the DEPSCoR states. IDA attempted to contact those investigators and completed three sets of interviews that included discussions with both the PIs and "customers" at the DOD or in industry to whom research was transitioned:

- Ronald DeVore, et al., University of South Carolina, Applied Mathematics, wavelet mathematics for image compression for tactical applications
- Michael Pursley, et al., Clemson University, Electrical Engineering, wireless, mobile, distributed, multimedia communication networks
- Christopher Lawson et al., University of Alabama, exploitation of spectral regions over many different wavelengths including unexploited spectral bands for sensor applications.

The three completed examples are reported below.

Example 1: Wavelet Compression—Ronald DeVore, et al., University of South Carolina, Industrial Mathematics Institute (IMI)

The DEPSCoR-supported wavelet compression research by Ronald DeVore and his co-researchers has affected DOD applications through a range of related implementation activities that influenced the defense community. Professor DeVore has received 8 DEPSCoR awards—the largest number of any single investigator. As one example, in the 1990s, members of the DeVore research group discussed their recent advances in the emerging fields of wavelets, multiresolution, and zerotree encoders and the potentials these advances might have for DOD applications with Defense laboratory personnel at the Navy's China Lake and Patuxent River facilities. This led to ongoing interaction between those researchers and the Navy on implementation for specific applications. DeVore and his colleague Robert Sharpley identified as one such example their involvement with missile navigation developments at China Lake. During this program, under Navy program manager Gary Hewer, of the Michelson Laboratory (Naval Air Warfare Center (NAWC)) at China Lake, the DEPSCoR researchers collaborated with NAWC for several years and delivered a wavelet-based image processing platform in the form of code libraries and various generic defense-specific applications built on this library. Over time, these ideas materialized as a specialized and lean wavelet-based image processing system for navigation in the Tomahawk (BGM-109) Block II program. The code development for this implementation was done by Charles (Chuck) Creussere of China Lake (who has subsequently moved to become a faculty member at New Mexico State University). In interviews, Professors DeVore

[13] An additional 49 awards were labeled "Possible transition," 101 awards were labeled "Low probability of transition," and 40 awards were labeled "No possibility of transition." Sufficient information was unavailable to make a determination for the remaining 502 awards.

and Sharpley mentioned that several of their graduate students and post-docs visited China Lake to collaborate on this and other topics (and at least one of these researchers has gone on to work for a defense contractor).

Example 2: Wireless Communications Benefit to the War Fighter

Michael B. Pursley, Holcombe Professor of Electrical and Computer Engineering, received four DEPSCoR awards. Dr. Pursley had first received funding from DOD for his investigations of spread-spectrum communications in the mid 1970s. As early as the late 1970s, some of the research had been applied to what would become the Army's primary tactical radio for the next few decades. Around 1978, Dr. Pursley worked with the International Telephone & Telegraph Company (ITT) to apply some of his research results to design a synchronization sequence for the Single Channel Ground and Airborne Radio System (SINCGARS). During the late 1970s and early 1980s, ARO funded Dr. Pursley to pursue several 6.1 basic research topics in direct-sequence and frequency-hop spread-spectrum communications. This research clarified that tactical frequency hop radios would benefit from Reed-Solomon (RS) coding that employs information that could be developed in the radio receivers. In the early 1980s, Dr. Pursley and his team again worked with ITT on a project for the Air Force. The Air Force jam-resistant digital communication system incorporated the use of reliability information at the input to an RS decoder, following from the prior basic research results. In the mid 1980s, the team recognized that similar reliability information should be employed with RS coding for packet communications in SINCGARS in collaboration with SRI International and ITT.

Professor Pursley's group used DEPScoR funding to support research that provided better anti-jam communications and greater multiple-access capability. Dr. Pursley stated that this research led to the Soldier Level Integrated Communications Environment (SLICE) wideband networking waveforms that have been integrated into the SINCGARS radio. DEPSCoR research contributed to the synchronization sequence, the error-control coding, the mitigation of partial-band interference, and the enhanced multiple-access capability for the new SINCGARS units. Both the SLICE radio and the Soldier Radio Waveform (SRW) are compliant with the Joint Tactical Radio System (JTRS).

Other applications of the basic research work from the Clemson Center for Research in Wireless Communication include

- The Navy's High-Frequency Intra-Task Force (ITF) Network
- The U.S. Army's Communications Electronics Command (CECOM) study of adaptive spread-spectrum networks

- The Defense Advanced Projects Research Agency's (DARPA) GloMo project, in which the program manager reported that the Clemson group was at least 2 years ahead of other teams because of their prior basic research in adaptive transmission protocols.

Together with Clemson Professor Harlan Russell, Dr. Pursley assisted in the development of ITT's Near Term Data Radio (NTDR) and Handheld Multimedia Terminal (HMT) radio. ITT teamed with Clemson University, BBN Technologies, and Techno-Sciences to develop a mobile wireless network, called RAVEN, which is based upon the HMT radio. The RAVEN project resulted in the development of ITT's Enhanced Handheld Multimedia Terminal (EHMT), and the core design has been extended into ITT's Small Unit Operation Situational Awareness System (SUO-SAS) radio, More recent DEPSCoR research, funded by ONR, aims to advance the state of the art in adaptive protocols for military mobile ad hoc wireless networks. The types of networks of interest are often referred to as tactical packet radio networks. Generally, such networks have much more capable radios than those used in commercial networks (e.g., Institute of Electrical and Electronics Engineers (IEEE) 802.11 wireless networks)). Results of this most recent ONR-funded research have been provided to the Naval Research Laboratory (NRL), Massachusetts Institute of Technology (MIT) Lincoln Laboratory, the Naval Postgraduate School, and Rockwell Collins.

Example 3: Optical Sensor Systems—Christopher Lawson—University of Alabama, Birmingham

Over 10 years, Professor Lawson received three DEPSCoR awards from the ARO. He states that this research has been employed directly by the Army Research Laboratory (ARL) in developing a "practical system for deployment"[14] that "would have never happened without the DEPSCoR." Using a cooperative agreement mechanism with ARL, his center has researched "new complexes for specialized spectral regions over many different wavelengths including unexploited spectral bands" The DEPSCoR funding enabled the development of expertise and the purchase of equipment that the center is now using in the later, more mature stages of research that are increasingly implementation oriented.

Example Summary

Of these three completed cases, the DEPSCoR funding to the University of South Carolina and Clemson has led to results that are certainly in operational use, while the University of Alabama funding has led to results that may already be used by the warfighter.

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14 Note: The DOD customer has requested that the specifics of these applications not be divulged.

The coalition of EPSCoR states have identified other success "nuggets" of research that have direct military application or are approaching operational use; however, case studies could not be completed to verify the extent of the maturity of the concepts. These include[15]

- Kelly Drew et. al., University of Alaska, battlefield-relevant medical research into the central nervous system to extend the window of opportunity for transport to medical facilities
- Frederick van Kuijk et al., Montana State University, protecting pilots and sensors from attack by laser weaponry
- Andrzej Trzyandlowski et al., University of Nevada, noise mitigation in electric vessels.

D. An Assessment of Whether the Program Has Expanded the National Research Infrastructure

This portion of the assessment focuses on determining whether DEPSCoR has played a role in expanding research capacity at universities and in DEPSCoR states more generally. The sections below examine evidence that DEPSCoR has contributed to the national research infrastructure through the following mechanisms:

- Involving new investigators in defense-related research
- Creating publications and intellectual property
- Initiating or enhancing research collaborations
- Training graduate students and postdoctoral fellows
- Building physical infrastructure
- Leveraging new funding for defense-related research.

1. Involving New Investigators in Defense-Related Research

Evidence suggests that most DEPSCoR winners had never previously received funding from one of the DOD basic research offices. Of the 329 DEPSCoR awardees who received their awards from ARO, only 58 (18%) had previously received non-DEPSCoR funding from ARO before the DEPSCoR award. The percentage of DEPSCoR awardees who had previously received ARO funding varied substantially by state. More than one-third of DEPSCoR investigators in the ARO database received previous ARO awards in Delaware, South Dakota, and South Carolina and fewer than 10% in Nevada, Louisiana, and West Virginia (see Figure 1-5).

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[15] Statement of James Hoehn, Senior Associate, EPSCoR/IDeA Foundation on Behalf of the Coalition of EPSCoR States to the Senate Subcommittee on Defense Appropriations, May 17, 2004.

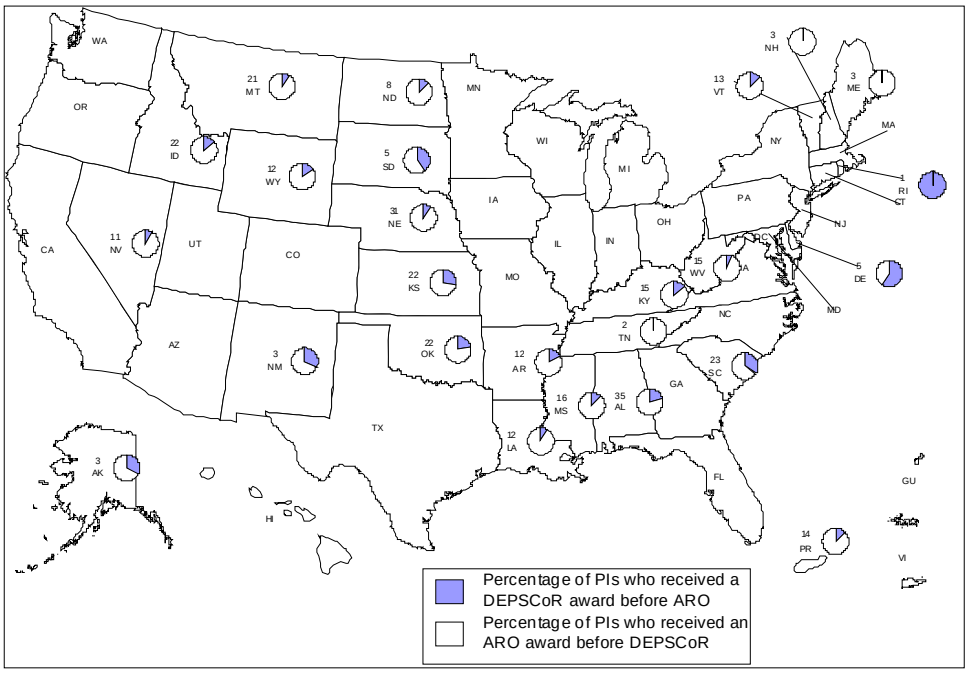

Figure 1-5. Number of PIs Winning DEPSCoR Awards and Percentage of PIs Having Previously Won Non-DEPSCoR ARO Awards, by State

Sources: Analysis of ARO and IDA DEPSCoR databases

This suggests that DEPSCoR did involve new investigators into defense-related research, particularly in certain states.

By contrast, comparison of the NSF awards database with the DEPSCoR database showed that more than half of DEPSCoR investigators (56.2% of the 546 individual investigators, who won 59.7% of total awards) had been funded by the NSF either previous to or within the same year of their first DEPSCoR award. This finding suggests that while most DEPSCoR investigators were new to DOD research, they were established investigators who had received peer-reviewed research funding before they received DEPSCoR-funded defense research.

However, IDA also investigated whether the number of awarded investigators who were new to the DEPSCoR program changed over time. Figure 1-6 shows that the percentage of funded investigators who were new to the DEPSCoR program fell from more than 75% during the 1997–1999 competitions (chosen to be 3 to 5 years after the program start to avoid the start-up transient in which everyone is a new investigator) to below 60% in the 2006–2008 competitions and that the absolute number fell from approximately 60 per year during the mid-to-late

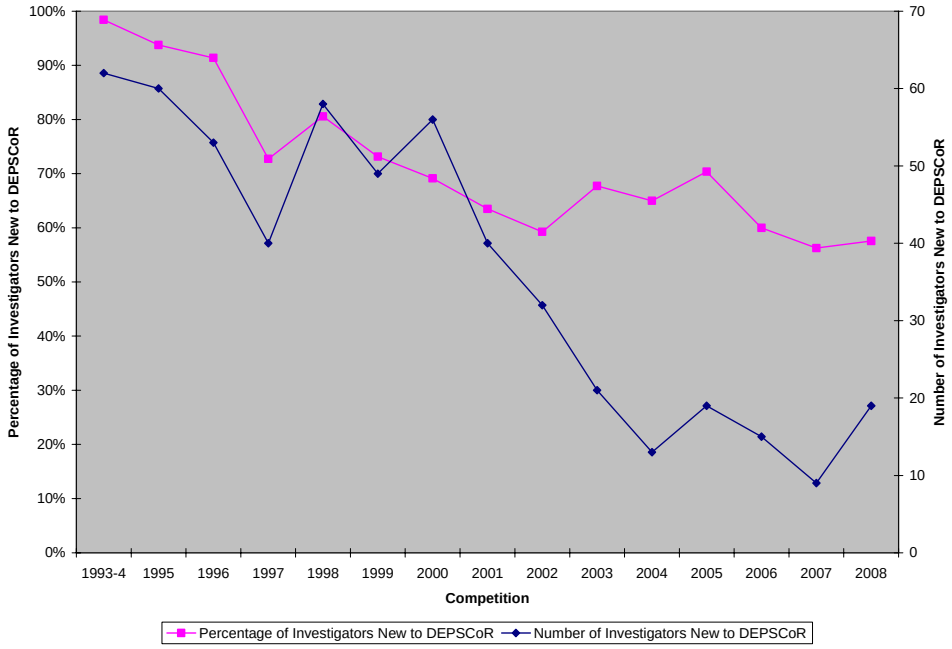

Figure 1-6. Number and Percentage of Investigators Funded Who Had Received a Previous DEPSCoR Award, by Competition

Source: IDA analysis of DEPSCoR award database

Note for Figure 1-6: *In the 1993–1994 competition, one researcher received two DEPSCoR awards.*

1990s to fewer than 20 since the 2003 competition. The number of DEPSCoR awards per year also decreased during the same time period.[16] This suggests that if DEPSCoR has contributed to expanding the national infrastructure by drawing new investigators into defense-related research, its capacity-building effects are likely to have been stronger 10 years ago than they are at present.

2. Creating Publications and Intellectual Property

No centralized database of DEPSCoR-related publications and patents is available, and IDA did not attempt to construct one as part of this assessment. However, beginning in 2001, ARO began to build a database of publications linked to its DEPSCoR awards. Table 1-4 summarizes publication-related information for the Army DEPSCoR awards in the 1999–2005 competitions.[17]

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16 One DEPSCoR program manager indicated that informally direction has been received to limit the number of awards that can be won by any individual investigator to 2 awards over a 5-year period.

17 The publications data suggest that records are sufficiently complete for analysis beginning with DEPSCoRs funded in the 1999 competition.

Table 1-4. Publications of ARO-Funded DEPSCoR Awards

Competition	Number of Army DEPSCoRs	Number of DEPSCoRs With One or More Publications	Percentage of Army DEPSCoRs With Publications in ARO File	Total Number of Publications in ARO File	Average Number of Publications per Award
1999	25	10	40	38	1.52
2000	29	19	66	161	5.55
2001	26	12	46	86	3.31
2002	24	11	46	66	2.75
2003	14	4	29	19	1.36
2004	8	3	38	21	2.63
2005	10	5	50	27	2.70
Summary: 1999–2005	136	64	47	418	3.07
Publications from awards in earlier competitions				21	–
Total publications				439	–

Source: IDA analysis of ARO database of DEPSCoR publications

The ARO data identified 439 publications attributed to DEPSCoR awards, of which 418 were attributed to awards in the 1999–2005 competitions. Among these DEPSCoR awards, approximately half resulted in publications, leading to an overall average of approximately three publications per award. If DEPSCoR awards made by the other services were published at a similar rate, the program likely has contributed on the order of 2,000 publications since research-oriented competitions began in FY 1993.

A similar analysis of the ARO file of patent applications and patents awarded identified 19 submissions and 5 awarded patents. Extrapolating, as before, to the full universe of DEPSCoR awards suggests that an order-of-magnitude estimate for total patenting activities (patents awarded and those under review) is approximately 125. Three spinoff companies have also been linked to DEPSCoR awards through the success stories:

1. Multi-Photon Absorption Technologies [Montana]
2. SensoPath Technologies [Montana]
3. Summus, Ltd. [South Carolina].

3. Initiating or Enhancing Research Collaborations

Anecdotal evidence for collaborations created or enhanced by DEPSCoR can be found in the success stories ("nuggets") provided by the DEPSCoR committees and program managers.

Unfortunately, neither the state executive summaries nor the "nuggets" are designed to identify the formation or strengthening of research clusters (e.g., groups of businesses and non-businesses in the same economic sector and geographic region that jointly participate in the cluster).[18]

Examples of collaborations as described in "nuggets" involving DEPSCoR awardees in the indicated states include the following:

- Collaborations with DOD laboratories
  - XXX [investigator] plans to conduct a micro-stress and failure analysis of textile composites as a long-term collaboration with the Wright-Patterson Air Force Research Laboratory. Experimental measurements of stress and other properties will be predicted using models developed at the Air Force laboratories [Kansas].
  - We will deliver a prototype SiAlON-coated[19] high-temperature acoustic wave sensors tested in the Controls Branch/Turbine Engine Division at Wright Patterson Air Force Research Laboratory [Maine].
  - Tests were conducted in the Navy's Large Cavitation Channel located in Memphis, Tennessee [Mississippi].
  - We have also completed our first modular Adaptive Optics system for the telescope, and it is being tested at the Kirtland Air Force Base (AFB), Air Force Research Laboratory [Puerto Rico].
  - DEPSCoR funding is building bridges between the Naval Underwater Warfare Center (NUWC), Newport, Rhode Island, battery companies, and XXX [university] [South Carolina].
- Collaborations with industry
  - The research is being coordinated with an industrial consortium of aerospace investment casing foundries in several states and jet engine builders in Ohio and Florida so that the technology developed is rapidly commercialized [Alabama].
  - While the specific focus is on military aircraft through the Air Force Office of Scientific Research (AFOSR) and in partnership with Boeing, the findings would apply to a host of military applications [Montana].
  - XXX [university] is developing, in conjunction with Ingalls shipyard in Pascagoula, Mississippi, a sensor for on-line control of weld penetration [Alabama].

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18 See President's Council of Advisors on Science and Technology, "Federal-State R&D Cooperation: Improving the Likelihood of Success," June 2004 Appendix C for more detail regarding definitions and typologies of research clusters. Available at http://www.ostp.gov/pdf/fed_state.pdf; last accessed July 22, 2008.

19 SiAlON = silicon aluminum oxynitride.

- Formation of new collaborations or research groups at investigator's university
  - With the aid of DEPSCoR funding to XXX [university] Department of Mathematics, an active interdisciplinary program has been established between this department and the Departments of Computer Science, Mechanical Engineering and Chemistry [South Carolina].
  - Professors from at least four XXX [university] departments are involved in the research: XXX (Molecular Physiology and Biophysics), XXX (Biology), XXX (Pathology), and XXX (Physics) [Vermont].
- Collaborations with Investigators at other universities
  - Inspired by our successes, the University of California-Davis group contacted us and is willing to give us one of their magnetometers to set up here so that XXX would become part of their system [North Dakota].
  - The DEPSCoR program has supported several joint research collaborations with national and international research centers dealing with image processing, including those at Princeton University, Purdue University, and the University of Paris [South Carolina].
  - The proposed research has already strengthened formal collaborations between individual investigators and colleagues and other medical colleges, including Johns Hopkins University (XXX), Harvard University (XXX), Duke University (XXX), and Ohio State University (XXX) [Vermont].

4. Training Graduate Students and Postdoctoral Fellows

Interviews with the chairs whose departments have received multiple DEPSCoR awards, a review of success stories, and other information from state executive committees suggest that several 3-year DEPSCoR awards funded approximately one full PhD or multiple Master's degrees. ARO and ONR provided the number of participants in DEPSCoR research and the number of Master's and PhD degrees awarded for fiscal years 2006–2008. Over those 3 years, 52 PhDs and 77 Master's degrees were awarded to DEPSCoR participants, and 94 postdocs were supported (although the ARO and ONR data do not permit an assessment of the fraction of the degree that was funded by the award). Since DEPSCoR awards are 3 years apiece, a weighted average of the number of ARO- and ONR-funded awards 2003–2007 was used to compute the average number of PhDs and Master's degrees funded per award.[20] Based on a weighted average

[20] Ten ARO-funded awards were funded in the 2003 competition; 6 in the 2004 competition; 10 in the 2005 competition; 9 in the 2006 competition; and 5 in the 2007 competition. The weighted average of active awards across the 3 years was 25 (10*.33+6*.67+10*1+9*.67+5*.33). The awards begin in the year after the competition, and the weighed average reflects the fraction of the years between 2006–2008 the 3-year awards were active. Similarly, there were 10 ONR-funded awards in the 2003 competition, 6 in the 2004 competition; 6 in

of 25 ARO-funded and 19.66 ONR-funded awards active at this time, the data suggest that DEPSCoR supported 1.16 PhDs (52/44.67) and 1.72 Master's degrees (77/44.67) per award.

NSF WebCASPAR data on PhDs awarded by university department suggest that DEPSCoR funding may have supported a substantial percentage of all PhDs granted by certain university departments. Table 1-5 shows a side-by-side comparison of the 7 university departments receiving the largest number of DEPSCoR awards (through 2005) and the number of PhD graduates in those departments between 1996 and 2005. One finding to note is that of the top six pairs, two are Physics departments (Montana State University and University of Arkansas), and two are Electrical Engineering departments (University of Nebraska-Lincoln and Clemson University). The table also shows that for these six institutions, the ratio between the number of DEPSCoR awards and the number of graduated PhDs is substantial—especially at the first three institutions.

Table 1-5. Comparison of DEPSCoR Awards and Graduated PhDs, by University-Department Pair

University-Department Pairs	DEPSCoR Awards 1993–2005	Number of Graduated PhDs 1996–2005	Column 2/ Column 3 (%)
Montana State University (Physics)	20	41	49
University of Arkansas-Fayetteville (Physics)	14	40	35
University of Nebraska-Lincoln (Electrical Engineering)	12	24	50
University of South Carolina (Mathematics)	10	63	16
University of Wyoming (Chemistry)	9	72	13
Clemson University (Electrical and Computer Engineering)	9	77	12

Sources: IDA DEPSCoR database and NSF WebCASPAR database

5. Building Physical Infrastructure

The exact amount of DEPSCoR funds used to purchase equipment is not known for competitions after 1992. Given the emphasis on infrastructure development in the DEPSCoR program (described in greater detail in Sections 3 and 4), however, IDA assumed (an assumption not disputed by DEPSCoR program managers) that 20% was not unreasonable. Twenty percent of the $243 million dispersed between 1993 and 2008, plus the $10 million for infrastructure

the 2005 competition; 7 in the 2006 competition; and 5 in the 2007 competition, for a weighted average of 19.67 awards per year.

spending in the FY 1992 competition, suggests that approximately $58 million was used to fund infrastructure for defense research at DEPSCoR institutions.

The DURIP intends to "improve the capabilities of U.S. institutions of higher education (hereafter referred to as 'universities') to conduct research and to educate scientists and engineers in areas important to national defense, by providing funds for the acquisition of research equipment."[21] DURIP awards generally provide between $50,000 and $1 million for the purchase of research instrumentation. Because the two programs both can provide funds that can be used to purchase equipment, IDA examined whether a correlation exists between the number of DURIP and DEPSCoR awards won by institutions in DEPSCoR states[22]. Fifty-seven institutions in DEPSCoR-eligible states were identified as having at least one DEPSCoR and one DURIP award, but no such correlation was apparent (see Figure 1-7, correlation coefficient 0.07). The average DEPSCoR/DURIP award ratio for these institutions is 2.03 to 1 (652 DEPSCoRs, 320 DURIPs). At 12 institutions, however, this ratio was more than 6 to 1. In these institutions, DEPSCoR was probably more important than DURIP as a funder of physical infrastructure for DOD-funded research by these two programs at these institutions.[23]

6. Leveraging New Funding for Defense-Related Research

Finally, IDA also examined evidence that the DEPSCoR program contributed to the expansion of the national research infrastructure base by helping investigators in eligible states obtain additional funding for defense-related research. In particular, IDA looked at success of DEPSCoR PIs and institutions in obtaining funding from ARO, DURIP, and two "signature" DOD basic research programs: the MURI program and the National Defense Science and Engineering Graduate (NDSEG) program.

A database of ARO awards between 1980 and 2008 was used to analyze the extent to which DEPSCoR awards preceded additional ARO awards to individual investigators. A total of 840 investigators from universities in DEPSCoR-eligible states received awards from ARO

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21 BAA for the Defense University Research Instrumentation Program, FY 2009, AFOSR-BAA-2008-5, p. 3.

22 Email from Kurt Preston, ARO to Evelyn Kent, OSD, September 2008.

23 Institutions falling into this category include the following: University of Oklahoma–Norman (24 DEPSCoR, 1 DURIP), University of Idaho (23 DEPSCoR, 1 DURIP), North Dakota State University (17 DEPSCoR, 1 DURIP), West Virginia University (33 DEPSCoR, 2 DURIP), University of Louisville (16 DEPSCoR, 1 DURIP), University of North Dakota (11 DEPSCoR, 1 DURIP), University of Puerto Rico-Rio Piedras (10 DEPSCoR, 1 DURIP), University of Kentucky (19 DEPSCoR, 2 DURIP), University of Nevada-Las Vegas (8 DEPSCoR, 1 DURIP), Alabama A&M University (7 DEPSCoR, 1 DURIP), University of Wyoming (41 DEPSCoR, 6 DURIP), and University of Nebraska-Lincoln (47 DEPSCoR, 7 DURIP).

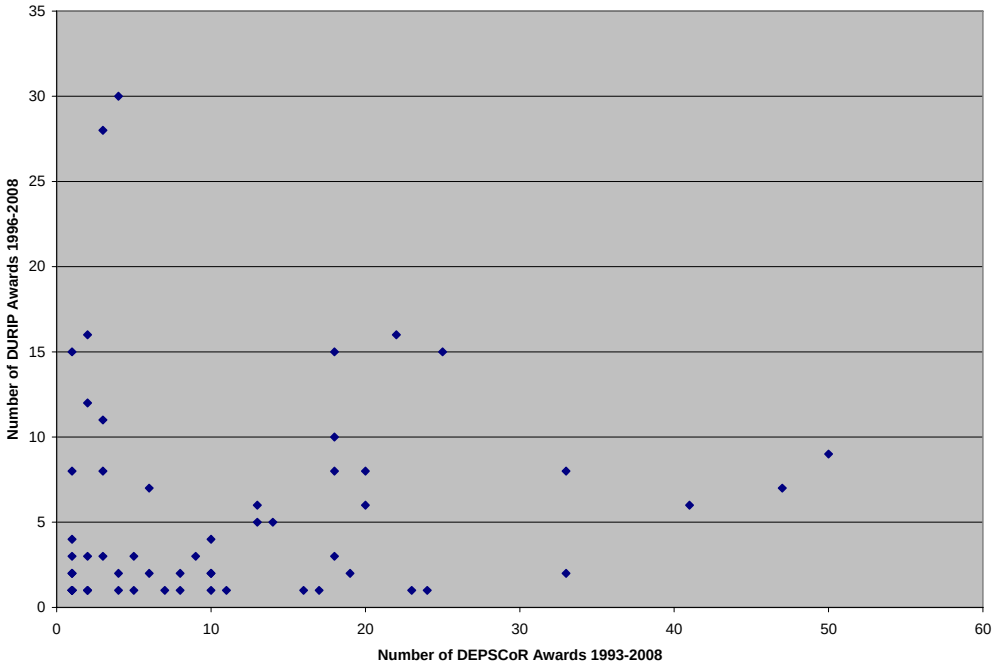

Figure 1-7. Scatter Plot of DEPSCoR and DURIP Awards, by DEPSCoR-Eligible Institution

Sources: Analysis of IDA DEPSCoR and DURIP databases

Note for Figure 1-7: *Includes only institutions for which at least one DURIP and one DEPSCoR award record appears in the IDA databases.*

programs between 1993 and 2008. Of those 840 awardees, 621 (74%) received non-DEPSCoR ARO awards and 110 (13%) received both DEPSCoR and non-DEPSCoR ARO awards. About half of the 110 (52 or 47%) received the DEPSCoR award first or in the same year. Overall, about 8% (52 of 621) of non-DEPSCoR ARO awardees in DEPSCoR states received a DEPSCoR award before (or in the same year as) their first non-DEPSCoR ARO award. However, the likelihood that a non-DEPSCoR ARO award was preceded by a DEPSCoR award appeared to vary by state. In some states (e.g., Wyoming, Montana, Mississippi, Kansas, Oklahoma, and Vermont), more than one-sixth of the total number of ARO award recipients had previously won DEPSCoR awards. In other states (e.g., Alaska, Idaho, and North Dakota), no ARO recipient won a DEPSCoR award before his or her first other award from ARO (see Figure 1-8). In only one state did as many as 25% of the investigators first receive a DEPSCoR award and in the rest of the states that percentage did not rise above 16%.

Fifty-nine PIs were identified as having received a DEPSCoR award in the year of, or previous to, their first DURIP award in the IDA database. However, since the IDA DURIP database extends only to FY 1996, some of these PIs may actually have received a previous DURIP award before their first DEPSCoR award.

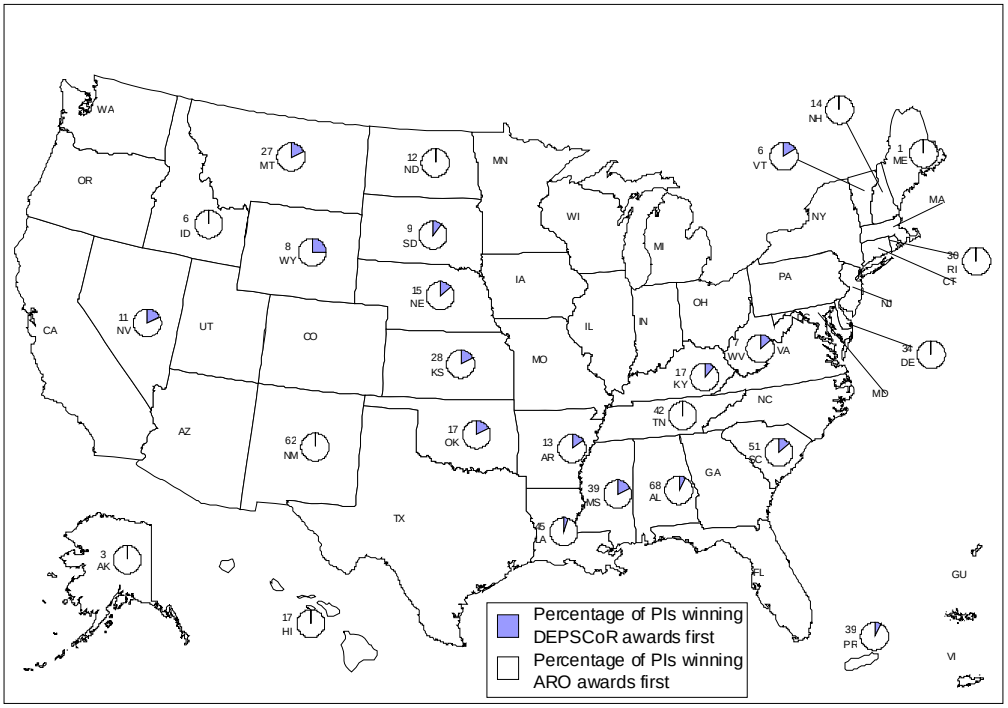

Figure 1-8. Number of PIs Winning ARO Non-DEPSCoR Awards and Percentage of PIs Having Previously Won DEPSCoR Awards, by State

Sources: Analysis of ARO and IDA DEPSCoR databases

The corresponding comparison with the NSF awards database identified 63 investigators (12% of the 546 total investigators) who had received their first NSF funding subsequent to their first DEPSCoR funding. The percentage varied little across states. The analysis suggests that for a small percentage of DEPSCoR investigators, the funding won may have served to enhance their stature not just as defense investigators, but also as researchers able to compete for non-defense peer-reviewed funding.

The MURI funds "multidisciplinary research efforts that intersect more than one traditional science and engineering discipline to address issues of critical concern to the DOD."[24] MURI awards are funded for up to 5 years and $1.5 million per year and generally include multi-university teams.[25] The IDA database of MURI awards between the 1996 and 2008 competitions contains 326 awards. The identity of the PI and lead institution is known for all awards in the

[24] BAA for the Multidisciplinary University Research Initiative, FY 2007, ONR BAA Announcement Number 06-028, p. 2.

[25] BAA for the Multidisciplinary University Research Initiative, FY 2007, ONR BAA Announcement Number 06-028, pp. 5, 10.

database, but the identity of collaborating institutions is available for only 154 of the awards (47%).

As shown in Table 1-6, 17 of the 326 awards (5%) have been led by investigators from institutions that have participated in the DEPSCoR program, including 12 from investigators at institutions that were DEPSCoR eligible at the time of the competition. Those 17 MURIs were led by investigators from Brown University (four awards); Vanderbilt University (three awards); Clemson University and Dartmouth College (two awards each); and Kansas State University, Oklahoma State University, University of Nebraska-Lincoln, University of Nevada-Las Vegas, University of Puerto Rico-Mayaguez, and University of South Carolina (one award each).

Table 1-6. MURI Awards Led by Investigators From DEPSCoR-Eligible Institutions

Competition	Total Number of Awards in Database	Number of Awards to Institutions Ever DEPSCoR Eligible	Number of Awards to Institutions DEPSCoR Eligible in That Year
1996	10	1	0
1997	13	2	1
1998	17	0	0
1999	19	2	0
2000	14	1	1
2001	48	0	0
2002	26	2	2
2003	17	1	0
2004	31	0	0
2005	33	3	3
2006	30	1	1
2007	35	3	3
2008	33	1	1
Total	326	17	12

Source: Analysis of IDA MURI database

Of the MURI awards to faculty at DEPSCoR-eligible institutions, three were awarded to investigators who had received DEPSCoR funding previous to MURI, and one was awarded to an investigator who received DEPSCoR and MURI funding within the same year:

- Michael Pursley, Clemson University, 2000 MURI: Adaptive Mobile Wireless Networks
- Donald Thompson, Oklahoma State University, 2002 MURI: Energetic Materials Designed for Improved Performance/Low Life Cycle Cost

- Yongfeng Lu, University of Nebraska-Lincoln, 2005 MURI: Multi-Laser-Beam Open-Atmosphere Surface Coating Techniques Based on Precursor Excitation, Photodissociation, and Controlled Cooling (same year as DEPSCoR)
- Ronald DeVore, University of South Carolina, 2007 MURI: Model Classes, Approximation, and Metrics for Dynamic Processing of Urban Terrain Data.

Of those four awards, analysis of the ARO database shows that Donald Thompson was a well-funded ARO investigator before he received his first MURI. Michael Pursley was identified in the South Carolina "nuggets" documents as having been funded by ARO and the Air Force since the 1970s. Since, at most, two investigators received MURI funding as a consequence of their DEPSCoR participation, it appears unlikely that DEPSCoR awards were sufficient to help PIs compete for MURI awards.[26]

The NDSEG program specifically aims to train the next generation of defense research investigators.[27] The program funded 200 3-year fellowships in FY 2008.[28] The fellows are highly concentrated at a small number of universities. Ninety of the fellows (45%) are training at just four institutions: MIT, Stanford University, University of California-Berkeley, and Harvard University. Only four (0.5%) are being trained at universities in DEPSCoR-eligible states: two at Brown University, one at the University of Oklahoma, and one at the University of South Carolina. As will be described in greater detail in Section 5, if the fellowships were based on state populations, approximately 20% would be training in DEPSCoR-eligible states.

Although the evidence suggests that the DEPSCoR contribution to launching investigators and institutions from eligible states toward success in winning additional funding from DOD signature programs is at most rather small, anecdotal evidence does exist, as expected, in the success stories for a DEPSCoR contribution to increased funding for these particular awardees. Known examples include the following:

- Instrumentation provided in the grant has allowed me to obtain competitive research funding from NASA and the Memorial Institute for the Prevention of Terrorism (Department of Justice (DoJ)) [Oklahoma].
- During the past 6 years, XXX [research group] has received extensive funding from DOD agencies for research in a variety of photonics applications. This research has

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26 Comparison of the NSF and DEPSCoR databases identified investigators in two DEPSCoR states (Idaho and Wyoming) who are NSF EPSCoR PIs as well as DEPSCoR PIs and two PIs (one in West Virginia, one in Mississippi) who were PIs on NSF-funded Industry/University Cooperative Research Centers as well as DEPSCoR PIs. All four investigators were NSF-funded previous to their involvement with DEPSCoR.

27 NDSEG Internet site, https://www.asee.org/ndseg/index.cfm. Last accessed July 15, 2008.

28 List of awardees available from https://www.asee.org/ndseg/2008Selectees.cfm, last accessed July 15, 2008. Institution information was not available for two fellows.

been funded by AFOSR and ARO through Montana's EPSCoR program and has involved extensive interaction with both Air Force Research Laboratory (AFRL) and ARL sites as well as private industry (Scientific Materials Corporation, Bozeman, Montana, and Laser Photonics Technology, Inc., Amherst, New York). This has prompted the formation of an Montana State University spin-off company, Multi-Photon Absorption Technologies (MPAT) [Montana].

- XXX [university] was recently granted $1 million from the Missile Defense Agency [MDA] to establish a Center for Laboratory Studies of Rocket Plume Chemistry [Montana].
- This collaborative effort between XXX [university], Scientific Materials Corporation, and others has led to a $16-million development contract for the company from the U.S. Army Space and Missile Defense Command (SMDC), as well as funding from the DARPA Optical Signal processing Program [Montana].

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Section 2.
An Assessment of Whether the Activities Undertaken Under the Program Are Consistent With the Statute Authorizing the Program

A. Scope and Methods

This section focuses upon whether the activities undertaken by the program—defined as the type of activities funded and the eligibility of states to participate—are consonant with the DOD's underlying statutory authority.

For this assessment, analysis of the relevant section of the United States Code (10 U.S.C §2358) was performed. This analysis focused on two elements of the DEPSCoR program—the activities authorized and the eligibility criteria.[29] The legislative mandate was compared against programmatic operations, as formalized in the DEPSCoR BAAs.

B. Assessment of DEPSCoR Programmatic Activities

1. Authorizing Legislation: Activities

The original DEPSCoR authorizing legislation (National Defense Authorization Act for Fiscal Year 1995, P.L. 103-337, §257; Oct. 5, 1994, 108 Stat. 2705) authorized the following DEPSCoR activities (§257c):

> (c) PROGRAM ACTIVITIES– In order to achieve the program objectives, the following activities are authorized under the program:
>
> (1) Competitive award of research grants.
>
> (2) Competitive award of financial assistance for graduate students

The program activities section was modified by Section 246 of the Bob Stump National Defense Authorization for FY 2003 (P.L. 107-314 §246, Dec. 2, 2002, 116 Stat. 2502), changing the authorizing language to its current form (changes <u>underlined</u>):

> (c) Program Activities– In order to achieve the program objectives, the following activities are authorized under the program:

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[29] Assessment of the role of state committees occurs in Section 4.

(1) Competitive award of grants for research and instrumentation to support such research.

(2) Competitive award of financial assistance for graduate students.

(3) Any other activities that are determined necessary to further the achievement of the objectives of the program.

2. Programmatic Activities

The DEPSCoR BAA for the FY 1995 competition defined the specific programmatic activities to be pursued through the program. Key elements include the following:[30]

- **Research topics.** The DEPSCoR BAA did not define a particular set of research topics of interest but instead referred applying investigators to the individual service offices' BAAs and stated that proposals in those areas identified (or in others) would be accepted. The BAA also encouraged participating investigators to contact the relevant DOD program managers (e.g., at ARO, AFOSR, ONR) before applying, to discuss potential research topics.
- **Size and length of research.** The BAA specified that research projects would be funded for up to 3 years. While the BAA did not impose a specific limit (either a maximum or minimum) on project size, states participating were limited to up to 15 proposals submitted and a total of $5 million of DOD funding.
- **Activities supported.** The BAA specified that the research supported would be that of an individual investigator rather than a multi-investigator team (although language on page 3 of the BAA suggested that a focused, multi-investigator effort could be proposed). The BAA stated that it was expected that more funding for research equipment/infrastructure and training would be requested than in a traditional single-investigator DOD proposal. Computers devoted to DEPSCoR research could be funded.
- **Activities not supported.** The BAA specified that funding could not be designated for facilities construction/refurbishment or for the operations of state EPSCoR committees. General-purpose computing equipment or equipment for instructional purposes could not be purchased.
- **Cost match.** The BAA specified a minimum cost match of $1.00 from state/industry/other institution sources for each $2.00 of DOD support.

Subsequently, changes were made to several facets of programmatic activity, including the size of research proposals, the number of proposals that could be submitted, and the type of teams supported, as shown in Table 2-1.

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30 1995 BAA, pp. 1–4.

Table 2-1. Programmatic Activity Across BAAs

Topic	FY 1995–1996 BAAs	FY 1997–1998; 1999 BAAs	FY 2001–2002 BAAs	FY 2003 BAAs	FY 2004 BAAs	FY 2005–2007 BAAs	FY 2008 BAAs
Maximum number of proposals submitted per state	15			10		5	3
Minimum size of individual proposal?	None			$500K	2 unlimited; rest $500K	$350K	$250K ($2M maximum)
Minimum size of individual proposal?	$5 million			No maximum limit			$6 million
Support for focused-teams?	Potentially	Yes	Potentially	Yes			
Support for centers of excellence?	No		Potentially				
Support for multi-institution or unfocused single-institution teams?	Possible, but discouraged						

Source: IDA analysis of DEPSCoR BAAs

Note for Table 2-1: *2000 BAA not available at time of interim assessment but likely is similar to the preceding and following years.*

Neither the research topics, the types of activities supported, nor the cost match requirements changed over successive BAAs despite the substantially increased funding flexibility afforded by the FY 2003 authorization language. Beginning in FY 2003, successive BAAs decreased the number of proposals that each state could submit and began to impose a minimum size on submissions. The minimum submission size was set for the FY 2003 competition in the belief by DOD that sufficiently large, funded awards were necessary to build capacity through the conduct of research, purchase of infrastructure, and training of students.[31] DEPSCoR program managers have set an approximate funding target of 25% of proposals. DOD program managers related that since the start of the program, the number of proposals per state has been

[31] Letter from Keith Thompson, OSD, to state DEPSCoR contacts, 2003 (date unknown), pp. 1–2, provided to IDA by the Coalition of EPSCoR/IDeA States.

reduced. The elimination (with the exception of the 2008 competition) of the maximum-funding-per-state proposal package and the reduction of the proposal minimum size requirement were intended to give states increased flexibility in submitting proposals. By doing taking this action, DOD felt that the proposals would be funded based upon the needs of the science rather than an arbitrary cost threshold.[32] Over time, the language in the BAAs also shifted to reflect the possibility that multi-investigator teams or centers of excellence could be supported (although the BAAs did not specifically define a "center of excellence"). The 2001–2002 BAA also began to specify that support for multi-institutional teams was possible, although support for such teams was described as "not normally funded and are discouraged."

3. Authorizing Legislation: Eligibility

The original DEPSCoR authorizing legislation (National Defense Authorization Act for Fiscal Year 1995, P.L. 103-337, §257; Oct. 5, 1994, 108 Stat. 2705) set out criteria by which determinations regarding states' eligibility would be determined (§257d):

> (d) ELIGIBLE STATES–
>
> (1) The Director of the National Science Foundation shall designate which states are eligible states for the purposes of this section and shall notify the Director of Defense Research and Engineering of the states so designated.
>
> (2) The Director of the National Science Foundation shall designate a state[33] as an eligible state if, as determined by the Director—
>
> (A) the institutional average amount of federal financial assistance for research and development received by the institutions of higher education in the state for the fiscal year preceding the fiscal year for which the designation is effective, or for the last fiscal year for which statistics are available, is less than the amount equal to 60% of the national institutional average amount of federal financial assistance for research and development received by the institutions of higher education in the United States for such preceding or last fiscal year, as the case may be;

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32 E-mail from Evelyn Kent, OSD to IDA, July 29, 2008.

33 As per the Fiscal Year 1998 National Defense Authorization Act (P.L. 105-85, § 243, Nov. 18, 1997, 111 Stat. 1667), "state" was defined to include all states of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, the Virgin Islands, American Samoa, and the Commonwealth of the Northern Mariana Islands.

(B) the state has demonstrated a commitment to developing research bases in the state and to improving science and engineering research and education programs at institutions of higher education in the state; and

(C) the state is an eligible state for purposes of the Experimental Program to Stimulate Competitive Research conducted by the National Science Foundation.

The legislation denoted two quantitative eligibility criteria: one based upon participation in the NSF EPSCoR program and a second based upon a comparison of the level of federal R&D funding received by each state. States that received less than 60% of the national average were eligible. The third criterion, "demonstrated a commitment," required a subjective assessment by the Director of the NSF.[34] In each BAA (and again in each announcement of awardees), the DOD publishes the list of states eligible for the program based upon the eligibility criteria. Beginning with the 1995 BAA, eligibility within states has been restricted to, "institutions of higher education with degree granting programs in science, mathematics or engineering [which] are eligible for DEPSCoR grants."[35]

The eligibility section was modified by Section 264 of the National Defense Authorization for Fiscal Year 1997 (P.L. 104-201, Sept. 23, 1996, 110 Stat. 2465), changing the authorizing language to the form used through the 2008 competition (changes underlined):

(d) ELIGIBLE STATES–

(1) The Under Secretary of Defense for Acquisition, Technology, and Logistics shall designate which states are eligible states for the purposes of this section.

(2) The Under Secretary of Defense for Acquisition, Technology, and Logistics shall designate a state as an eligible state if, as determined by the Under Secretary—

(A) the average annual amount of all Department of Defense obligations for science and engineering research and development that were in effect with institutions of higher education in the state for the three fiscal years preceding the fiscal year for which the designation is effective or for the last three fiscal years for which statistics are available is less than the amount determined by multiplying 60 percent times the amount equal to 1/50 of the total average annual amount of all Department of Defense obligations for science and engineering research and development that

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34 DEPSCoR program managers interpret the "failure to demonstrate a sufficient commitment" as "failure to form an EPSCoR committee." (Email from Kurt Preston, ARO, to Evelyn Kent, OSD, September 2008). They did not identify a separate "failure to demonstrate" criterion used in the determination of eligibility.

35 1995 BAA, p. 1.

were in effect with institutions of higher education in the United States for such three preceding or last fiscal years, as the case may be; and

(B) the state has demonstrated a commitment to developing research bases in the state and to improving science and engineering research and education programs at institutions of higher education in the state.

The eligibility change resulted in shifting the eligibility calculation from 60% of the institutional average amount of federal government R&D provided to universities across all agencies to 1.2% (60%/50) of the S&E R&D the DOD provided to universities.[36] According to the revised eligibility criteria, all states whose university S&E R&D funding levels were below 1.2% of the DOD total could become eligible (since the reference to EPSCoR was removed); however, the rules by which proposals could be submitted (National Defense Authorization Act for Fiscal Year 1995, P.L. 103-337, §257(e)) continued in practice to limit programmatic eligibility to EPSCoR states:[37]

(e) COORDINATION WITH SIMILAR FEDERAL PROGRAMS–

(2) All solicitations under the Defense Experimental Program to Stimulate Competitive Research shall be made to, and all awards shall be made through, the state committees established for purposes of the Experimental Program to Stimulate Competitive Research conducted by the National Science Foundation.

The eligibility criteria were changed by the FY 2008 DOD authorization. Section 239 of the FY 2008 Defense Authorization (P.L. 110-181 §239, Jan. 28, 2008, 122 Stat. 3) states that

Section 257(e)(2) of the National Defense Authorization Act for Fiscal Year 1995 (10 U.S.C. 2358 note) is amended by striking ''shall'' each place it appears and inserting ''may.''[38]

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36 The determination of eligibility has occasionally drawn scrutiny from the participating states. DOD program managers identified the example of Alabama requesting clarification of its determination of eligibility through its Congressional delegation when Alabama was declared ineligible to participate in DEPSCoR for the 2005 competition. This issue was addressed by OSD, and Alabama remained ineligible for that year.

37 Researchers from Missouri applied for and received DEPSCoR awards in the 1993–1994 competition. According to the NSF EPSCoR program managers, Missouri has never been eligible for the EPSCoR program (Email from Henry Blount, NSF, to IDA, August 8, 2008).

38 The amendment had the following effect on the section:(e) Coordination With Similar Federal Programs.

(1) The Secretary ~~shall~~ may consult with the Director of the National Science Foundation and the Director of the Office of Science and Technology Policy in the planning, development, and execution of the program and ~~shall~~ may coordinate the program with the Experimental Program to Stimulate Competitive Research conducted by the National Science Foundation and with similar programs sponsored by other departments and agencies of the Federal Government.

The change has two implications regarding eligibility:

1. Proposals no longer have to be submitted through the state EPSCoR committees, which means that within DEPSCoR states, individual proposers can submit directly to the DOD.
2. Since proposals no longer have to be submitted through the state EPSCoR committees, the only quantitative eligibility criterion is Section (d)(2)—that the states receive less than 1.2% of DOD university S&E research development in the average of the 3 most recent years where data are available.

The rationale for the change provided in the conference report is to provide DOD greater flexibility in managing and executing the program in future competitions.[39]

The effect of the combined eligibility criteria (participation in the NSF EPSCoR program and state receipt of less than 1.2% of DOD university S&E R&D funds) from the 1997 to 2008 competitions divided states into four categories, with two categories of particular interest:

1. Those states that have NSF-designated EPSCoR committees but are not eligible to participate in DEPSCoR because they exceed the DEPSCoR 1.2% eligibility criteria
2. Those states that fall below the 1.2% threshold but cannot participate because they are not eligible under the NSF EPSCoR program.

Table 2-2 shows the list of states in each category as of FY 2008. Four states have "graduated" from DEPSCoR, while nine states (and three territories) not currently eligible through the 2008 competition may become eligible now that DOD university S&E R&D funding is the sole criterion for inclusion. While the program's activities and eligibility criteria are

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(2) All solicitations under the Defense Experimental Program to Stimulate Competitive Research ~~shall~~ may be made to, and all awards ~~shall~~ may be made through, the State committees established for purposes of the Experimental Program to Stimulate Competitive Research conducted by the National Science Foundation.

(3) A State committee referred to in paragraph (2) ~~shall~~ may ensure that activities carried out in the State of that committee under the Defense Experimental Program to Stimulate Competitive Research are coordinated with the activities carried out in the State under other similar initiatives of the Federal Government to stimulate competitive research.

39 The committee recommends a provision that would give the Department of Defense more flexibility in its execution of the Defense Experimental Program to Stimulate Competitive Research (DEPSCoR) program. The provision would enable the Department to award merit-based grants and other support under the program's authority directly to entities in participating DEPSCoR states, or by using the existing mechanism of awarding contracts through state planning committees . . . .

The committee believes that the flexibility provided by this provision will enable the Department to better use DEPSCoR funding to support warfighter needs, including potentially supporting educational activities, while still preserving the important role of state planning committees to coordinate activities with other similar federal programs and state-based efforts where appropriate. (National Defense Authorization Act for Fiscal Year 2008, Senate Report 110-77, p. 146).

Table 2-2. States Eligible Under Only One of the Two Quantitative Criteria

Less Than 1.2% of DOD University S&E R&D, but Not Eligible for EPSCoR	Eligible for EPSCoR, but Greater Than 1.2% of DOD university S&E R&D
American Samoa	Alabama
Arizona	Hawaii
Connecticut	Mississippi
Colorado	New Mexico
Guam	
Indiana	
Iowa	
Minnesota	
Missouri	
Oregon	
Wisconsin	
Trust Territory of the Pacific Islands	

Source: IDA analysis of DOD funding of university S&E R&D funds based upon NSF surveys as described in Section 1

Note for Table 2-2: *NSF EPSCoR eligibility criteria identified from the following Web site: http://www.nsf.gov/od/oia/programs/epscor/Eligibility-FY2007.pdf*

consistent with the sections of the authorizing legislation that define them, the programmatic goals and objectives described in the authorizing legislation are not consistent with the activities that have been legislatively authorized and the funding levels that have been appropriated to implement the program. This finding is discussed in greater detail in Section 6.

Section 3.
An Assessment of Whether the Various Elements of the Program, Such As Structure, Funding, Staffing, Project Solicitation and Selection, and Administration, Are Working Effectively and Efficiently To Support the Effective Execution of the Program

A. Scope and Methods

The assessment in this section covers DOD's administration of the DEPSCoR program. The assessment of the activities of the state committees occurs in Section 4. The seven programmatic elements assessed in this section are

1. Program participation
2. Development and release of the BAA
3. Project solicitation
4. Review of applications and project selection
5. Review criteria in the BAA
6. Application format
7. Post-award administration.

Data for the assessment in this section are drawn primarily from interviews with program managers—both from the Office of the Secretary of Defense (OSD) and the individual services (see Appendix D for the list of interviewees). Analysis of BAAs is used to assess the timing of the application process and of review criteria. Where applicable, comments taken from the survey of state committees on program elements are included.[40]

[40] Several state EPSCoR committees include DEPSCoR-relevant information on their Internet sites (e.g., http://www.webs.uidaho.edu/epscor/assistance.htm). However, because the information on these sites lacked uniformity, they were not used as a data source for the assessment.

B. Description of Programmatic Elements

1. Program Participation

At the outset of the program (beginning with the first research awards in 1993), one office from each service (ARO, ONR, AFOSR) participated in DEPSCoR, along with DARPA. The Ballistic Missile Defense Organization (BMDO) did not participate in the 1993 solicitation. BMDO's participation began after the program was formally authorized in the 1995 Defense Authorization.

DARPA ceased to participate after the 1996 DEPSCoR BAA, and BMDO[41] ceased to participate after the 2003 BAA.[42]

2. Development and Release of the BAA

As described by the service program managers and referenced in the DEPSCoR BAA, the first step in the DEPSCoR solicitation process (since the 1995 competition) is exogenous to the program. The release of the individual services' BAAs (describing their areas of research interest) signals to the investigators topics that may be of interest.

The timeline for the DEPSCoR DOD BAA, as described by interviewees, generally consists of the following:

- **Begin compilation of BAA (generally by July).** OSD/Deputy Under Secretary of Defense (DUSD) meets with service program managers to discuss the draft BAA. OSD/DUSD is responsible for calculating which states are eligible, based upon the criteria described in Section 2. ARO has the responsibility for compiling the BAA, with ONR and AFOSR providing comments and input into the process
- **Final compilation of BAA and review (generally in August).** A first draft of the BAA is compiled and sent to OSD/DUSD by mid-August. After review by the OSD program manager (who is separate from each service's DEPSCoR program manager) and the Director of Defense Research and Engineering (DDR&E), the BAA is reviewed by the DOD general counsel.
- **BAA release (in August-September).** The BAA usually is released in August or in early September
- **Applications due (October).** Applications are due to ARO at the end of October.

41 BMDO was renamed the MDA (Missile Defense Agency) on January 4, 2002.

42 E-mail from Evelyn Kent, OSD, to IDA, July 29, 2008.

3. Project Solicitation

The DEPSCoR BAA refers applicants to the regular ARO, AFOSR, and ONR BAAs, which provide the services' list of topics of interest and the service point of contact (POC) for each topic. The three DEPSCoR service program managers were asked whether, to the extent of their knowledge, investigators contacted program managers at ARO, AFOSR, and ONR listed as topic-specific contacts in each office's general BAA in advance of the DEPSCoR BAA release. One DEPSCoR program manager indicated that applicants usually contacted program managers, one DEPSCoR program manager indicated that contact occurred on occasion, and the third did not know the answer.

The three DEPSCoR service program managers were asked whether situations ever arose in which a DEPSCoR proposal had been funded using the general pool of BAA funds or (the reverse situation) in which a BAA-submitted proposal was moved into the DEPSCoR pool. Two of the DEPSCoR service program managers mentioned that they could identify specific cases in which the service's general BAA funds were used to fund DEPSCoR proposals. One of the program managers had the sense, anecdotally, that there had been cases in which applicants had taken a proposal that could have been submitted to the general BAA pool and instead submitted it as a DEPSCoR proposal. In contrast, another DEPSCoR program manager stated that applicants would be unlikely to submit a BAA-fundable proposal through the DEPSCoR program because it would require two rounds of review—once at the state level and then again by DOD—with potentially different criteria.

4. Review of Applications and Project Selection

The DEPSCoR service program managers were asked to describe the process by which applications are reviewed. Their response was as follows:

- **Designation of reviewers.** The DEPSCoR BAA directs applicants to designate a program manager contact as lead reviewer on a cover sheet accompanying the proposal. When proposals are received at each individual service, proposals are routed to the appropriate program manager. If proposals do not have a program manager listed, the service DEPSCoR program manager routes the proposals to an appropriate reviewer. Each service DEPSCoR program manager receives the full list of proposal titles, which is also used to identify proposals routed to one service that may be of interest to another. There have also been cases in which services jointly fund DEPSCoR proposals.
- **Identity of reviewers.** For one of the services, the review is conducted solely by program managers. At a second service, the review is conducted by program managers, who involve other DOD scientist-experts in the scoring process as

appropriate. At the third service, the review is conducted by panels that incorporate both DOD scientist-experts and extramural scientists, as appropriate.

- **Review stages.** For two of the services, a single round of ranking/scoring takes place before the final Order of Merit list is created and sent to the office director for review. At the third service, the DEPSCoR program director described a two-stage ranking process that occurs after individual awards are scored.
- **Role of the head of the office in review.** The head of the office makes the final decision as to the ranking of each service's Order of Merit list. At all three services, the director was described as being actively involved in the selection process—discussing the Order of Merit list and asking questions about individual rankings. At one service, the program manager could identify instances in which the director had changed the Order of Merit list.

5. Review Criteria in the BAA

The BAA is the source for the criteria to be used by DOD reviewers of proposals. The BAA specifies a set of "primary" evaluation criteria (all equally weighted) and a set of "secondary" evaluation criteria (of less importance than the primary criteria but equally weighted).

Two evaluation criteria have been "primary" across all DEPSCoR BAAs:

1. The scientific and technical merits of the proposed research
2. The potential contributions of the proposed research to the defense missions of the sponsoring agencies.

Three evaluation criteria have been "secondary" across all DEPSCoR BAAs:

1. The qualifications, capabilities, experience, and past research accomplishments of the proposed PI, team leader, and other key personnel who are critical to achieving the objectives of the proposal
2. The proposed involvement and interaction with DOD or other federal laboratories, industry, or other existing research centers of excellence
3. The realism and reasonableness of cost, cost sharing, and availability of funds.

Two final criteria—one involving developing research capabilities and one regarding education—have changed in substance and importance over time, as described in Table 3-1. The first change (shown by the comparison between rows 1 and 2), made in the 1997–1998 BAA, expanded the number of primary review criteria from two (scientific and technical merits, relevance to DOD mission) to four (research capabilities, education of scientists and engineers). The text of the criteria did not change, just their relative weighting. The second change (comparing the underlined portions of row 2 to row 3 in column 1), made in the 2003 BAA, redefined the "research capabilities" goal, making two explicit additions:

1. Added "advance research infrastructure goal of the university or state"—making explicit both the infrastructure role of the DEPSCoR and specifically linking the program to state-level or university-level capacity-building
2. Added "enhancing existing" to "develop[ing] new" research capabilities.

Table 3-1. Changes in DEPSCoR Review Criteria

BAA FY	Text of Research Capability Goal (Column 1)	Primary or Secondary?	Text of Education Goal (Column 2)	Primary or Secondary ?
1995–1996 (Row 1)	The likelihood of the proposed effort to develop new research capabilities and to broaden the university research base in support of national defense	Secondary	The potential to contribute to the education of future scientists and engineers in disciplines critical to the DOD mission	Secondary
1997–1998, 1999, 2001–2002 (Row 2)	The likelihood of the proposed effort to develop new research capabilities and to broaden the university research base in support of national defense	Primary	The potential to contribute to the education of future scientists and engineers in disciplines critical to the DOD mission	Primary
2003–2008 (Row 3)	The likelihood of the proposed effort to advance the research infrastructure goals of the university or state by developing new or enhancing existing research capabilities and to broaden the university research base in support of national defense	Primary	The potential to contribute to the education of future scientists and engineers in disciplines critical to the DOD mission	Primary

Source: IDA analysis of DEPSCoR BAAs

Note 1 for Table 3-1: *In 1997–1998, 1999, and 2001–2002 BAAs, "new research capabilities" and "contribute to the education of future scientists and engineers" were combined as a single review criterion.*

Note 2 for Table 3-1: *2000 BAA not available at time of this assessment but likely is similar to the preceding and following years.*

The conference report accompanying the FY 2003 DOD authorization provides one possible rationale for the change in the "Research Capability" criterion as shown in Table 3-1.[43] Page 573 of the report states (with the most relevant text underlined):

43 National Defense Authorization Act for Fiscal Year 2003, Conference Report To Accompany H.R. 4546, Report 107-772, Nov. 12, 2002. This is not a sufficient explanation. Previous conference reports (e.g., the conference report accompanying the FY 1997 DOD Authorization stated "Coordination with the state-based EPSCoR committees is an essential element for the ultimate success of this program. The committee urges the Department of Defense to give significant weight to the recommendations of the state committees and to the likely impact an award under the DEPSCoR program will have on the overall EPSCoR program of participating states") directed DOD to change its review criteria without triggering a comparable shift in the BAA and review processes. National Defense Authorization Act for Fiscal Year 1997 Report [To Accompany S. 1745]

> The conferees direct the Secretary of Defense to continue to support the DEPSCoR effort to develop new defense research capabilities across the Nation. The conferees encourage the Secretary to continue to support activities that will develop world-class researchers in DEPSCoR states and to work closely with the individual states' planning committees to ensure that the program supports the development of defense research infrastructure.

As part of a 2003 memorandum sent by Dr. Keith Thompson, Office of the Director for Basic Research, to the state EPSCoR committees, the rationale for the change in BAA language was explained to the states:

> I expressed the rationale for the changes in the original e-mail, but the thumbnail is that the changes are driven by the desire to increase the university research infrastructure impact of this program. The changes were prompted by the almost unanimous expression of concern expressed at Lake Tahoe that the program is having little lasting infrastructure impact . . . . I am aware that the PIs may not fully appreciate how their project fits in with the overall state or university plan to improve long term research capability. They may need help from their leadership in addressing this primary evaluation point. This is a level of planning that probably exists at the Department or Dean level and should certainly exist at the state committee level. What is the value of this particular project to the overall plan to improve our competitive research capability? I believe that asking and answering this question at the state or university level is critical to making the most of the opportunity that a DEPSCoR grant represents.[44]

6. Application Format

In the 2008 BAA, proposers are instructed, in a 25-page application,[45] to[46]

- Describe in detail the research to be undertaken, state the objectives and approach and the relationship to the state of knowledge in the field and to comparable work elsewhere, include an appropriate bibliography and list of literature citations, and discuss the nature of the expected results
- Describe how this effort relates to and advances the research infrastructure development goals of the university or the state

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On Authorizing Appropriations for Fiscal Year 1997 for Military Activities of the Department of Defense, for Military Construction, and for Defense Activities of the Department of Energy, To Prescribe Personnel Strengths for Such Fiscal Year for the Armed Forces, and for Other Purposes, Senate Report 104-267, May 13, 1996, p. 190.

44 Letter from Keith Thompson, OSD, to DEPSCoR state contacts, 2003, p. 1, 3.

45 In the 2003 BAA, application length was increased from 20 to 25 pages.

46 2008 BAA, p. 10. ()

- Describe plans for the education of graduate students in the specified research areas of interest. Estimate the number of graduate students and of other technical personnel who will be directly associated with the project
- Describe plans for the involvement and interaction with DOD, other federal laboratories, industry, or other existing research centers of excellence
- Describe facilities available for performing the proposed research and any additional facilities or equipment that the organization proposes to acquire at its own expense
- Provide a rationale for each item of equipment requested in the budget and how this equipment will contribute to the infrastructure building goals of the proposal
- Identify other parties who will receive the proposal or who will partially fund the proposed effort or activity
- Furnish a brief vita for key personnel critical to the research, including senior investigators (provide short biographical sketches and list relevant publications)
- Furnish a list of current and pending support for the PI and other senior personnel, which should include the project title and brief description, name of the organization or agency funding the work or requested to perform the work, award amount or dollar value, period of performance, and breakdown of the time required of the PI and other senior personnel.

The largest change to the application format occurred beginning with the FY 2003 BAA. Two changes were made in the instructions to applicants regarding the technical portion of their proposals. The BAA added a new instruction:

> (b) Describe how this effort relates to and advances the research infrastructure development goals of the university or the state.

It also modified a second instruction, adding the <u>underlined</u> text:

> (f) Provide a rationale for each item of equipment requested in the budget <u>and how this equipment will contribute to the infrastructure building goals of the proposal</u>.

7. Post-Award Administration

All three DEPSCoR service program managers stated that once a proposal is funded, it moves into the general award portfolio of the program manager responsible for that particular topic area. There is not a uniquely "DEPSCoR" post-award program management structure. Two of the DEPSCoR program managers indicated that the individual service program managers can involve others—service scientists or other technical experts—in the post-award administration of awards. One DEPSCoR program manager indicated that such technical oversight was common, while the other DEPSCoR program manager indicated that this was uncommon. One DEPSCoR

program manager, in written comments on the interim assessment, described the proactivity of program managers in working with investigators and in managing awards to ensure that the research best met the DOD's needs.

All three DEPSCoR program managers, in their written comments on the interim assessment, described (in varying degrees of detail) post-award administration activities that program managers undertake, even in the absence of a separate structure for DEPSCoR awardees. The program managers described efforts made by program managers to encourage collaborations and to mentor individual DEPSCoR investigators. One program manager specifically mentioned that program managers in his service worked with investigators to guide them in targeting future research proposals to DOD needs so as to maximize the likelihood that future proposals would be well written and well received.[47]

The DEPSCoR service program managers were also asked about transitions to "operational use." All the DEPSCoR service program managers indicated that the DEPSCoR program was a basic research program, with two stating that awards not sufficiently 6.1 in character are not reviewed favorably. One DEPSCoR program manager mentioned that in his office, some program managers who received DEPSCoR awards in their portfolios would track the outcomes of the research—but generally only as far as whether the research made a transition to more applied 6.2 or 6.3 research.

The post-award management of DEPSCoR awards as portions of individual service and program managers' portfolios is reflected in the variable information DEPSCoR program managers had at their disposal regarding the outcomes of DEPSCoR awards, based upon the level of computerization of administrative records of each office as a whole. One DEPSCoR service program manager (ARO) had at his disposal a bibliography of publications and patents associated with DEPSCoR awards. Information for the other services could potentially be obtained through manual data entry from final progress reports, which are beyond the scope of the assessment to date.

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47 Emails from Kurt Preston (ARO), William Lukens (ONR), and Edward Lee (AFOSR) to Evelyn Kent (OSD), September 2008.

Section 4.
A Description and Assessment of Past and Ongoing Activities of State Planning Committees Under the Program in Supporting the Achievement of the Objectives of the Program

A. Scope and Methods

This section summarizes data collected from the DEPSCoR state committees relating to their activities and progress on achieving their objectives. Program elements assessed are

- Composition of DEPSCoR committees
- Proposal solicitation processes
- Proposal submission processes
- Responsibility for identifying sources of matching funds
- Proposal review processes
- Description of fields of research of 2007–2008 DEPSCoR proposals

Data for the assessment in this section are drawn from two sources:

- The first source of information is the results of a data call made to the EPSCoR state committees in May 2008, coordinated by the EPSCoR/IDeA coalition but incorporating IDA-suggested questions regarding the operations of the state committees.[48]
- A second source of information regarding the operations of the state committees came from IDA analysis of the executive summaries that accompanied the DEPSCoR states' proposal packages in 2007 and 2008. Although state executive summaries were not intended for this analysis, they were a secondary source of information about state-level practices.

All data were coded and standardized and followed by an assessment of inter-rater concordance.

[48] The 13 state committees that responded to the data call were Arkansas, Idaho, Kentucky, Louisiana, Maine, Montana, Nebraska, Nevada, Oklahoma, South Carolina, South Dakota, Vermont, and West Virginia.

B. Composition of DEPSCoR Committees

The composition of DEPSCoR committees is almost always a combination of academia, industry, and state representatives. Committee size ranges from a small 4-member panel to large committees consisting of up to 32 participants, typically averaging at least 12 members. Often the DEPSCoR committee is the same as the EPSCoR committee for the state or a subcommittee appointed by them. For example, from Nevada's data call submission: "The Nevada System of Higher Education (NSHE) Research Advisory Council consists of the Vice Presidents of Research at the University of Nevada-Las Vegas, the University of Nevada-Reno, and the Desert Research Institute. This council, along with the statewide EPSCoR Director, appoints a state DEPSCoR Project Director. The project director works with the Director of the Nevada EPSCoR Office, the staff of the Nevada EPSCoR office, the NSHE Research Affairs Council, and NSHE faculty."

Another example is Puerto Rico, where the 2008 Executive Summary package describes the state EPSCoR committee, "The Committee has well-defined bylaws and is made up of 16 members and the University of Puerto Rico President, who is an ex officio member of the Committee. The committee's membership includes four high-tech science and technology entrepreneurs, research scientists, and academic administrators representing the major fields of endeavor of the EPSCoR programs" (p. 1).

C. Proposal Solicitation Processes

1. Promotion of Collaborations With DOD Program Managers

There were 14 applicable comments from 12 state committees that addressed any activities facilitated by the committee or participating universities before proposal submission. Described activities fell into one of four types:

1. **No action.** One committee indicated that activities in advance of the proposal submission were deliberately not undertaken to ensure a fair process. Another committee indicated that this type of activity was not undertaken because investigators already had well-established relationships with DOD program officers.
2. **No formal action.** In five cases, committees work informally with potential PIs to identify DOD program officers who are a good match or "fit" with investigators' research agendas, to facilitate the development of relationships with DOD personnel and facilities/labs, and to assist in proposal development, including concept development and budgeting decisions.
3. **Delegated action.** Pre-submission activities were delegated to the state's universities (one state) or to the state's EPSCoR Office (one state). In some instances, the state

committee has delegated that responsibility to the institutions. For example, the Idaho response to the data call indicated that the state EPSCoR committee delegated the role of facilitating collaborations to the Vice Presidents for Research (VPRs) at each public university. These VPRs are also members of the state committee, and each institution works to develop strong DOD collaborations that would facilitate successful DEPSCoR projects.

4. **Deliberate action.** Three state DEPSCoR committees described activities in which face-to-face meetings between investigators and DOD program officers and between investigators and the state DEPSCoR coordinators took place before proposal submission. Two of these state committees described providing funds to investigators to travel to DOD offices and facilities to develop better relationships with DOD staff and better understand DOD priorities. For example, the Kentucky data call response indicated that the state DEPSCoR committee offers provide travel funds to investigators for visiting DOD laboratories before submitting full proposals.

Responses did not indicate the extent to which facilitation of collaborations between state researchers and DOD program managers occurs before the submission of proposals. Certainly, there is a desire to increase these collaborations (and some require it), but there is significantly less evidence as to whether DEPSCoR committees are focused on facilitating and nurturing those contacts *in advance* or whether this type of facilitation takes place on an ongoing or as-needed basis throughout the year.

A considerable set of coded responses (7 of 11 data call responses) indicated that state committees feel that more DOD interaction and contact is necessary, especially in providing guidance on the DOD program manager priorities, so that the states can best match the proposals to DOD needs. Suggestions included improving efforts or strengthening the role of state committees and coordinators or centralizing management. For example, one state pointed out that "the absence of a more centralized management structure, both at the national and jurisdictional level, hinders the distillation of program impact and more strategic use of program resources."

2. Promotion of Collaborations

Eight state responses explicitly mentioned that they facilitate collaboration between researchers in advance of pre-proposal submission. Most data call responses, however, pointed out that a process is in place to work with the PI after the submission of pre-proposals. For example, the Vermont data call response stated, " . . . not in advance of the pre-proposal process. We informally work with the applicants of pre-proposals to assist with match identification and development. We have only one research university in the state, the University of Vermont, and this allows us to easily work closely with the applicants and suggest interactions once we see the pre-proposals. Meeting in advance of the pre-proposal submission is a good idea that we will

adopt." The New Hampshire state executive summaries describe collaborations as part of the descriptions of proposed projects. Collaborations described include ones with companies, colleagues at a university outside New England and a physician/researcher at Dartmouth Medical School.

Some state data call responses described active efforts to facilitate collaboration. Kentucky has created a research database through which university and industry researchers can identify collaborators and sources of support for DOD research. Other states also make available travel grants to facilitate forming collaborations. The North Dakota 2007 state executive summary, for example, described that the EPSCoR committee provides support for trips to national laboratories "and also provides substantial support for researchers who travel to make use of equipment and facilities . . . these trips often lead to summer appointments at the National Labs and, ultimately, collaborations that result in research support for the PIs program at her/his home institution."

3. Other Forms of Committee Assistance

Although approximately half of the data call responses were not explicit enough about whether a committee *directly* helps with proposal content to be analyzed, the collected information indicated that several committees do assist applicants, primarily with feedback and grantsmanship advice. Thirteen committees described resources to support the development of individual proposals and activities aimed at developing the skill of investigators in crafting successful proposals. Types of support include the following:

- Seven committees provide reviewers' comments on unsuccessful proposals to improve future reapplications.
- One committee provides copies of previously successful proposals.
- Four committees provide general support activities, such as assisting in the identification of collaborators, determining matches, and making budget decisions.
- One EPSCoR office funds an expert technical review service in addition to the expertise present on the review panel (whose comments are shared).

In addition, two data call responses indicate that assistance occurs at the universities—technical assistance, general support, budgeting, and proposal writing services—but do not say whether DEPSCoR supports these activities.

A good example of comprehensive help for applicants is that of Montana, where committee members assist in a wide range of areas including "providing new investigators copies of previously successful proposals and helping with finding the 'right' place for a white paper,

introductions to potentially interested program managers, budget discussions with advice on the level of support it is possible to request, as well as providing answers to questions."

4. Coordination With Other EPSCoR Programs

Most committees facilitate the coordination of DEPSCoR proposals with other EPSCoR programs. In fact, DEPSCoR and EPSCoR management in many states (e.g., Oklahoma) are often the same or similar. Twelve committees mentioned instances of submitted proposals taking advantage of previous investments in infrastructure made possible by other EPSCoRs (primarily NSF infrastructure grants) or that submitting investigators also served as co-PIs on projects funded by other EPSCoRs; however, the role of the state committee itself in facilitating these linkages was not described.

In a few states (e.g., Maine), candidates for DEPSCoR proposals have come from a pre-established EPSCoR infrastructure. The Maine data call response stated that, "The NSF EPSCoR Office, within University of Maine-Orono, is a well-funded university program that runs a thorough request process including leveraged partnership and identified collaborations. This process has served as the cornerstone for PIs that have eventually sought DEPSCoR funding." These coordination activities are responsive to the DEPSCoR legislative mandate.

5. Limits (If Any) on the Number of Proposals That Universities Can Submit

Two state data calls referred to limiting the number of proposals that could be submitted per university.

D. Proposal Submission Processes

1. White Papers or Pre-Proposals

All but one state DEPSCoR committee mentioned the use of a pre-proposal, white paper, or letter of intent as an early or initial step in the process in their data call (also mentioned explicitly by 10 states in their executive summaries). The most common reason given for including this step was to ensure the alignment of the proposed concept with DOD goals (four instances) and state R&D goals (two instances) and to ensure that the concept had been discussed with a DOD program manager (two instances).

Most committees use a white paper/pre-proposal process to winnow down potential ideas. A typical example is the Arkansas data call response, which stated, "The state committee has networks for communicating with researchers in the state, which gives access to a strong pool of applicants. The committee-solicited pre-proposals are received by the Arkansas Science

and Technology Authority (ASTA) some 2 months before proposals are due at DOD. The committee reviews these proposals based on well-defined criteria that include the R&D plan of Arkansas. The committee selects the proposals to be fully developed and submitted to DOD. This process ensures full involvement of the state."

The pre-proposal stage is also an opportunity for the committee to ensure that the links and alignment with DOD mission and program managers are clear. Indeed, this pre-proposal is a prerequisite in some states. For example, Montana requires a pre-proposal describing exactly where in a DOD program a full proposal would fit. As the data call response stated, "Without strong encouragement from a DOD program manager, a pre-proposal is a non-starter."

2. Letters of Support

Although many committees are emphatic that successful proposals must have previously established connections with DOD program managers related to the specific proposal, states vary on how they ask for proof or evidence of formal commitments, such as a letter of support. The required inclusion of documented communication with a DOD program manager encouraging the proposal concept was indicated in the comments of 10 state committees. In these cases, the inclusion of documented contact was a requirement for the pre-proposal/white paper (seven instances) and/or the final proposal (seven instances).

Four committees did not explicitly indicate that documented communication with a DOD program manager is required in pre-proposals or proposals, but two committees did report that submitted proposals (as part of the state executive summaries) included such information. The purpose of including documented support in the proposal was often to indicate the proposed research's relevance to DOD mission. One committee indicated that documented endorsement by DOD was no longer required.

The requirement or emphasis of demonstrated communication and support also played a role in spurring investigators to develop relationships or communication channels with DOD program managers and/or reach out to DEPSCoR or university resources for facilitation of these relationships. As mentioned previously, some committees take an active role in funding investigators to visit DOD offices and facilities or hosting DOD program managers at universities to meet investigators.

E. Responsibility for Identifying Sources of Matching Funds

The available text of data call responses rarely (four responses) gave a direct indication of the party responsible for identifying the matching funds. The exact nature of matching funds

varies by state, institution, and project, although it is evident that some states rely heavily on the PIs' institutions to meet program requirements.

For the sources of matching funds, coded responses were identified for most states. However, the states differ on the strategy for securing matching funds. Text from 19 committees gave information on the source of the matching funds. The most common source of matching funds was the PI's home university (11 instances); however, the university was the sole source of matching funds for only a minority of these cases (4 instances). For instance, the South Dakota data call response stated that, "Because we are unable to provide cost-share for DEPSCoR on a state-wide, appropriated dollar basis, the DEPSCoR program has had to rely almost exclusively on university investments to meet the required cost-share. The required cost-share is verified by the state EPSCoR Office on behalf of the state EPSCoR Advisory Committee before submission of the proposals." State (five instances, including state EPSCoR funds) and private sector or industry funds (two instances) were also described as the source of matching funds. State funds served as the sole source of the match in three states: Maine, South Carolina, and Kansas.

F. Proposal Review Processes

1. Identity of Reviewers

In general, state committees prefer to have peer-review panels (external) review the proposals. Eleven data call responses indicated that states assign panels to review pre-proposals. Sometimes these external panels are out-of-state. For instance, the Louisiana data call response stated that the State EPSCoR committee, "convened a four-member review panel of distinguished out-of-state experts from institutions around the country." A committee may seek out-of-state experts for several reasons, apart from avoiding the possible conflict of interest issues of remaining in-state. Choosing reviewers nationwide (or from neighboring states) allows the marshalling of additional expertise in the review process. States that use internal committees (or subcommittees), such as Montana and Maine, opt to appoint review members only if no conflicts of interest exist. Some states (e.g., Oklahoma) add experts who have military procurement backgrounds or work at DOD laboratories and can offer opinions about whether the proposals are well aligned with DOD mission priorities.

2. Review Criteria

Committees worked to ensure that proposals met state infrastructure/capacity-building targets and reflected the mission or research needs of DOD. Responses that *explicitly* mentioned proposal review criteria were available from 13 state committees, all of whom included

alignment or reflection of the proposal with DOD's mission or stated priority areas. Similarly, all states for which responses could be identified indicated that they reviewed proposals with criteria designed to meet their state capacity-building in science and technology (S&T). One representative example is Idaho, where proposals are reviewed to see whether they fit within the "Core S&T Competencies" identified by the state as research infrastructure priorities and whether they build upon previous investments in facilities and evaluate "the potential contributions of the proposed research to the defense missions of the participating agencies." Another example is Maine, a state that has a Science and Technology Action Plan developed by the Maine Office of Innovation. This plan offers five different key objectives that are reflected in the stated review criteria, alongside the criterion to "address critical needs of the targeted DOD agency." In general, the DEPSCoR review process is designed to reflect the DOD's interests and to advance state S&T infrastructure and capacity-building. *Such processes are, therefore, consonant with legislatively authorized objectives (as described in Section 1) and DOD review criteria (as described in Section 3).*

G. Description of Fields of Research of 2007–2008 DEPSCoR Proposals

The 2007 and 2008 executive summaries provide detail regarding the content of the DEPSCoR proposals submitted during those competitions; each proposal is described by an abstract of at least paragraph length. The field of research described by each proposal was uniquely coded into one of six distinct topic areas: (1) Computer, Electrical, Network, and Information Systems; (2) Nanotechnology, Nanoscience, and Materials Research; (3) Biosciences, Chemistry, Chemical and Bio-Engineering; (4) Environmental and Geo-Sciences; (5) Civil, Mechanical and Manufacturing Engineering; and (6) Physics.

As shown in Table 4-1, nearly three-quarters of the proposals were best-classified as either "Computer, Electrical, Network, and Information Systems" or "Nanotechnology, Nanoscience, and Materials Research." Most states (e.g., Arkansas, Delaware, Kentucky, Nebraska, New Hampshire, Tennessee) proposed research in one of those two areas, but several states (e.g., Alaska, Louisiana, Maine, Montana, Wyoming) submitted research that spanned a broad range of scientific disciplines and topic areas.[49] The results of this analysis—at least at a

[49] A parallel attempt was made to relate proposals to state-level focus areas or priorities, as indicated in either the executive summaries or state Science and Technology Plans. Several difficulties arose in this analysis: (1) not all executive summaries contained a statement of focus areas, and not all plans were publicly available through an Internet search; (2) where both state plans and focus-area descriptions were available for a given state, they did not necessarily describe the same areas of focus; and (3) the breadth of the focus areas varied substantially among states. For example, Arkansas' description of state science and technology priority areas is, "Advanced materials and manufacturing systems (emphases on: electronics, nanotechnology, photonics, lean manufacturing); Environmental Sciences (emphases on advanced thermal, energy and renewable resources,

high level—suggest that it is not possible to identify specific "ecological niches" filled by proposers from particular states from these 2 years' worth of proposals analyzed.

Table 4-1. Categorization of the Field of Research of DEPSCoR Proposals: 2007 and 2008 Competitions, by State

State	Computer, Electrical, Network, & Information Systems	Nanotechnology, Nanoscience, and Materials Research	Other	Percentage Either Computer Science/Information Systems or Nano/materials	Number of Distinct Topic Areas
Alaska	1	1	6	25	5
Arkansas	2	6	0	100	2
Delaware	0	3	0	100	1
Idaho	2	0	1	67	2
Kansas	5	1	2	75	3
Kentucky	6	2	0	100	2
Louisiana	4	0	4	50	5
Maine	1	3	4	50	4
Montana	1	3	3	57	4
Nebraska	1	6	1	88	3
Nevada	5	0	3	63	2
New Hampshire	2	5	1	88	3
North Dakota	2	2	1	80	3
Oklahoma	1	4	3	63	4
Puerto Rico	1	2	0	100	2
Rhode Island	2	3	3	63	5
South Carolina	4	3	1	88	3
South Dakota	0	3	2	60	3
Tennessee	1	4	0	100	2
Vermont	4	0	1	80	2
West Virginia	3	3	1	86	3
Wyoming	3	2	3	63	5
Total	51	56	40	73	–

Source: IDA Analysis of 2007 and 2008 State Executive Summaries

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geosystems and environmental impacts, sustainability); Biotechnology, Bioengineering, Agriculture, and Life Sciences (emphases on genetics; geriatrics; medical devices; neuroscience; nutrition; oncology; nanotoxicology); Information technology (emphases on data, knowledge, and systems engineering, data and information quality, distributed systems, software development, applications to bioinformatics, health care, logistics, and transportation)" (http://www.accessarkansasscience.org/pdf/2008%20R&D%20Plan.%20pdf.pdf, page 1, last accessed September 29, 2008). Tennessee, on the other hand, identified a regional set of priorities, "Energy, Environmental, and Transportation Technologies (Chattanooga); Advanced Manufacturing, Design, and Logistics (Memphis); Drugs and Medical Products (Tri-Cities); Nanotechnology and Advanced Materials (Knoxville/Oak Ridge); Health Management and IT (Nashville)" (http://www.tntechnology.org/pdfs/TIRM.pdf, pages 31–33, last accessed September 29, 2008. Given the lack of comparability, no results are reported in this section.

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Section 5.
An Analysis of the Advantages and Disadvantages of Having an Institution-Based Formula for Qualification To Participate in the Program When Compared With the Advantages and Disadvantages of Having a State-Based Formula for Qualification To Participate in Supporting Defense Missions and the Objective of Expanding the Nation's Defense Research Infrastructure

A. Methods

This section, supplemented by Tables A-17 to A-23 in Appendix A, considers the possible implications of state-based or institution-based eligibility for DEPSCoR. It begins by exploring a range of options for state- and institution-based formulae. Advantages and disadvantages are then discussed with respect to

- Determining eligibility and the likely number of participants in the program
- Eliciting qualified applications to support defense missions
- Expanding the nation's defense research infrastructure.

The analyses in this section assume that all elements of the DEPSCoR program design, apart from eligibility criteria (e.g., research grants as the form of awards, co-funding required, approximately $10 million per year in programmatic funding), remain constant. Section 6 contains a broader assessment of the relationship of program goals, funding levels, and programmatic forms.

B. Options for State- and Institution-Based Formulae

Before the advantages and disadvantages can be compared, the terms "state-based formula" or "institution-based formula" have to be clarified. In simplest terms, a state-based formula is an eligibility criterion based on the attributes of the state or territory in which an applicant's institution is located. An institution-based formula is one in which eligibility is based on characteristics of the institution, regardless of the state in which it is located.

In both cases, specifying an actual formula for eligibility requires at least two steps:

1. Defining state- or institution-based research capacity and selecting appropriate metrics
2. Setting appropriate minimum or maximum thresholds relative to the selected metrics.

In theory, the possibilities for state- or institution-based formulae are infinite. The sections that follow discuss some possible metrics of research capacity at the state and institution levels and their implications for eligibility relative to the current formula.

1. State-Level Metrics of Research Capacity

Between 1997 and 2008, the DEPSCoR authorizing legislation mandated a state-based formula based on two criteria:

1. State participation in EPSCoR
2. Receipt of less than 1.2% of total DOD funding for S&E R&D to universities.

The first criterion underscores the state-based approach to capacity-building and Congress's desire for coordination across agencies' EPSCoR programs. Applications have been submitted through the EPSCoR state committees since the inception of the program. The second criterion suggests that Congress considers a state's success in competing for DOD research dollars to be the most important metric of state-level research capacity. However, both criteria impact eligibility. Figure 5-1 shows DOD S&E R&D funding to universities, by state, in FY 2005, the most recent year of NSF data available. All the DEPSCoR-eligible states are on the right-hand side but so are Iowa, Oregon, Wisconsin, Connecticut, Missouri, and Minnesota, six states that fall below the 1.2% threshold but have been excluded from previous DEPSCoR competitions because they do not participate in EPSCoR.[50]

Although the 1.2% threshold is the legislatively authorized measure of state competitiveness for federal R&D funding, it is not the only possible scale on which to measure state capacity. For example, the Milken Institute took a more diversified approach in its *State Technology and Science Index*, which aggregates 77 individual indicators of research capacity to produce a single score for each state.[51] If states are ranked according to this index, most of the bottom half

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50 As described in Section 2, a 2008 legislative change allows DOD to designate states below the 1.2% threshold that do not have EPSCoR committees DEPSCoR-eligible.

51 DeVol et al., *State Technology and Science Index: Enduring Lessons for the Intangible Economy*, Milken Institute, June 2008, p. 1.

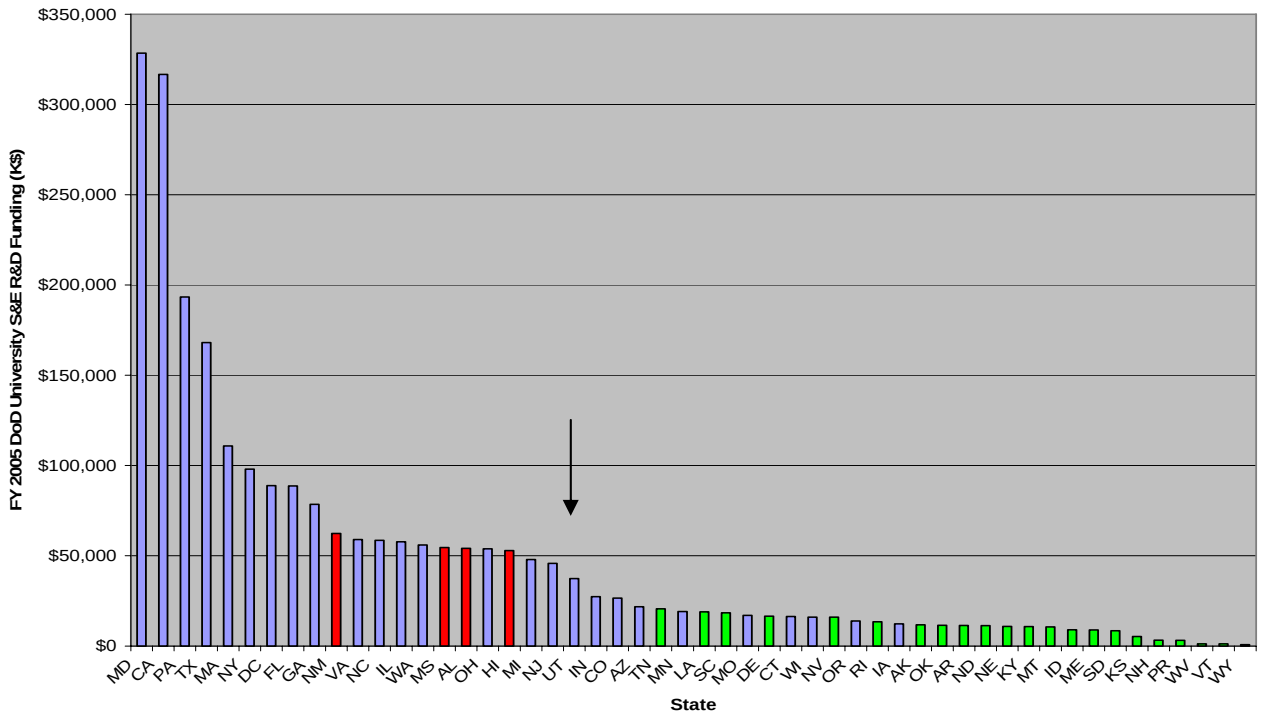

Figure 5-1. DOD Funding of University S&E R&D, FY 2005

Source: NSF/Division of Science Resources Statistics, Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions, FY 2005. Table 14

Note for Figure 5-1: *DEPSCoR-eligible states in FY 2008 competition in green, formerly eligible states in red, and others in blue.*

Note for Figure 5-1: *Arrow indicates that the 1.2% eligibility threshold falls between Utah and Indiana*

of states are currently or formerly DEPSCoR eligible (see Figure 5-2). However, two DEPSCoR states rank in the top quartile (New Hampshire at #9 and Rhode Island at #10), and four others are in the second quartile (Delaware at #14, New Mexico at #16, Vermont at #19, and Kansas at #24). Contrariwise, several of the states that fall below the 1.2% threshold and have not been DEPSCoR-eligible, such as Connecticut and Minnesota, have a very high Milken index score.

A similar approach is taken by the NSF in *Science and Engineering Indicators*, which presents 47 separate indicators of research capacity at a state level but does not attempt to aggregate them into a single score or ranking.[52] Table 5-1 summarizes seven R&D output measures for the 25 U.S. states (not including Puerto Rico) that have participated in the DEPSCoR program since 1995. Eleven DEPSCoR states (Alaska, Arkansas, Hawaii, Idaho, Maine, Montana, Nevada, North Dakota, South Dakota, West Virginia, and Wyoming) are in the bottom

52 National Science Board, *Science and Engineering Indicators 2008*, Arlington, VA (NSB 08-01; NSB 08-01A), January 2008, Chapter 8.

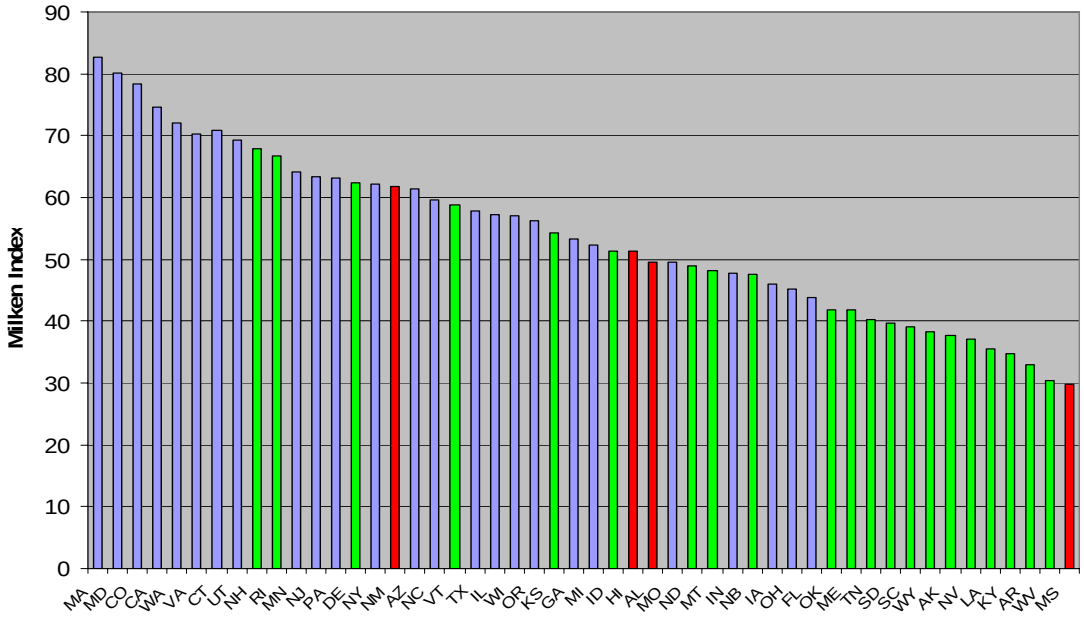

Figure 5-2. The 2008 Milken Institute State Technology and Science Index Rankings

Source: IDA Analysis of Milken Institute, State Technology and Science Index, Table 1, p. 2

Note for Figure 5-2: *DEPSCoR-eligible states in FY 2008 competition in green, formerly eligible states in red, others in blue.*

Table 5-1. Relative Ranking of DEPSCoR States in S&E Indicators Indexes of R&D Outputs, by Indicator

Indicator (2005 or 2005/6)	Top Quartile (N = 13)	Second Quartile (N = 13)	Third Quartile (N = 13)	Bottom Quartile (N = 12)
Academic article output per $1M of academic R&D	2	5	6	12
Academic article output per 1,000 S&E doctorate holders in academia	3	3	7	12
Industry-performed R&D as share of private-industry output	4	2	8	11
Academic patents awarded per 1,000 S&E doctorate holders in academia	3	5	7	10
Patents awarded per 1,000 individuals in S&E occupations See Note 2	2	4	9	9
Academic R&D per $1,000 of GDP, by state: 2005	7	4	6	8
S&E doctorates conferred per 1,000 S&E doctorate holders	5	5	8	7

Source: IDA analysis of National Science Board (NSB) *Science and Engineering indicators*, 2008 Tables 8-34 to 8-40

Note for 1 Table 5-1: *Quartiles include U.S. States plus the District of Columbia, but not Puerto Rico.*

Note for 2 Table 5-1: *For the "Patents Awarded" indicator, no data were available for Idaho in 2006.*

quartile for four or more of the indicators. Seven DEPSCoR states (Alabama, Delaware, Kansas, Nebraska, New Hampshire, Rhode Island, and Vermont) are in the top or second quartiles for more than half of the indicators. The other seven DEPSCoR states fall between these two extremes.

Finally, differences in state size (or the size of the state university sector) may be important in assessing research capacity. A threshold for eligibility based on a state's share of DOD funds normalized by population was recommended in a previous DOD Congressional report regarding state-level research capacity.[53] Figure 5-3 shows DOD research dollars normalized by state population. The contrast with Figures 5-1 and 5-2 is striking. A state-based eligibility criterion based on competitiveness for funding normalized by population would result in a very different set of eligible states.

2. Institution-Level Metrics of Research Capacity

Fewer readily available sources of information exist on research capacity at the level of the institution, particularly for defense-related basic research. Since DOD is likely to be the most important funder of defense-related research activities, a useful metric could be DOD S&E research funds to universities. In FY 2005, about 18% of DOD S&E R&D funds to universities were sent to institutions located in states that are currently or were DEPSCoR eligible (see Table 5-2). This percentage is roughly proportional to the DEPSCoR states' total share of 2005 population (see Table 5-2).[54]

C. Impact of Shifting From the Current State-Based Formula to an Institution-Based Formula

1. Eliciting Qualified Applications To Support Defense Missions

The most immediate impact of shifting from the current state-based formula for eligibility to an institution-based criterion would be a shift in the number and/or identity of eligible institutions. Table 5-3 describes the potential impact on the number of eligible institutions for

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53 Department of Defense, "The Department of Defense Report on Geographic Diversity of Support of Research at Academic Institutions," for the Committee on Appropriations, June 1990, pp. 12–27. The section identifies a range of normalizing factors including state population and number of academic researchers.

54 The Carnegie Foundation for the Advancement of Teaching, http://www.carnegiefoundation.org/classifications/ and http://www.carnegiefoundation.org/classifications/sub.asp?key=808&subkey=2594; last accessed July 18, 2008. The Carnegie Foundation has been periodically classifying institutions by level of research activity. Unfortunately for this assessment, the criteria for assessment changed for the 2005 classification, so it is not possible to compare institutions between the 2005 and earlier (2000, 1994) ranking periods.

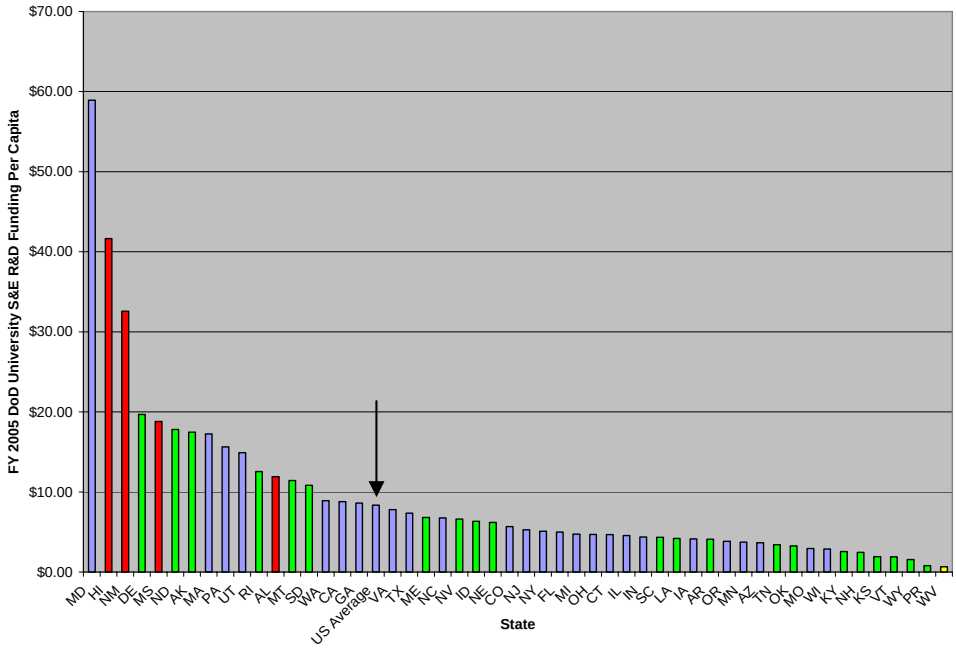

Figure 5-3: Per Capita DOD Funding of University S&E R&D, FY 2005

Source: Figure 5-1, normalized by population as taken from the U.S. Census Bureau, Table 1: Annual Estimates of the Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2007 (NST-EST2007-01), December 27, 2007 release

Note 1 for Figure 5-3: *Washington, DC, is not included on figure to preserve scale (per capita $152.03). Arrow denotes US average.*

Note 2 for Figure 5-3: *DEPSCoR-eligible states in FY 2008 competition in green, formerly eligible states in red, others in blue.*

Table 5-2. Percentage of 2005 DOD S&E R&D Funding to Universities, Population, and "High" and "Very High" Research Universities, by DEPSCoR Eligibility Status

Eligibility	Percent DOD University S&E R&D	Number "Very High" Plus "High" Research Institutions	Percent "Very High" or "High" Research Institutions	Percent of Population, 2005
Ever eligible, 1997–2008	18	49	25	20
Never eligible	76	125	63	68
Potentially newly eligible based on FY 2008 Authorization	6	25	12	12

Source: IDA Analysis of Carnegie Rankings, Census data for July 1, 2005, from Population Division, U.S. Census Bureau, Table 1: Annual Estimates of the Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2007 (NST-EST2007-01), Release Date: December 27, 2007

Table 5-3. Number of Universities With Non-Zero DOD Research Funding in 2005 Potentially Eligible To Participate in DEPSCoR Based on Institution-Level Thresholds

Maximum DOD Funding Threshold	All Universities With Non-Zero DOD Research Funding in 2005	Eligible for the 2008 Competition	Potentially Eligible for the 2009 Competition
No limit	360	77	114
$10 million	316	75	109
$5 million	269	65	90
$3 million	231	55	76
$1 million	157	36	52

Source: IDA analysis of NSF Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions, 2005.

some possible threshold values for DOD funding to institutions. Table 5-3 includes only those universities that received non-zero DOD research funding during FY 2005. For comparison the average DOD research funding received by these institutions in FY 2005 was $4.5 million ($1.63 billion divided among 360 institutions), with a median of $1.5 million. Including institutions that did not receive any DOD research funding would add hundreds of additional eligible institutions.

As Table 5-3 demonstrates, substituting even a relatively low institution-based threshold for the 2008 state-based criteria would substantially increase the number of institutions, currently receiving DOD funding, which would be eligible to participate in the program. For instance, a maximum threshold of $3 million in DOD research funding would result in a pool of 231 eligible institutions that currently receive DOD research funding, compared with only 77 institutions receiving DOD funding that were eligible for the 2008 competition and 114 that may be eligible in 2009 (see Table 5-3).

Shifting to an institution-based formula would change not only the number, but also the identity of the eligible institutions, with new universities becoming eligible and previously eligible institutions becoming ineligible. Table 5-4 gives some examples of specific universities that would be included or excluded at particular threshold levels, assuming that the current state-based criteria had been replaced by an institution-based threshold for DOD research dollars to universities in FY 2005. Different campuses of state universities are usually treated in the NSF data as separate, eligible institutions.[55] Table 5-4 identifies particular universities in DEPSCoR

[55] There are states (e.g., Colorado), however, where only one listing was provided for the full state university system. In such cases, all funding was arbitrarily assigned to the flagship institution.

Table 5-4. Institutions Newly Excluded or Included by Institution-Based Thresholds Based on DOD Research Funding, FY 2005

Threshold	Institutions That Were Eligible in 2008 but Would Become Ineligible With an Institution-Based Threshold of That in Column 1	Examples of Institutions That Were Ineligible in 2008 but Would Become Eligible With an Institution-Based Threshold of That in Column 1
$10 million	University of Nevada, University of Delaware	University of Minnesota, Boston University, University of Virginia, University of Arizona, University of North Carolina-Charlotte, University of California-San Francisco, University of New Mexico, Auburn University, George Mason University, Ohio State University, University of Connecticut, Washington State University, North Carolina State University, Cornell University, Oregon State University, University of Massachusetts-Amherst, University of Illinois-Chicago, University of Notre Dame, Colorado State University, University of Iowa, University of California-Davis, Utah State University, Rice University
$5 million	North Dakota State, Clemson University, Louisiana State University, University of Alaska-Fairbanks, Vanderbilt University, Brown University, University of Nebraska-Lincoln, University of Maine, South Dakota School of Mines and Technology, Medical University of South Carolina	Michigan State University, College of William and Mary, Indiana University, University of Cincinnati, University of North Texas, New Mexico State University, Jackson State University, Virginia Commonwealth University, University of California-Santa Cruz, Florida Atlantic University, Mississippi State University, Yale University, Iowa State University, Hampton University, Emory University, Wake Forest University, Drexel University, Miami University, Case Western University, Brigham Young University
$3 million	University of Rhode Island, University of Idaho, University of Arkansas-Fayetteville, University of Oklahoma, University of Tennessee-Knoxville, University of Louisville, Boise State University, University of Nevada-Las Vegas, University of Nebraska Medical Center, Montana State University-Bozeman	Alabama A&M University, Clarkson University, Florida A&M University, Georgetown University, Howard University, New Jersey Institute of Technology, Old Dominion University, Rose-Hulman Institute of Technology, San Diego State University, State University of New York (SUNY)-Buffalo, Temple University, Texas Tech University, Tufts University, University of California-Irvine, University of Maryland-Baltimore, University of Chicago, Washington University-St. Louis, Wright State University

Source: IDA analysis of NSF Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions, 2005

states that would be ineligible under particular institution-based thresholds, (e.g., the University of Delaware and the University of Nevada if all universities receiving more than $10 million for DOD research in 2005 were excluded).

Tables 5-5 and 5-6 demonstrate the potential impact on eligibility for the institutions that were classified as “Very High” and “High” research universities by the Carnegie Foundation in 2005. Only 13 of the 96 (14%) “Very High” institutions are currently eligible, which would increase to 28 of the 96 (29%) if the EPSCoR requirement is removed for the 2009 competition. At an institutional threshold level of $5 million, 31 of the 96 (32%) “Very High” research

Table 5-5. Eligibility of Carnegie "Very High" Research Universities With Potential Threshold Values Based on DOD Research, FY 2005

Threshold Value	Eligible for 2008 Competition	Eligible If EPSCoR Requirement Is Removed	Eligible Under Institution-based Formula	Total "Very High"
Current criteria	13	28	N/A	96
$3 million threshold	6	9	21	96
$5 million threshold	8	14	31	96
$10 million threshold	12	25	59	96
No threshold	13	28	96	96

Sources: IDA analysis of Carnegie Foundation rankings and the NSF Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions

Table 5-6. Eligibility of Carnegie "Very High" Plus "High" Research Universities With Potential Threshold Values Based on DOD Research, FY 2005

Threshold Value	Eligible for 2008 Competition	Eligible If EPSCoR Requirement Is Removed	Eligible Under Institution-Based Formula	Total "Very High" + "High"
Current criteria	38	63	N/A	199
$3 million threshold	20	33	90	199
$5 million threshold	28	44	121	199
$10 million threshold	36	59	158	199
No threshold	38	63	199	199

Sources: IDA analysis of Carnegie Foundation rankings and the NSF Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions

universities would be eligible, which is roughly comparable to the number that may be eligible for the 2009 competition. At higher threshold levels, however, substantially higher fractions of the "Very High" research universities become eligible (see Table 5-5).

When "High" research universities are included, however, there is a dramatic difference. Thirty-eight of 199 (19%) are currently eligible, and 63 of 199 (32%) would be eligible were the EPSCoR requirement for DEPSCoR participation removed. However, 121 of 199 (60%) would be eligible under a $5-million threshold (see Table 5-6).

Taken together, these findings suggest that shifting from either the 2008 state-based formula or a state-based formula allowing participation by states that do not have EPSCoR committees to an institution-based formula would increase the number of eligible institutions, including a dramatic increase in eligibility for institutions classified as "High" research institutions by the Carnegie Foundation. The percentage of FY 2005 DOD S&E funding going to

"Very High" ranked institutions is 69% ($1.12 billion of $1.63 billion), with the average institutional amount being $11.8 million. An additional 17% of DOD research funds went to "High" ranked universities ($273 million of $1.63 billion), with the average institutional amount being $2.7 million. The remaining 14% ($228 million) went to 172 other institutions.

As shown in Tables 5-5 and 5-6, a shift from a state-based to an institution-based formula is likely to improve the quantity of high-quality proposals submitted because it expands the number of highly rated, eligible institutions. Taking the "Very High" and "High" ranked institutions as an indicator, shifting to an institution-based threshold of $5 million in DOD research funding would increase the number of eligible universities by a factor of three (from 38 to 121). A shift to the different state-based formula as enabled by the FY 2008 Defense Authorization also has the potential to expand the pool of eligible institutions, but the newly eligible institutions would be located in a smaller number of states as compared with an institution-based approach and would include several universities that received more than $10 million in DOD research funding in FY 2005.[56]

2. Expanding Defense Research Infrastructure

Unlike considering eligibility and funding levels, which can be defined in a fashion that allows for direct quantitative comparison of state- and institution-based formulae, the potential impact on "expanding the defense research infrastructure" is difficult to predict or quantify. The following paragraphs discuss the potential advantages and disadvantages of a shift to an institution-based formula for several aspects of defense research infrastructure-building objectives.[57]

One potential disadvantage of shifting to a purely institution-based formula is that it would limit the ability of the state EPSCoR committees to coordinate infrastructure and capacity-building at the state level. Under the DEPSCoR program as managed through the FY 2008 solicitation, states identify their own capacity-building priorities and carry out strategies to meet them. Examples of capacity-building priorities that might require coordination at the state level include collaborations across multiple institutions or with external stakeholders, such as industry or DOD facilities. As discussed in Section 4, capacity-building in response to state priorities is a primary filter for pre-proposals in some states, and, as discussed in Section 3, all DEPSCoR

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56 Colorado State University, Oregon State University, Purdue University, University of Connecticut, University of Iowa, University of Minnesota, University of Notre Dame, University of Wisconsin, and University of Colorado.

57 The following paragraphs describe the strengths and weaknesses of the current state-based EPSCoR model and a "pure" institution-based model whereby there is no coordination through a state committee. In practice, combinations of these approaches could also be designed.

proposals must be related to state-level infrastructure-building objectives. In most DEPSCoR states, the largest public university would be the first to be excluded under an institution-based threshold; therefore, an institution-based approach could jeopardize infrastructure-building strategies that involved those institutions.

If state-level capacity-building is an important goal, the continuation of the DEPSCoR program in its current form may be preferable. The EPSCoR approach gives states the flexibility to design and implement strategies specific to their individual priorities.

A second potential disadvantage of a shift to an institution-based formula is that it could potentially divert resources away from traditionally underserved states, decreasing the likelihood that those states will ever develop a significant defense-related basic research infrastructure. If Congress considers a move toward greater equity for all states and territories in the distribution of DOD funding as the definition of expanding the defense research infrastructure, an institution-based formula would work against this goal.

On the other hand, if Congress aims to increase equity in distribution of funds and infrastructure to currently underserved institutions, regardless of their geographic location, an institution-based formula would be more effective than a state based formula. As demonstrated previously, the current state-based formulae result in eligibility for several institutions that already have substantial levels of basic research funding from DOD, while a large number of institutions in ineligible states receive little or no DOD research funding. Restricting DEPSCoR eligibility using a threshold based on existing DOD funding would necessarily channel funding only to those institutions that do not currently receive amounts of DOD funding above the threshold. Another advantage of an institution-based approach is that successful institutions would "graduate" from the DEPSCoR pool, allowing researchers at other institutions to take advantage of the program.[58]

A final definition of "national research infrastructure" that was identified during the assessment—and was also defined as such by one of the DEPSCoR service program managers—was to expand the number of investigators who are engaged in defense research. State- and institution-based eligibility approaches have different strengths in this regard. The state-based approach allows EPSCoR committees to devote state-level resources to mentoring investigators new to defense research. As described in Section 4, some states do facilitate collaborations

58 This was one of the arguments made in a 1990 DOD study for Congress for the value of the Research Initiation Program (RIP) program relative to a DEPSCoR-like program. "The Department of Defense Report on Geographic Diversity of Support of Research at Academic Institutions," for the Committees on Appropriations, June 1990. DOD study, pp. 31–33. RIP is described in greater detail in Section 6.

among investigators and with DOD program managers, although states have the discretion whether to focus those resources on “new” or “established” investigators. Moreover, at universities in DEPSCoR states, investigators who have stronger DOD ties and wish to become more active in defense research can begin to engage in defense research as co-investigators on existing proposals and can thereby meet DOD program managers and come to understand defense research priorities.

An institution-based approach, however, is more specifically targeted at those universities where investigators historically have not had strong relationships with DOD. Restricting the DEPSCoR pool solely to investigators at institutions below a threshold could potentially help investigators at those institutions build relationships with DOD and engage in defense-related research. The learning-by-doing approaches to becoming involved in defense research are less accessible to junior researchers in institutions without substantial DOD basic research funding, and, therefore, involving such investigators would require programmatic effort by DOD. The disadvantage of the institution-based approach for this purpose, however, is that the large number of research institutions potentially eligible (as shown in Table 5-6) could pose an administrative challenge for DOD program managers, especially since non-EPSCoR states may not have the structures to facilitate collaboration that those participating in the EPSCoR program have constructed.

Section 6.
An Identification of Mechanisms for Improving the Management and Implementation of the Program, Including Modification of the Statute Authorizing the Program, Department Regulations, Program Structure, Funding Levels, Funding Strategy, or the Activities of the State Committees

A. Methods

This section, supplemented by Table A-24 in Appendix A, addresses potential mechanisms for improving the management and implementation of DEPSCoR. Findings from the first five sections are synthesized to assess the program as currently structured and implemented. Alternative possible strategies and models for achieving DEPSCoR program goals are also addressed.

B. Assessment of the Program as Currently Implemented

1. Attainability of Capacity-Building Goals Given Current Funding Levels

Between FY 2005 and FY 2008, funding for the DEPSCoR program was on the order of $10 million per year. Twenty-three states were potentially eligible to share this amount, so approximately $0.5 million were available per state per year (see Figure 6-1). The threshold value of 1.2% of DOD S&E R&D funding for FY 2005 (the last year for which NSF data were available) was $30 million, or more than 60 times the per-state average. In contrast, the 1995 average of $1.4 million per state per year was only about one-twentieth of the 1.2% threshold of $19 million. While it is not entirely clear that even the early funding levels were sufficient to move states toward the 1.2% threshold, it seems highly unlikely that a funding level of less than one single-team award per state per year will be sufficient to do so. Furthermore, if an additional 12 states and territories become eligible for future competitions because of the changes to the FY 2008 authorization, this average is likely to drop further still.

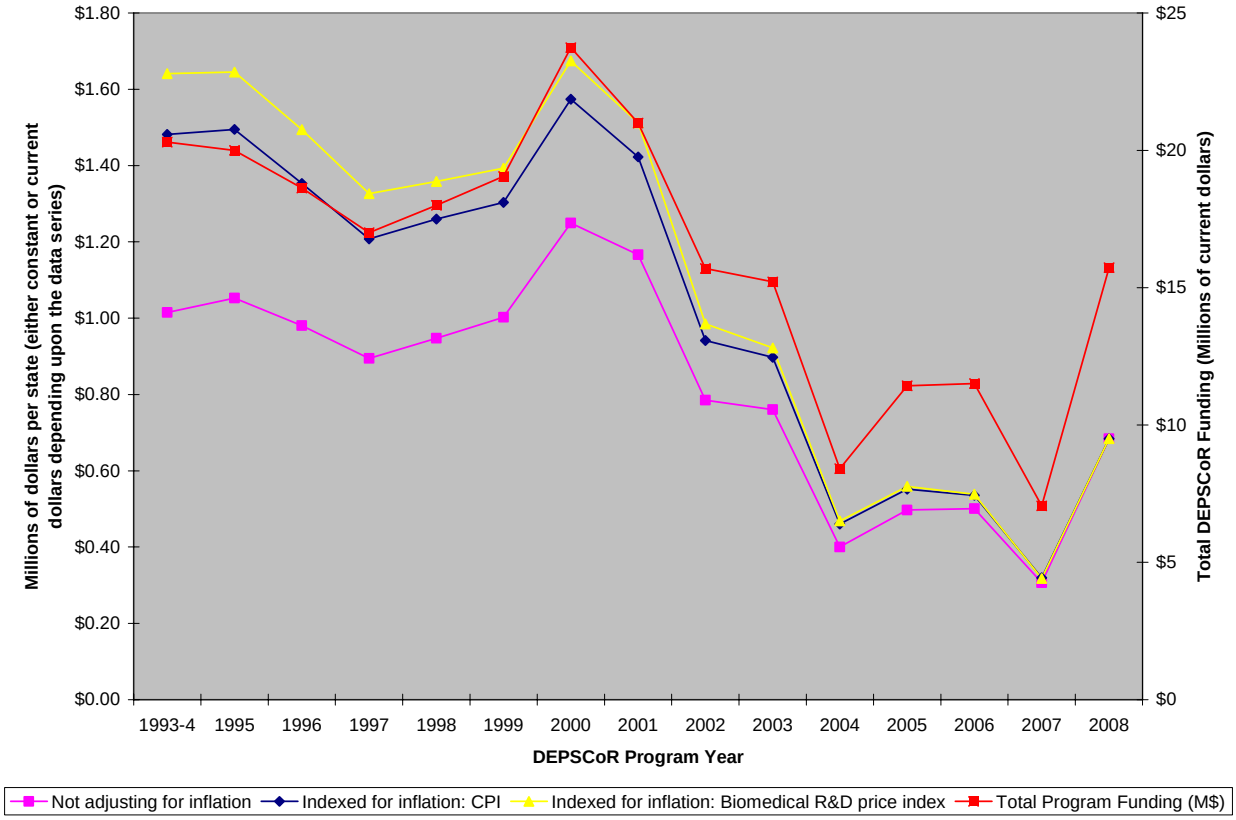

Figure 6-1. DEPSCoR Funding per State, by DEPSCoR Program Year

Sources: DEPSCoR funding and number of eligible states from IDA analysis of DEPSCoR news releases, Consumer Price Index calculated using CPI Inflation Calculator, available from http://www.bls.gov/CPI/, last accessed July 14, 2008; NIH-calculated Biomedical Research and Development Price Index (a measure of the cost of research, specifically) available from http://officeofbudget.od.nih.gov/UI/2008/BRDPI%20Table%20of%20Annual%20Formulas_01_04_2008.xls, last accessed July 14, 2008

Note for Figure 6-1: *IDA calculation of total DEPSCoR funding divided by number of eligible states, adjusted for inflation as described. Other methods of calculating inflation can also be used but lead to directionally similar findings.*

2. Consistency of Programmatic Objectives With Legislatively Mandated Program Goals

As described in Section 1, the DEPSCoR program has two legislatively mandated goals:

1. To enhance the capabilities of institutions of higher education in eligible states to develop, plan, and execute S&E research that is competitive under the peer-review systems used for awarding federal research assistance
2. To increase the probability of long-term growth in the competitively awarded financial assistance that institutions of higher education in eligible states receive from the federal government for S&E research.

These two goals are not necessarily independent. The first goal, enhancing the capabilities of institutions of higher education, is to build research capacity at the institutional level in DEPSCoR states. The second goal, increasing the competitiveness for federal research funds, is a potential long-term consequence of accomplishing the first. The first goal can therefore be understood as a likely precursor but not a sufficient condition for the second. However, the first goal is a more appropriate programmatic target for DEPSCoR because research capacity development depends on factors that DEPSCoR might be expected to influence directly, whereas the flow of federal research dollars from other sources is by definition exogenous to the program.[59]

DEPSCoR program documentation suggests that the actual program, as implemented, is attempting to pursue a variety of objectives. Table 6-1 catalogs seven specific programmatic objectives identified from the authorizing legislation for the program, committee reports, DEPSCoR BAAs, and the authorizing legislation for this assessment. Five of these objectives are related to the overarching goal of enhancing institutions' capacity to plan and execute research (see Table 6-1, Objectives A–E), while two others (objectives F and G) are not. Similarly, five objectives (A, B, D, E, and F) are related to increasing the probability of long-term growth in research funding, but two others (C and G) are not. The objective related to operational use (objective G) is not related to either of the legislatively-authorized program goals.

C. Alternative Strategies and Models for Research Capacity-Building

1. Strategies for Research Capacity-Building

A variety of possible strategies could be pursued to achieve the DEPSCoR goal of building institutional research capacity, but no clear consensus exists in the public policy community about which strategy would be the most effective. In the discussion that follows, six capacity-building strategies of potential interest for DEPSCoR are described.

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59 In the terminology of program evaluation, the first goal describes a desirable program "outcome," while the second describes an "impact." Rossi and Lipsey define "outcome" as "the results of these [programs'] activities," while "impact" is defined as "the improvement in social conditions." Programs are typically designed to achieve objectives at the level of outcomes. For more information, see: Peter H. Rossi et. al., *Evaluation: A Systematic Approach, Sixth Edition*, Sage Publications: Thousand Oaks, 1999; pp. 78, 202.

Table 6-1. Identified Objectives of the DEPSCoR Program

Objective	Source	Could Enhance Universities' Ability to Plan and Execute Research?	Could Increase the Probability of Long-term Growth in the Competitively Awarded Financial Assistance Institutions Receive?
A. Expand the national/state-level research infrastructure	Authorizing legislation for program; Authorizing legislation for assessment; Committee reports; BAA review criteria	Yes	Yes
B. Fund infrastructure at individual universities	Authorizing legislation; BAA review criteria	Yes	Yes
C. Contribute to the education of future scientists and engineers in disciplines critical to the DOD mission	Authorizing legislation; Committee reports; BAA review criteria	Yes	Not directly
D. Enhance involvement and interaction with DOD or other federal laboratories, industry, or other existing research centers of excellence	BAA review criteria	Yes	Yes
E. Develop world-class researchers	Committee reports	Yes	Yes
F. Contribute to the defense missions of the sponsoring agencies	Authorizing legislation for assessment; BAA review criteria	Not directly	Yes (from DOD only)
G. Activities lead to, or are fundamental to, applications used by, or supportive of, operational users	Authorizing legislation for assessment; Committee reports	Not directly	Not directly

Source: IDA legislative analysis and analysis of BAAs

a. Strategy 1: Fund Individual Investigators Who Are New to Defense-Related Basic Research

One possible strategy for DEPSCoR that would be consistent with program goals would be to provide incentives to draw new investigators into defense-related basic research. Under this scenario, DEPSCoR would most likely award funding for a set number of years on a competitive basis to individuals at eligible institutions. The capacity-building success of a program built around this strategy would depend to a large extent on selecting the right individuals—specifically, the individuals with the most potential to use the grant experience to increase their

probability to get future funding. These individuals might be junior investigators or senior investigators lacking prior DOD research experience. Potential outcomes would include increased ability on the part of awarded individuals to compete for DOD 6.1 research funds.

b. Strategy 2: Fund Pilot Projects in Strategic Areas of Need

A second possible strategy would be to develop sustainable research programs that focus on topics chosen strategically to meet particular capacity-building goals. Such goals might include

- Taking advantage of local defense infrastructure (e.g., military bases or test sites located near DEPSCoR-eligible institutions)
- Meeting state-level capacity-building priorities as established by the state EPSCoR committees
- Filling perceived gaps in the DOD portfolio of basic research.

The goal of such an approach would be to encourage DEPSCoR-eligible institutions to focus on developing research programs in areas of particular interest to DOD. Funds for pilot projects would likely be awarded on a competitive basis to investigators or teams at eligible institutions. To ensure that additional funding would be available to continue promising research begun through funded pilot projects, it would be advantageous to create close ties between this kind of DEPSCoR program and other military research programs so that successful collaborations could be sustained through other funding sources. In theory, such a program might also help to ensure that more of the military facilities and resources that are already distributed across the country are leveraged for basic research.

c. Strategy 3: Increase Access to Research Infrastructure for Eligible Institutions

A third possible strategy would seek to provide researchers at eligible institutions access to resources (e.g., equipment, facilities) to enable defense-related basic research. This strategy assumes that otherwise-competitive investigators may be hampered in their ability to conduct research (or to apply for funding) because they lack access to equipment or other physical infrastructure. A variety of program forms could be used to meet this objective. Options include

- Funding (to individual investigators at eligible institutions) research awards that include for the purchase of equipment
- Giving larger scale support for shared resources
- Funding institutional infrastructure directly, either as a stand-alone program or as part of a larger program, such as DURIP

- Allowing investigators at eligible institutions to make use of existing resources at nearby DOD laboratories, other federal laboratories, or centers of excellence.

d. Strategy 4: Fund Research Collaboration

A fourth possible strategy would be to focus on providing incentives for collaboration, especially between researchers at eligible institutions and DOD laboratories and research facilities and/or with industry.[60] Eligible collaborations would include at least one investigator from a DEPSCoR-eligible institution and at least one collaborator from industry or a DOD laboratory. Potential benefits include forging new relationships and creating opportunities for synergy. Training for graduate students or postdocs in military or industry labs might also be allowed as part of the collaboration. To facilitate the formation of such collaborations, actively recruiting potential collaborators from within the military or industry and facilitating "matching" of interests through active management might be helpful. The most important outcome for a program structured this way would be success in creating new and productive collaborations for defense-related research. In the longer term, one measure of success would be whether those investigators acquired additional funding to continue defense-related research. Because this type of strategy is likely to facilitate communication and technology transfer across institutional boundaries, it is also well suited to produce research that can be transitioned to operational use.

e. Strategy 5: Fund Training and Cross-Training

A fifth possible strategy would be to fund training and cross-training activities. Funding training for graduate students and postdoctoral fellows would have the short-term benefit of increasing the supply of labor available at eligible institutions and the long-term benefit of expanding the pool of researchers trained to conduct defense-related research (although training alone would not guarantee that these new researchers would remain in DEPSCoR-eligible states).[61] Training and cross-training for faculty members would likely be more difficult to implement but would be more effective in terms of retaining trained personnel at eligible institutions.

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60 Both the NASA and Department of Energy (DOE) EPSCoR programs have adopted this programmatic form. EPSCoR/IDeA Foundation, "EPSCoR/IDeA in Fiscal Year 2009," March 2008, pp. 7–8.

61 The NIH's IDeA Networks of Biomedical Research Excellence (INBRE) program is an example of an EPSCoR-like program that focuses on training. INBRE supports graduate students and postdoctoral fellows at research institutions in IDeA states; the creation of "pipeline" activities aiming to increase the number of students in undergraduate institutions or community colleges pursuing health research careers; and biomedical workforce training. See NIH Program Announcement PAR-08-150. To provide another example, the original DEPSCoR awards made through the 1991 competition were designed as a training supplement to existing DOD awards.

f. Strategy 6: Fund Non-Research Activities

A sixth possible strategy would be to facilitate research and career support activities such as faculty hiring, travel, networking, grant writing, project planning, and curriculum development for investigators at eligible institutions. A DEPSCoR program designed around this objective could take the form of small grants awarded competitively to individual investigators to support specific activities.[62] Alternatively, the program could make larger awards to eligible institutions and allow these institutions to distribute the funds to investigators pursuing defense-related research objectives. Potential outcomes include increased ability to compete for funds and more rapid career development for investigators in defense-related fields at eligible institutions.

2. Potential Models for a Redesigned DEPSCoR

The previous section described six "pure" strategies that might be useful in thinking about how to redesign DEPSCoR. In reality, however, most programs that have goals as ambitious as DEPSCoR pursue multiple strategies. The descriptions of the actual capacity-building programs that follow illustrate three distinct approaches: a state-level model, a centers model, and an investigator-level capacity development model. A detailed analysis of the success of each program at meeting its own goals was beyond the scope of this assessment, but examples of each program type are well established and long running.

a. State-level Model: Research Infrastructure Improvement (RII)

The NSF EPSCoR RII award provides funds to institutions in eligible states to support research capacity-building activities. These include

- Startup funding for new faculty and retention funding for existing faculty
- Development of partnerships/collaborations across universities within a state or between universities and industry within a state
- Development of partnerships/collaborations with federal laboratories
- Training for graduate students
- Purchase of equipment and other physical infrastructure.

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62 The National Science Foundation's Research Infrastructure Improvement (RII) awards are an example of this capacity-building strategy used by the NSF EPSCoR program. See NSF Program Solicitation 08-500. According to the NSF awards database, RII awards active in fiscal year 2008 were funded at approximately $57 million.

NSF RII allows up to $3 million per year for up to 5 years of funding for each participating state. Only one award per EPSCoR state is made, and institutions are eligible to participate as designated by the state EPSCoR committee. Activities must be linked to the EPSCoR state's State Science and Technology Plan. The currently funded EPSCoR RII awards employ a variety of strategies. Some states' awards are single institution while others fund capacity-building activities at multiple sites. Some states focus on a single theme or disciplinary focus, while others support capacity-building in multiple research areas.

The RII program is administratively similar to the current DEPSCoR program because it relies upon the EPSCoR state committees to determine capacity-building priorities and coordinate proposals at the state level. Unlike DEPSCoR, however, RII funds infrastructure-building activities directly rather than as a component of research projects. The RII awards are also substantially larger than the DEPSCoR awards, and they are managed separately from the NSF portfolio of research awards.

The active RII awards were categorized using the same approach that was used for categorizing DEPSCoR proposals. Nineteen of the 25 (76%) active RII awards include support either for computer science/information technology/networking or for nanotechnology and other materials research. Unlike the DEPSCoR awards, however, RII awards also focus on biosciences (21 of 25 awards or 84%) and environmental and geosciences (14 awards or 56%).[63]

b. Centers Model: NIH Centers of Biomedical Excellence (COBRE)

The NIH COBRE program supports relatively large awards made to eligible institutions with the intention of creating centers of excellence.[64] The centers of excellence ("centers") model is based on the assumption that bringing together a critical mass of investigators, research, and infrastructure at a single location can lead to synergies. Activities supported by COBRE include

- Funding for research projects in similar or complementary fields
- Career development funding for junior faculty
- Purchase and maintenance of research equipment and other physical infrastructure
- Funding for organizational infrastructure.

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63 Because there is only one RII award per state, most awards support infrastructure creation across a range of disciplines.

64 See NIH Request for Applications RFA-RR-08-007.

The COBRE program allows up to $1.5 million per year in direct costs for 5 years of funding. Institutions in NIH IDeA states (analogous to the EPSCoR states) are eligible to participate. As of July 2008, 80 centers were active.[65] Each center must have an overall research plan that explains how the research projects, mentoring of junior investigators, and shared facilities funded by the COBRE award will cohere into a single center of excellence. Centers are also required to develop a plan and set of milestones that identify how COBRE-participating investigators will transition to support from traditional NIH grant mechanisms.

The centers model is administered differently from the current DEPSCoR program. Applications are submitted directly by the institutions, and there is no state-level coordination analogous to the role played by the EPSCoR state committees. The awards are also substantially larger than the current DEPSCoR awards. The logic of the centers approach requires concentrating resources in a single location to achieve critical mass.

c. Investigator-level model: Academic Research Enhancement Award (AREA) and Research Initiation Program (RIP)

The NIH AREA program and the former DOD RIP are examples of programs designed to expand capacity at the level of the individual investigator. AREA funds meritorious research proposals from investigators at institutions that have been traditionally underrepresented in biomedical research.[66] AREA awards are currently capped at $150,000 in direct costs for the entire 3-year award period. DOD created the RIP program in FY 1989 in response to a Congressional mandate to broaden participation by universities in the DOD University Research Initiative (URI). Investigators were eligible to submit proposals if their universities received less than $4 million in DOD support (in FY 1989 and 1990) or $3 million in support (in FY 1991). In FY 1990, RIP funded 30 awards, totaling $9.5 million, for an average award size of $316,000.[67]

The AREA and RIP models are similar to the current DEPSCoR model in that both aim to build capacity by making relatively small research awards to individual investigators at underrepresented institutions. Allowing for inflation, the RIP awards were roughly the same size as

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65 IDeA Program, COBRE Directory of Active Awards by State and Program July 2008. Downloaded from http://www.ncrr.nih.gov/research_infrastructure/resource_directory/cobre_directory.pdf; last accessed August 8, 2008. With 80 centers active at up to $1.5 million in direct costs (not including indirect costs), the COBRE program is funded in excess of $100 million per year.

66 Specifically, eligibility is limited to institutions that have received no more than $3 million per year in both direct and facilities and administrative (F&A)/indirect costs from NIH in 4 or more of the last 7 years. See Program Announcement PA-06-042.

67 The description of RIP is drawn from "The Department of Defense Report on Geographic Diversity of Support of Research at Academic Institutions," for the Committees on Appropriations, June 1990, pp. 4–10.)

DEPSCoR awards. The AREA awards are smaller than the current DEPSCoR awards, and, unlike DEPSCoR, they are intended to support research activities only rather than support a mix of research, training, and infrastructure-building. Also unlike the current DEPSCoR, AREA and RIP both use an institution-based criterion for eligibility. AREA also limits the number of times an individual investigator can be funded and the additional support that eligible investigators can receive from NIH, thus ensuring that the program continues to draw investigators who are new to NIH.

D. Recommendations for Improvement

The final portion of the assessment used all previous analyses and findings to identify mechanisms for improving the management and implementation of DEPSCoR. Assuming that the current DEPSCoR objectives and structure remain unchanged, several aspects of implementation could be improved. The assessment identified three changes that would improve current implementation of the DEPSCoR program in its current form.

Recommendation for Improvement 1: The DOD should change the current process for review of proposals to focus on investigators' future potential to conduct defense research rather than on their current research capabilities.

According to the legislative mandate, DEPSCoR is primarily intended to increase the ability of investigators at institutions of higher education in eligible states to compete for federal research funding. Following submission by the state EPSCoR committees, DEPSCoR proposals are evaluated by the services relative to four primary (and three secondary) criteria. Two of those primary criteria focus on the capacity-building potential of the proposal in that they examine the potential to train students and the potential to advance the research infrastructure goals of the university or state. The other two primary criteria, however, emphasize the current capabilities and experience of the PIs and the scientific merit of the proposed research. While these two sets of criteria do not necessarily conflict, they do bias the selection process toward applicants who have already achieved a moderate degree of success in competing for defense-related research funding, at the expense of those applicants who have potential but who have not yet had a chance to prove themselves. Such a bias is consistent with the program goals only if it is assumed that experienced investigators at eligible institutions are close to becoming competitive for DOD funding and need only the extra support from DEPSCoR to compete successfully in the future. The ARO data, which show that few DEPSCoR investigators have won their first other DOD award subsequent to winning DEPSCoR awards, suggest that this is not the case.

In contrast, a set of criteria more consistent with the program mandate would focus exclusively on the likelihood that participation in DEPSCoR would increase an applicant's ability to compete. Table 6-2 provides a proposed reframing of several of the review criteria. Similarly, application instructions should be intended for researchers to demonstrate not only the merits of their research and their current capabilities, but also how participation in the DEPSCoR program would allow them to engage in research trajectories that would be both scientifically meritorious and of value to the mission of the DOD.

Table 6-2. "Capacity-Building" Versions of Programmatic Review Criteria

Current Review Criterion	Alternate Version of the Review Criterion
The scientific and technical merits of the proposed research (Primary)	The potential for the investigator to contribute to the defense missions of the sponsoring agencies
The potential contributions of the proposed research to the defense missions of the sponsoring agencies (Primary)	
The qualifications, capabilities, experience, and past research accomplishments of the proposed PI, team leader and other key personnel who are critical to achieving the objectives of the proposal (Secondary)	The likelihood that after completing the DEPSCoR project the qualifications, capabilities, experience, and research accomplishments of the proposed PI team leader and other key personnel will be sufficient to propose and execute high-quality research critical to the defense missions of the sponsoring agencies
The proposed involvement and interaction with DOD or other federal laboratories, industry or other existing research centers of excellence (Secondary)	New collaborations formed or existing collaborations strengthened with DOD or other federal laboratories, industry, or other existing research centers of excellence

It may also be useful to place a limit on the number of DEPSCoR awards for which a single investigator can apply to ensure a robust supply of awards to investigators whose defense research experience is more limited.

Recommendation for Improvement 2: DOD program managers should be formally encouraged to serve as mentors and facilitators for DEPSCoR investigators seeking to engage in defense-related research.

As described in Section 3, no set of post-award management guidelines or procedures exist that pertain only to DEPSCoR awards. However, recognizing that many DEPSCoR investigators are new to the defense research community, some program managers who have DEPSCoR awards in their portfolios make a particular effort to serve as mentors. The possibility that DEPSCoR awardees may require particular attention in this regard should be officially acknowledged, and program managers should be formally encouraged to actively manage DEPSCoR awards to maximize capacity-building potential. Effective management can be enhanced further by documenting and sharing best practices across research portfolios and services.

Recommendation for Improvement 3: The DOD should create data systems that will allow systematic tracking of DEPSCoR activities and outcomes.

As described in Section 3, processes for collecting data on key DEPSCoR program activities and outcomes are neither adequate nor consistent across the services. Intensifying and harmonizing data collection processes would likely carry an efficiency cost for the sponsoring agencies up front, but long-term benefits include streamlined reporting and assessment as well as the possibility of active monitoring and adaptive program management. DEPSCoR, although now more than 15 years old, is by title an "experimental program." Sufficient data are critical to determine whether the experiment has been successful.

Recommendation for Improvement 4: Congress should re-examine and consider clarifying the DEPSCoR legislative mandate.

As described previously, certain aspects of the legislative mandate for DEPSCoR are ambiguous, creating potential for misinterpretation of legislative intent.

The legislatively-mandated DEPSCoR objectives are

- To enhance the capabilities of institutions of higher education in eligible states to develop, plan, and execute science and engineering research that is competitive under the peer-review systems used for awarding federal research assistance
- To increase the probability of long-term growth in the competitively awarded financial assistance that institutions of higher education in eligible states receive from the federal government for science and engineering research.

Two aspects of authorizing language with respect to objectives are worth noting:

1. Both objectives specify that the research *institution* is the level at which competitiveness is to be enhanced.
2. The program aims to enhance competitiveness for federal research funding in general rather than defense-related research funding in particular.

However, the authorizing legislation also specifies that eligibility for DEPSCoR should be determined at the *state* level and, since the Section 264 of the National Defense Authorization for Fiscal Year 1997, in reference to DOD funding levels. Through the 2008 competition, proposals were also required to be submitted through the state EPSCoR committees. Changes to the DEPSCoR to target competitiveness at the institution or state level and whether the program should focus narrowly on research that is relevant to DOD missions and priorities (and within that focus, whether the program should remain targeted towards 6.1 research as it is currently) or whether the program should focus more broadly on increasing the competitiveness of researchers in obtaining all federal R&D funds.

Recommendation for Improvement 5: Once the DEPSCoR objectives have been clarified, redesign the program with a clear and focused strategy for enhancing competitiveness at the relevant level.

As currently implemented, DEPSCoR includes elements that appear to target capacity-building at both the level of the institution (e.g., investigators are allowed and encouraged to support training and purchase of equipment) and the state (e.g., the state EPSCoR committees play a significant role in screening proposals and coordinating state-level research priorities). In terms of basic structure, however, DEPSCoR supports individual or small-group research projects. It can therefore be understood to primarily target capacity-building at the level of the *individual*. While it might be argued that institutional competitiveness depends on individual competitiveness and state competitiveness depends on institutional competitiveness, these dependencies are neither straightforward nor self-evident.

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Glossary

§	Section
AFB	Air Force Base
AFOSR	Air Force Office of Scientific Research
AFRL	Air Force Research Laboratory
AREA	Academic Research Enhancement Award
ARL	Army Research Laboratory
ARO	Army Research Office
ASTA	Arkansas Science and Technology Authority
BAA	Broad Agency Announcement
BGM	ballistic guided missile
BMDO	Ballistic Missile Defense Organization
BRDPI	Biomedical Research and Development Price Index
CECOM	U.S. Army Communications Electronics Command
COBRE	Centers of Biomedical Research Excellence
CPI	Consumer Price Index
DARPA	Defense Advanced Projects Research Agency
DDR&E	Director of Defense Research and Engineering
DEPSCoR	Defense Experimental Program To Stimulate Competitive Research
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
DoJ	Department of Justice
DURIP	Defense University Research Instrumentation Program
DUSD	Deputy Under Secretary of Defense
EHMT	Enhanced Handheld Multimedia Terminal
EPA	Environmental Protection Agency
EPSCoR	Experimental Program To Stimulate Competitive Research

F&A	facilities and administrative
FY	Fiscal Year
GDP	Gross Domestic Product
H.R.	House Report
HHS	Health and Human Services
HMT	Handheld Multimedia Terminal
IDA	Institute for Defense Analyses
IDeA	Institutional Development Award
IEEE	Institute of Electrical and Electronics Engineers
IMI	Industrial Mathematics Institute
INBRE	IDeA Networks of Biomedical Research Excellence
ITF	Intra-Task Force
ITT	International Telephone & Telegraph Company
JTRS	Joint Tactical Radio System
MDA	Missile Defense Agency
MIT	Massachusetts Institute of Technology
MURI	Multidisciplinary University Research Initiative
NASA	National Aeronautics and Space Administration
NAWC	Naval Air Warfare Center
NDEP	National Defense Education Program
NDSEG	National Defense Science and Engineering Graduate
NIH	National Institutes of Health
NUWC	Naval Underwater Warfare Center
NPO	Non-Profit Organization
NRL	Naval Research Laboratory
NSB	National Science Board
NSF	National Science Foundation
NSHE	Nevada System of Higher Education
NTDR	Near Term Data Radio
ODUSD	Office of the Deputy Under Secretary of Defense
ODUSD(LABS)	Office of the Deputy Under Secretary of Defense, Laboratories and Basic Science
ONR	Office of Naval Research

OSD	Office of the Secretary of Defense
P.L.	Public Law
PA	Program Announcement
PI	principal investigator
POC	point of contact
R&D	research and development
RFA	Request for Applications
RII	Research Infrastructure Improvement
RIP	Research Initiation Program
RS	Reed-Solomon
S&E	science and engineering
S&T	science and technology
SINCGARS	Single Channel Ground and Airborne Radio System
SMDC	U.S. Army Space and Missile Defense Command
SLICE	Soldier Level Integrated Communications Environment
SRW	Soldier Radio Waveform
SUNY	State University of New York
SUO-SAS	Small Unit Operation Situational Awareness System
U.S.	United States
U.S.C	United States Code
USDA	United States Department of Agriculture
URI	University Research Initiative
VPR	Vice President for Research

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Appendix A.
Comprehensive Defense Experimental Program To Stimulate Competitive Research (DEPSCoR) Award Data Digest

A. Introduction

Tables A-1–A-4 supplement information from the Summary (Volume I) of this report.

Table A-1. Data Corresponding to Figure S-1: Number of Research Awards and Program Funding, by Competition

Competition	Funding (M$)	Number of Awards
1993–1994	20.3	63
1995	20.0	64
1996	18.6	58
1997	17.0	55
1998	18.0	72
1999	19.0	67
2000	23.7	81
2001	21.0	63
2002	15.7	54
2003	15.2	31
2004	8.4	20
2005	11.4	27
2006	11.5	25
2007	7.1	16
2008	15.7	33

Sources: Institute for Defense Analyses (IDA) analysis of DEPSCoR program funding database and IDA DEPSCoR awards database

Table A-2. Data Corresponding to Figure S-2: Distribution of DEPSCoR Research Awards, by State

State	Total
Alabama	53
Alaska	6
Arkansas	38
Delaware	5
Hawaii	1
Idaho	33
Kansas	38
Kentucky	37
Louisiana	28
Maine	26
Mississippi	35
Missouri	6
Montana	54
Nebraska	49
Nevada	36
New Hampshire	6
New Mexico	4
North Dakota	28
Oklahoma	52
Puerto Rico	18
Rhode Island	2
South Carolina	47
South Dakota	12
Tennessee	5
Vermont	31
West Virginia	38
Wyoming	41
Grand Total	729

Source: IDA analysis of DEPSCoR awards database

Table A-3. Data Corresponding to Table S-2 and Figure S-3: Distribution of Awards by Institution Within DEPSCoR States

State	University	Number of DEPSCoRs
Montana	Montana State University	50
	University of Montana	4
Alabama	Auburn University	20
	University of Alabama-Birmingham	14
	Alabama A&M University	7
	University of Alabama-Huntsville	6
	University of Alabama-Tuscaloosa	5
	University of South Alabama	1
Oklahoma	University of Oklahoma-Norman	24
	Oklahoma State University	18
	University of Tulsa	6
	University of Oklahoma Health Sciences Center	4
Nebraska	University of Nebraska-Lincoln	47
	University of Nebraska-Omaha	2
South Carolina	University of South Carolina	25
	Clemson University	22
Wyoming	University of Wyoming	41
West Virginia	West Virginia University	33
	Marshall University	5
Kansas	Kansas State University	18
	Wichita State University	10
	University of Kansas	10
Arkansas	University of Arkansas-Fayetteville	33
	University of Arkansas for Medical Sciences	3
	University of Arkansas-Little Rock	2
Kentucky	University of Kentucky	19
	University of Louisville	16
	Western Kentucky University	2
Nevada	University of Nevada	18
	University of Nevada-Desert Research Institute	10
	University of Nevada-Las Vegas	8

Table A-3. Data Corresponding to Table S-2 and Figure S-3: Distribution of Awards by Institution Within DEPSCoR States (Continued)

State	University	Number of DEPSCoRs
Mississippi	University of Southern Mississippi	13
	Mississippi State University	13
	University of Mississippi	6
	University of Mississippi Medical Center	2
	Jackson State University	1
Idaho	University of Idaho	23
	Boise State University	9
	Idaho State University	1
Vermont	University of Vermont	30
	St Michael's College	1
North Dakota	North Dakota State University	17
	University of North Dakota	11
Louisiana	Louisiana State University	18
	Tulane University	3
	University of Southwestern Louisiana	2
	Louisiana State University Medical Center	1
	Louisiana Tech University	1
	Southeastern Louisiana University	1
	Louisiana State University Health Sciences Center	1
	University of New Orleans	1
Maine	University of Maine	20
	University of Southern Maine	3
	University of New England	2
	Bigelow Laboratory for Ocean Sciences	1
Puerto Rico	University of Puerto Rico-Rio Piedras	10
	University of Puerto Rico-Mayaguez	8
South Dakota	South Dakota School of Mines & Technology	10
	University of South Dakota	1
	South Dakota State University	1
Alaska	University of Alaska-Fairbanks	6

Table A-3. Data Corresponding to Table S-2 and Figure S-3: Distribution of Awards by Institution Within DEPSCoR States (Continued)

State	University	Number of DEPSCoRs
Missouri	University of Missouri-Rolla	3
	Washington University	1
	University of Missouri-Columbia	1
	University of Missouri-St. Louis	1
New Hampshire	University of New Hampshire	3
	Dartmouth College	3
Delaware	University of Delaware	4
	Delaware State University	1
Tennessee	Vanderbilt University	2
	University of Tennessee	2
	Tennessee Technological University	1
New Mexico	University of New Mexico	3
	New Mexico Tech	1
Rhode Island	Brown University	2
Hawaii	University of Hawaii-Manoa	1

Source: IDA analysis of DEPSCoR awards database

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**Table A-4. Data Corresponding to Figure S-4:
Number of DEPSCoR Awards Won by Principal Investigators (PIs)
Winning N Research Awards, Fiscal Year (FY) 1993–2008 Competitions**

Bin	Number of Investigators	Number of Awards
1 award per investigator	425	425
2 awards per investigator	79	158
3 awards per investigator	29	87
4 awards per investigator	9	36
5 awards per investigator	3	15
8 awards to investigator	1	8

Source: IDA analysis of DEPSCoR awards database

B. Section 1

Tables A-5–A-15 supplement information from Section 1 of this report.

Table A-5. Data Corresponding to Table 1-1 and Figure 1-1: Regression Analyses for Time Trends—Summary Data

Total Department of Defense (DOD) University Science and Engineering (S&E) Research and Development (R&D) Share To:	DEPSCoR State in One or More Competitions 1995–2008	DOD EPSCoR States Eligible for 2008 Competition	Formerly Eligible DEPSCoR States
1992	0.06688	0.03468	0.03220
1993	0.09852	0.05323	0.04529
1994	0.09282	0.05381	0.03900
1995	0.06943	0.03898	0.03046
1996	0.10085	0.07051	0.03034
1997	0.08946	0.06289	0.02657
1998	0.10697	0.07460	0.03237
1999	0.09523	0.05688	0.03835
2000	0.11660	0.06676	0.04984
2001	0.11568	0.05958	0.05610
2002	0.12668	0.06381	0.06287
2003	0.14143	0.08125	0.06018
2004	0.15419	0.07715	0.07704
2005	0.17468	0.08490	0.08978

Table A-5. Data Corresponding to Table 1-1 and Figure 1-1: Regression Analyses for Time Trends—Summary Data (Continued)

Total DOD University S&E Research Share To:	DEPSCoR State in One or More Competitions 1995–2008	DEPSCoR States Eligible for 2008 Competition	Formerly Eligible DEPSCoR States
1992	0.07560	0.04937	0.02623
1993	0.12085	0.06824	0.05260
1994	0.09276	0.05399	0.03877
1995	0.07644	0.04425	0.03214
1996	0.12425	0.08698	0.03727
1997	0.09854	0.06912	0.02942
1998	0.11351	0.07678	0.03673
1999	0.09090	0.06048	0.03042
2000	0.11232	0.07209	0.04023
2001	0.11071	0.06683	0.04389
2002	0.12001	0.06874	0.05128
2003	0.14631	0.09421	0.05209
2004	0.14558	0.08955	0.05602
2005	0.16977	0.10567	0.06410

Source: IDA analysis of National Science Foundation (NSF)/Division of Science Resources Statistics, Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions

Table A-6. Data Corresponding to Table 1-1 and Figure 1-1: Regression Tableaux—Total DOD University S&E R&D Models

Summary Output	DEPSCoR State in One or More Competitions 1995–2008					
Regression Statistics						
Multiple R	0.90147					
R Square	0.81266					
Adjusted R Square	0.79704					
Standard Error	0.01376					
Observations	14					
ANOVA						
	df	*SS*	*MS*	*F*	*Significance F*	
Regression	1	0.00986	0.00986	52.0533	0.00001	
Residual	12	0.00227	0.00019			
Total	13	0.01214				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.06787	0.00698	9.72407	0.00000	0.05267	0.08308
Time Trend	0.00658	0.00091	7.21480	0.00001	0.00460	0.00857

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Table A-7. Data Corresponding to Table 1-1 and Figure 1-1: Regression Tableaux—Research University S&E R&D Models

Summary Output	DEPSCoR State in One or More Competitions 1995–2008					
Regression Statistics						
Multiple R	0.761406					
R Square	0.579740					
Adjusted R Square	0.544718					
Standard Error	0.018204					
Observations	14					
ANOVA						
	df	*SS*	*MS*	*F*	*Significance F*	
Regression	1	0.005485	0.005485	16.553730	0.001557	
Residual	12	0.003976	0.000331			
Total	13	0.009462				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.082193	0.009231	8.904084	0.000001	0.062080	0.102305
Time Trend	0.004910	0.001207	4.068628	0.001557	0.002281	0.007540

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Table A-8. Data Corresponding to Figure 1-2:
Percentage Share of DOD S&E R&D Funding to Universities, by State and Year

"Near or Above Threshold"	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Alabama	0.87	1.00	1.05	0.89	1.12	0.96	1.05	0.69	0.90	0.86	1.97	1.45	1.11	2.16
Hawaii	0.27	0.22	0.23	0.39	0.17	0.57	0.28	0.65	0.44	0.76	1.33	1.78	2.33	2.11
Louisiana	0.22	1.13	1.35	0.71	1.62	1.45	1.80	1.74	1.47	1.06	1.19	0.92	0.97	0.75
Mississippi	0.21	0.37	0.42	0.34	0.43	0.32	0.73	1.32	1.78	1.75	1.65	1.55	1.92	2.18
New Mexico	1.99	3.03	2.29	1.53	1.44	0.97	1.32	1.29	1.97	2.32	1.46	1.26	2.34	2.49
South Carolina	0.23	0.38	0.29	0.48	1.05	1.60	1.38	0.79	0.80	1.03	0.70	0.87	0.43	0.73
"Rising Fast"	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Alaska	0.03	0.05	0.10	0.08	0.04	0.03	0.06	0.04	0.06	0.11	0.13	0.43	0.44	0.47
Idaho	0.04	0.03	0.05	0.02	0.10	0.08	0.18	0.07	0.34	0.25	0.05	0.31	0.21	0.36
Kentucky	0.08	0.08	0.15	0.07	0.22	0.09	0.21	0.16	0.16	0.42	0.28	0.16	0.28	0.43
Maine	0.01	0.02	0.11	0.03	0.08	0.13	0.22	0.21	0.58	0.29	0.20	0.30	0.24	0.36
Montana	0.03	0.06	0.10	0.07	0.28	0.08	0.29	0.16	0.14	0.11	0.28	0.39	0.22	0.43
Nebraska	0.11	0.08	0.23	0.11	0.21	0.15	0.27	0.19	0.16	0.53	0.53	0.63	0.64	0.43
Nevada	0.04	0.04	0.01	0.01	0.07	0.00	0.08	0.15	0.10	0.12	0.12	0.36	0.40	0.64
North Dakota	0.09	0.08	0.03	0.02	0.17	0.09	0.10	0.16	0.12	0.09	0.14	0.73	0.56	0.45
South Dakota	0.00	0.00	0.00	0.00	0.06	0.04	0.04	0.03	0.07	0.03	0.04	0.17	0.30	0.34
"In the Middle"	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Arkansas	0.07	0.25	0.33	0.22	0.38	0.16	0.22	0.10	0.19	0.08	0.11	0.11	0.19	0.45
Delaware	0.62	0.33	0.43	0.64	0.46	0.44	0.54	0.57	0.58	0.37	0.47	0.56	0.50	0.66
Kansas	0.09	0.63	0.11	0.10	0.20	0.22	0.35	0.26	0.31	0.21	0.23	0.42	0.41	0.21
Oklahoma	0.42	0.33	0.34	0.33	0.34	0.37	0.52	0.36	0.51	0.22	0.23	0.31	0.43	0.46
Rhode Island	0.77	0.64	0.57	0.70	0.75	0.87	0.56	0.43	0.72	0.72	0.79	0.71	0.57	0.53
Tennessee	0.75	0.71	0.88	0.91	0.76	0.99	0.60	0.68	0.87	0.63	0.86	0.67	0.96	0.82
"Lagging"	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
New Hampshire	0.18	0.22	0.15	0.17	0.21	0.19	0.39	0.18	0.26	0.22	0.23	0.20	0.07	0.13
Puerto Rico	0.04	0.11	0.07	0.06	0.23	0.07	0.13	0.08	0.10	0.07	0.13	0.13	0.11	0.13
Vermont	0.05	0.02	0.05	0.05	0.09	0.03	0.10	0.06	0.06	0.06	0.02	0.06	0.03	0.05
West Virginia	0.04	0.69	0.09	0.13	0.49	0.06	0.16	0.09	0.09	0.16	0.13	0.07	0.07	0.05
Wyoming	0.06	0.10	0.15	0.04	0.15	0.02	0.17	0.05	0.04	0.04	0.06	0.18	0.04	0.03

**Table A-8. Data Corresponding to Figure 1-2:
Share of DOD S&E R&D Funding to Universities, by State and Year (Continued)**

Group	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
"Near or Above Threshold"	3.79	6.13	5.63	4.34	5.84	5.87	6.56	6.48	7.36	7.78	8.31	7.84	9.09	10.43
"Rising Fast"	0.42	0.45	0.79	0.41	1.24	0.69	1.45	1.18	1.72	1.96	1.77	3.48	3.29	3.90
"In the Middle"	2.73	2.88	2.67	2.90	2.89	3.05	2.78	2.40	3.17	2.24	2.68	2.78	3.06	3.14
"Lagging"	0.37	1.14	0.51	0.45	1.17	0.36	0.95	0.48	0.55	0.54	0.57	0.63	0.31	0.38
Total	7.31	10.60	9.59	8.10	11.13	9.97	11.74	10.54	12.80	12.52	13.33	14.73	15.75	17.87

Source: IDA Analysis of NSF/Division of Science Resources Statistics, Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions

Table A-9. Data Corresponding to Figure 1-3:
Ratio Between DEPSCoR Funding and DOD Awards to DEPSCoR-Eligible States

Competition Year	DEPSCoR Dollars Disbursed (M$)	DOD Total University S&E R&D to States DEPSCoR Eligible in That Year (M$)	DOD University S&E Research to States DEPSCoR Eligible in That Year (M$)	Percentage of DOD Total University S&E R&D	Percentage of DOD Total University S&E Research
1993	13.2	92.00	82.05	14.3	16.1
1994	5.5	85.19	65.62	6.5	8.4
1995	20.0	59.18	46.85	33.8	42.7
1996	18.6	116.68	99.53	16.0	18.7
1997	17.0	89.82	65.48	18.9	26.0
1998	18.0	123.60	89.35	14.6	20.1
1999	19.0	113.16	78.10	16.8	24.4
2000	23.7	118.97	80.92	20.0	29.3
2001	21.0	105.36	80.60	19.9	26.0
2002	15.7	186.91	113.42	8.4	13.8
2003	15.2	196.85	151.22	7.7	10.1
2004	8.4	191.59	139.69	4.4	6.0
2005	11.4	256.96	208.43	4.4	5.5
2006	11.5	N/A	N/A	N/A	N/A
2007	7.1	N/A	N/A	N/A	N/A
2008	15.7	N/A	N/A	N/A	N/A

Sources: IDA analysis of NSF Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions, IDA DEPSCoR database, and DEPSCoR program funding database

Note for Table A-9: *Missouri (6 DEPSCoRs) not included.*

Table A-10. Data Corresponding to Figure 1-4: Percentage of State Funds (During DEPSCoR-Eligible Years) Through DEPSCoR Program, 1993–2005

State	Total DEPSCoR/Total $$ in Eligible Years (%)	Total DEPSCoRs 1993–2008
Alabama	6.6	53
Alaska	5.1	6
Arkansas	17.8	38
Delaware	3.4	5
Hawaii	0.3	1
Idaho	21.3	33
Kansas	11.5	38
Kentucky	21.0	37
Louisiana	5.3	28
Maine	19.4	26
Mississippi	6.6	35
Montana	32.4	54
Nebraska	14.6	49
Nevada	21.1	36
New Hampshire	28.3	6
New Mexico	3.9	4
North Dakota	12.3	28
Oklahoma	17.8	52
Puerto Rico	22.1	18
Rhode Island	0.0	2
South Carolina	10.2	47
South Dakota	12.2	12
Tennessee	1.7	5
Vermont	61.9	31
West Virginia	36.8	38
Wyoming	63.2	41

Sources: IDA Analysis of NSF/Division of Science Resources Statistics, Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions, IDA DEPSCoR database, and DEPSCoR program funding database

Note for Table A-10: *Missouri (6 DEPSCoRs) not included.*

Table A-11. Data Corresponding to Table 1-2: Percentage of State Funds (During DEPSCoR-Eligible Years) Through DEPSCoR Program, 1993–2005

State	Total DEPSCoR $$ in Eligible Years, 1993–2000 ($)	Total DOD S&E R&D $$ in Eligible Years, 1993–2000 (K$)	Total DEPSCoR Dollars in Eligible Years, 2001–2005 ($)	Total DOD S&E R&D Dollars in Eligible Years, 2001–2005 (K$)
Alabama	10,998,845	123,767	4,769,192	113,441
Alaska	–	–	1,843,417	35,808
Arkansas	6,723,552	29,751	2,438,804	21,587
Delaware	–	–	935,000	27,261
Hawaii	–	–	500,000	169,541
Idaho	6,625,016	14,559	2,067,897	26,188
Kansas	4,359,333	35,437	3,414,484	32,240
Kentucky	8,045,769	18,638	3,082,221	34,304
Louisiana	8,246,298	156,274	–	–
Maine	6,220,598	23,499	4,226,398	30,427
Mississippi	8,963,860	95,871	1,825,570	68,074
Montana	9,851,413	19,297	6,776,353	32,027
Nebraska	8,795,054	22,820	3,238,845	59,746
Nevada	4,873,031	7,813	4,616,151	37,163
New Hampshire	–	–	905,174	3,201
New Mexico	–	–	1,170,430	30,112
North Dakota	5,185,496	12,622	1,817,768	44,177
Oklahoma	7,938,799	50,550	7,563,590	36,616
Puerto Rico	5,321,578	13,692	390,000	12,167
Rhode Island	–	–	0	13,385
South Carolina	12,782,131	108,832	3,150,600	47,053
South Dakota	1,581,714	3,906	1,366,295	20,318
Tennessee	–	–	350,000	20,569
Vermont	4,681,071	7,487	2,772,764	4,562
West Virginia	8,229,106	28,765	6,073,284	10,139
Wyoming	5,682,044	11,612	6,441,862	7,562

Sources: IDA Analysis of NSF/Division of Science Resources Statistics, Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions, IDA DEPSCoR database, and DEPSCoR program funding database

Note for Table A-11: *Missouri (6 DEPSCoRs) not included.*

Table A-12. Data Corresponding to Table 1-3:
Total and Percentage of DOD S&E R&D Funding to Universities, by State: 1992 and 2005

State	DOD S&E R&D, 1992 ($)	Percentage of 1992 DOD S&E R&D Funding (%)	DOD S&E R&D, 2005 ($)	Percentage of 2005 DOD S&E R&D Funding (%)
Maryland	296,109	22.5	328,370	13.1
California	175,802	13.4	316,600	12.6
Pennsylvania	123,533	9.4	193,355	7.7
Massachusetts	122,192	9.3	110,785	4.4
Texas	73,404	5.6	168,073	6.7
New York	56,784	4.3	97,982	3.9
Georgia	52,743	4.0	78,498	3.1
Ohio	42,484	3.2	53,848	2.2
Florida	42,336	3.2	88,671	3.5
Utah	33,184	2.5	37,361	1.5
New Mexico	26,182	2.0	62,404	2.5
Illinois	26,127	2.0	57,741	2.3
Michigan	20,748	1.6	47,939	1.9
Minnesota	18,969	1.4	19,093	0.8
North Carolina	18,633	1.4	58,538	2.3
New Jersey	17,555	1.3	45,765	1.8
Virginia	15,308	1.2	58,984	2.4
Colorado	15,174	1.2	26,505	1.1
Washington	12,691	1.0	55,914	2.2
Alabama	11,410	0.9	54,080	2.2
Arizona	10,429	0.8	21,811	0.9
Rhode Island	10,171	0.8	13,385	0.5
Tennessee	9,833	0.7	20,569	0.8
Connecticut	8,532	0.6	16,329	0.7
Delaware	8,110	0.6	16,533	0.7
Wisconsin	7,967	0.6	16,033	0.6
Oregon	7,329	0.6	13,890	0.6
Indiana	6,757	0.5	27,336	1.1
Oklahoma	5,559	0.4	11,544	0.5
Missouri	5,192	0.4	16,948	0.7
District of Columbia	4,474	0.3	88,780	3.5
Iowa	3,898	0.3	12,235	0.5
Hawaii	3,507	0.3	52,789	2.1
South Carolina	3,038	0.2	18,391	0.7

Table A-12. Data Corresponding to Table 1-3: Total and Percentage of DOD S&E R&D Funding to Universities, by State: 1992 and 2005 (Continued)

State	DOD S&E R&D, 1992 ($)	Percentage of 1992 DOD S&E R&D Funding (%)	DOD S&E R&D, 2005 ($)	Percentage of 2005 DOD S&E R&D Funding (%)
Louisiana	2,911	0.2	18,898	0.8
Mississippi	2,747	0.2	54,539	2.2
New Hampshire	2,314	0.2	3,201	0.1
Nebraska	1,414	0.1	10,840	0.4
Kansas	1,188	0.1	5,245	0.2
North Dakota	1,123	0.1	11,318	0.5
Kentucky	1,093	0.1	10,715	0.4
Arkansas	979	0.1	11,362	0.5
Wyoming	827	0.1	785	0.0
Vermont	607	0.0	1,181	0.0
West Virginia	589	0.0	1,188	0.0
Nevada	560	0.0	15,963	0.6
Puerto Rico	558	0.0	3,147	0.1
Idaho	549	0.0	9,046	0.4
Montana	336	0.0	10,681	0.4
Alaska	332	0.0	11,680	0.5
Maine	112	0.0	8,935	0.4
South Dakota	28	0.0	8,457	0.3

Sources: IDA Analysis of NSF/Division of Science Resources Statistics, Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions

Table A-13. Data Corresponding to Figure 1-5: Number of PIs Winning DEPSCoR Awards and Percentage of PIs Having Previously Won Non-DEPSCoR Army Research Office (ARO) Awards, by State

State	Total PIs With DEPSCoR Awards Who Applied To/Received Awards From DEPSCoR	Percentage of DEPSCoR Investigators Who Won Another ARO Award First
Alabama	35	20
Alaska	3	33
Arkansas	12	17
Delaware	5	60
Idaho	22	14
Kansas	22	27
Kentucky	15	13
Louisiana	12	8
Maine	3	0
Mississippi	16	13
Montana	21	10
Nebraska	31	10
Nevada	11	9
New Hampshire	3	0
New Mexico	3	33
North Dakota	8	13
Oklahoma	22	23
Puerto Rico	14	14
Rhode Island	1	100
South Carolina	23	35
South Dakota	5	40
Tennessee	2	0
Vermont	13	15
West Virginia	15	7
Wyoming	12	17
All States	329	18

Sources: Analysis of ARO and IDA DEPSCoR databases

Table A-14. Data Corresponding to Figure 1-6: Number and Percentage of Investigators Funded Who Had Received a Previous DEPSCoR Award, by Competition

Competition	Percentage New Investigators	New	Total
1993–1994	98	62	63
1995	94	60	64
1996	91	53	58
1997	73	40	55
1998	81	58	72
1999	73	49	67
2000	69	56	81
2001	63	40	63
2002	59	32	54
2003	68	21	31
2004	65	13	20
2005	70	19	27
2006	60	15	25
2007	56	9	16
2008	58	19	33
Grand Total	75	546	729

Source: Analysis of IDA DEPSCoR database

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**Table A-15. Data Corresponding to Figure 1-7:
Scatter Plot of DEPSCoR and Defense University Research
Instrumentation Program (DURIP) Awards, by DEPSCoR-Eligible Institution**

Institution	Number of DEPSCoRs 1993–2008	Number of DURIPs 1996–2008
Montana State University	50	9
University of Nebraska-Lincoln	47	7
University of Wyoming	41	6
University of Arkansas-Fayetteville	33	8
West Virginia University	33	2
University of South Carolina	25	15
University of Oklahoma-Norman	24	1
University of Idaho	23	1
Clemson University	22	16
Auburn University	20	8
University of Maine	20	6
University of Kentucky	19	2
Kansas State University	18	15
University of Nevada	18	10
Oklahoma State University	18	8
Louisiana State University	18	3
North Dakota State University	17	1
University of Louisville	16	1
University of Alabama-Birmingham	14	5
University of Southern Mississippi	13	6
Mississippi State University	13	5
University of North Dakota	11	1
University of Kansas	10	4
South Dakota School of Mines and Technology	10	2
Wichita State University	10	2
University of Puerto Rico-Rio Piedras	10	1
Boise State University	9	3
University of Puerto Rico-Mayaguez	8	2
University of Nevada-Las Vegas	8	1
Alabama A&M University	7	1
University of Alabama-Huntsville	6	7
University of Mississippi	6	2

**Table A-15. Data Corresponding to Figure 1-7:
Scatter Plot of DEPSCoR and DURIP Awards, by DEPSCoR-Eligible Institution (Continued)**

Institution	Number of DEPSCoRs 1993–2008	Number of DURIPs 1996–2008
University of Alabama-Tuscaloosa	5	3
Marshall University	5	1
University of Delaware	4	30
University of Montana	4	2
University of Oklahoma Health Sciences Center	4	1
University of New Mexico	3	28
Dartmouth College	3	11
University of Missouri-Rolla	3	8
Tulane University	3	3
Brown University	2	16
Vanderbilt University	2	12
University of Tennessee	2	3
University of Arkansas-Little Rock	2	1
University of New England	2	1
University of Hawaii -Manoa	1	15
Washington University	1	8
University of Missouri-Columbia	1	4
University of New Orleans	1	3
New Mexico Tech	1	2
Tennessee Technological University	1	2
Delaware State University	1	1
Idaho State University	1	1
Louisiana Tech University	1	1
South Dakota State University	1	1
University of South Dakota	1	1

Sources: Analysis of IDA DEPSCoR and DURIP databases

Table A-16. Data Corresponding to Figure 1-8: Number of PIs Winning ARO Non-DEPSCoR Awards and Percentage of PIs Having Previously Won DEPSCoR Awards, by State

State	Total PIs Receiving ARO Non-DEPSCoR Awards	Percentage of Those PIs Receiving DEPSCoR Awards First
Alabama	68	9
Alaska	3	0
Arkansas	13	15
Delaware	34	0
Hawaii	17	0
Idaho	6	0
Kansas	28	18
Kentucky	17	12
Louisiana	45	4
Maine	1	0
Mississippi	39	18
Montana	27	19
Nebraska	15	13
Nevada	11	18
New Hampshire	14	0
New Mexico	62	2
North Dakota	12	0
Oklahoma	17	18
Puerto Rico	39	8
Rhode Island	30	0
South Carolina	51	14
South Dakota	9	11
Tennessee	42	0
Vermont	6	17
West Virginia	7	14
Wyoming	8	25
All States	621	8

Sources: Analysis of ARO and IDA DEPSCoR databases

C. Section 5

Tables A-17–A-23 supplement information from Section 5 of this report.

Table A-17. Data Corresponding to Figure 5-1 and Table 5-2: DOD Funding of University S&E R&D, FY 2005

State	Total DOD Funding, 2005 ($)	DOD Research Funding, 2005 ($)
Alabama	54,080,000	30,963,000
Alaska	11,680,000	7,767,000
American Samoa	0	0
Arizona	21,811,000	21,763,000
Arkansas	11,362,000	4,234,000
California	316,600,000	274,301,000
Colorado	26,505,000	24,617,000
Connecticut	16,329,000	11,833,000
Delaware	16,533,000	14,580,000
District of Columbia	88,780,000	6,255,000
Florida	88,671,000	73,430,000
Georgia	78,498,000	33,486,000
Guam	0	0
Hawaii	52,789,000	38,740,000
Idaho	9,046,000	9,046,000
Illinois	57,741,000	52,470,000
Indiana	27,336,000	23,058,000
Iowa	12,235,000	10,004,000
Kansas	5,245,000	4,921,000
Kentucky	10,715,000	5,537,000
Louisiana	18,898,000	12,335,000
Maine	8,935,000	8,935,000
Maryland	328,370,000	62,366,000
Massachusetts	110,785,000	105,081,000
Michigan	47,939,000	47,845,000
Minnesota	19,093,000	9,677,000
Mississippi	54,539,000	12,591,000
Missouri	16,948,000	9,059,000
Montana	10,681,000	5,385,000
Nebraska	10,840,000	10,378,000
Nevada	15,963,000	15,937,000

Table A-17. Data Corresponding to Figure 5-1 and Table 5-2: DOD Funding of University S&E R&D, FY 2005 (Continued)

State	Total DOD Funding, 2005 ($)	DOD Research Funding, 2005 ($)
New Hampshire	3,201,000	3,101,000
New Jersey	45,765,000	34,576,000
New Mexico	62,404,000	21,179,000
New York	97,982,000	86,845,000
North Carolina	58,538,000	54,418,000
North Dakota	11,318,000	10,408,000
Ohio	53,848,000	37,419,000
Oklahoma	11,544,000	5,418,000
Oregon	13,890,000	13,890,000
Pennsylvania	193,355,000	151,857,000
Puerto Rico	3,147,000	3,147,000
Rhode Island	13,385,000	12,854,000
South Carolina	18,391,000	18,307,000
South Dakota	8,457,000	8,259,000
Tennessee	20,569,000	18,358,000
Texas	168,073,000	80,782,000
Utah	37,361,000	11,734,000
Vermont	1,181,000	1,181,000
Virgin Islands	0	0
Virginia	58,984,000	49,357,000
Washington	55,914,000	38,683,000
West Virginia	1,188,000	1,188,000
Wisconsin	16,033,000	15,484,000
Wyoming	785,000	749,000
Grand Total	2,504,260,000	1,625,788,000

Source: NSF/Division of Science Resources Statistics, Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions, FY 2005. Table 14

Table A-18. Data Corresponding to Table 5-2: U.S. Population, 2005

State	Estimated Population: July 1, 2005
Alabama	4,539,611
Alaska	669,411
Arizona	5,952,083
Arkansas	2,772,152
California	35,990,312
Colorado	4,673,724
Connecticut	3,486,490
Delaware	840,558
District of Columbia	582,049
Florida	17,736,027
Georgia	9,107,719
Hawaii	1,267,581
Idaho	1,425,894
Illinois	12,719,550
Indiana	6,257,121
Iowa	2,955,587
Kansas	2,741,665
Kentucky	4,171,016
Louisiana	4,495,670
Maine	1,312,222
Maryland	5,573,163
Massachusetts	6,429,137
Michigan	10,107,940
Minnesota	5,113,824
Mississippi	2,900,456
Missouri	5,787,885
Montana	935,784
Nebraska	1,754,042
Nevada	2,408,948
New Hampshire	1,303,112
New Jersey	8,657,445
New Mexico	1,916,331

Table A-18. Data Corresponding to Table 5-2: U.S. Population, 2005 (Continued)

State	Estimated Population: July 1, 2005
New York	19,262,545
North Carolina	8,679,089
North Dakota	635,938
Ohio	11,459,776
Oklahoma	3,535,926
Oregon	3,629,959
Pennsylvania	12,367,276
Puerto Rico	3,910,707
Rhode Island	1,066,721
South Carolina	4,254,989
South Dakota	780,046
Tennessee	5,989,309
Texas	22,843,999
Utah	2,505,013
Vermont	619,736
Virginia	7,557,588
Washington	6,270,838
West Virginia	1,805,626
Wisconsin	5,540,473
Wyoming	506,541
U.S. plus Puerto Rico	299,300,063

Source: Population Division, U.S. Census Bureau, Table 1: Annual Estimates of the Population for the United States, Regions, States, and Puerto Rico: April 1, 2000, to July 1, 2007 (NST-EST2007-01)

Table A-19. Data Corresponding to Figure 5-2:
State Technology and Science Index Rankings of DEPSCoR States, by Quartile

State	Rank 2008	Score 2008	Quartile 2008
Massachusetts	1	82.61	1
Maryland	2	80.04	1
Colorado	3	78.32	1
California	4	74.62	1
Washington	5	72.09	1
Virginia	6	70.33	1
Connecticut	7	70.13	1
Utah	8	69.21	1
New Hampshire	9	67.9	1
Rhode Island	10	66.69	1
Minnesota	11	64.06	1
New Jersey	12	63.44	1
Pennsylvania	13	63.23	1
Delaware	14	62.3	2
New York	15	62.22	2
New Mexico	16	61.86	2
Arizona	17	61.34	2
North Carolina	18	59.63	2
Vermont	19	58.78	2
Texas	20	57.78	2
Illinois	21	57.19	2
Wisconsin	22	57.12	2
Oregon	23	56.17	2
Kansas	24	54.18	2
Georgia	25	53.3	2
Michigan	26	52.27	3
Idaho	27	51.37	3
Hawaii	28	51.23	3
Alabama	29	49.99	3
Missouri	30	49.62	3

**Table A-19. Data Corresponding to Figure 5-2:
State Technology and Science Index Rankings of DEPSCoR States, by Quartile (Continued)**

State	Rank 2008	Score 2008	Quartile 2008
North Dakota	31	48.92	3
Montana	32	48.15	3
Indiana	33	47.75	3
Nebraska	34	47.52	3
Iowa	35	45.9	3
Ohio	36	45.25	3
Florida	37	43.76	3
Oklahoma	38	41.85	3
Maine	39	41.82	4
Tennessee	40	40.32	4
South Dakota	41	39.64	4
South Carolina	42	39.12	4
Wyoming	43	38.38	4
Alaska	44	37.68	4
Nevada	45	37.02	4
Louisiana	46	35.58	4
Kentucky	47	34.67	4
Arkansas	48	32.96	4
West Virginia	49	30.49	4
Mississippi	50	29.81	4

Source: IDA Analysis of Milken Institute, State Technology and Science Index, 2008. Table 1, p. 2

Table A-20. Data Corresponding to Figure 5-3:
Per Capita DOD Funding of University S&E R&D, FY 2005

State	Total DOD Funding Per Capita, 2005 ($/Person)	DOD Research Funding Per Capita, 2005 ($/Person)
Alabama	11.91	6.82
Alaska	17.45	11.60
Arizona	3.66	3.66
Arkansas	4.10	1.53
California	8.80	7.62
Colorado	5.67	5.27
Connecticut	4.68	3.39
Delaware	19.67	17.35
District of Columbia	152.53	10.75
Florida	5.00	4.14
Georgia	8.62	3.68
Hawaii	41.65	30.56
Idaho	6.34	6.34
Illinois	4.54	4.13
Indiana	4.37	3.69
Iowa	4.14	3.38
Kansas	1.91	1.79
Kentucky	2.57	1.33
Louisiana	4.20	2.74
Maine	6.81	6.81
Maryland	58.92	11.19
Massachusetts	17.23	16.34
Michigan	4.74	4.73
Minnesota	3.73	1.89
Mississippi	18.80	4.34
Missouri	2.93	1.57
Montana	11.41	5.75
Nebraska	6.18	5.92
Nevada	6.63	6.62
New Hampshire	2.46	2.38
New Jersey	5.29	3.99
New Mexico	32.56	11.05

Table A-20. Data Corresponding to Figure 5-3: Per Capita DOD Funding of University S&E R&D, FY 2005 (Continued)

State	Total DOD Funding Per Capita, 2005 ($/Person)	DOD Research Funding Per Capita, 2005 ($/Person)
New York	5.09	4.51
North Carolina	6.74	6.27
North Dakota	17.80	16.37
Ohio	4.70	3.27
Oklahoma	3.26	1.53
Oregon	3.83	3.83
Pennsylvania	15.63	12.28
Puerto Rico	0.80	0.80
Rhode Island	12.55	12.05
South Carolina	4.32	4.30
South Dakota	10.84	10.59
Tennessee	3.43	3.07
Texas	7.36	3.54
Utah	14.91	4.68
Vermont	1.91	1.91
Virgin Islands	0.00	0.00
Virginia	7.80	6.53
Washington	8.92	6.17
West Virginia	0.66	0.66
Wisconsin	2.89	2.79
Wyoming	1.55	1.48
U.S. + Puerto Rico Average	8.35	5.42

Source: IDA analysis of NSF/Division of Science Resources Statistics, Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions, FY 2005. Table 14; and Population Division, U.S. Census Bureau, Table 1: Annual Estimates of the Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2007 (NST-EST2007-01)

Table A-21. Data Corresponding to Table 5-5:
Carnegie Rankings, Based Upon DEPSCoR Eligibility, by State

"Very High Research" Universities

Number	Institution	Number	Institution
1	Arizona State University-Tempe Campus	31	Pennsylvania State University (Main Campus)
2	Boston University	32	Princeton University
3	Brandeis University	33	Purdue University-Main Campus
4	Brown University	34	Rensselaer Polytechnic Institute
5	California Institute of Technology	35	Rice University
6	Carnegie Mellon University	36	Rutgers University-New Brunswick
7	Case Western Reserve University	37	Stanford University
8	Colorado State University	38	SUNY-Albany
9	Columbia University in the City of New York	39	SUNY-Buffalo
10	Cornell University-Endowed Colleges	40	SUNY-Stony Brook
11	Dartmouth College	41	Texas A & M University
12	Duke University	42	Tufts University
13	Emory University	43	Tulane University of Louisiana
14	Florida State University	44	University of Alabama-Birmingham
15	Georgetown University	45	University of Arizona
16	Georgia Institute of Technology (Main Campus)	46	University of California-Berkeley
17	Harvard University	47	University of California-Davis
18	Indiana University-Bloomington	48	University of California-Irvine
19	Iowa State University	49	University of California-Los Angeles
20	Johns Hopkins University	50	University of California-Riverside
21	Kansas State University	51	University of California-San Diego
22	Louisiana State University Hebert Laws Center	52	University of California-Santa Barbara
23	Massachusetts Institute of Technology	53	University of California-Santa Cruz
24	Michigan State University	54	University of Chicago
25	Montana State University-Bozeman	55	University of Cincinnati (Main Campus)
26	New York University	56	University of Colorado-Boulder
27	North Carolina State University-Raleigh	57	University of Colorado-Denver Health Sciences Center
28	Northwestern University	58	University of Connecticut
29	Ohio State University (Main Campus)	59	University of Delaware
30	Oregon State University	60	University of Florida

Table A-21. Data Corresponding to Table 5-5:
Carnegie Rankings, Based Upon DEPSCoR Eligibility, by State (Continued)

"Very High Research" Universities (Continued)

Number	Institution	Number	Institution
61	University of Georgia	79	University of Pittsburgh (Main Campus)
62	University of Hawaii-Manoa	80	University of Rochester
63	University of Illinois-Chicago	81	University of South Carolina-Columbia
64	University of Illinois–Urbana-Champaign	82	University of South Florida
65	University of Iowa	83	University of Southern California
66	University of Kansas Main Campus	84	University of Tennessee
67	University of Kentucky	85	University of Texas-Austin
68	University of Maryland-College Park	86	University of Utah
69	University of Massachusetts-Amherst	87	University of Virginia (Main Campus)
70	University of Miami	88	University of Washington-Seattle Campus
71	University of Michigan-Ann Arbor	89	University of Wisconsin-Madison
72	University of Minnesota-Twin Cities	90	Vanderbilt University
73	University of Missouri-Columbia	91	Virginia Polytechnic Institute and State University
74	University of Nebraska-Lincoln	92	Washington State University
75	University of New Mexico (Main Campus)	93	Washington University-St. Louis
76	University of North Carolina-Chapel Hill	94	Wayne State University
77	University of Notre Dame	95	Yale University
78	University of Pennsylvania	96	Yeshiva University

Source:
http://www.carnegiefoundation.org/classifications/index.asp?key=63&search_flag=true&ref=783&start=783&BASIC2005=15

Note for Table A-20: *The "Number" column is merely a means of tracking the number of colleges/universities. It does not indicate ranking.*

Table A-22. Data Corresponding to Table 5-6:
Carnegie Rankings, Based Upon DEPSCoR Eligibility, by State (Continued)

"High Research" Universities

Number	Institution	Number	Institution
1	Auburn University (Main Campus)	33	Mississippi State University
2	Baylor University	34	New Jersey Institute of Technology
3	Boston College	35	New Mexico State University (Main Campus)
4	Bowling Green State University (Main Campus)	36	North Carolina A & T State University
5	Brigham Young University	37	North Dakota State University (Main Campus)
6	Catholic University of America	38	North Eastern University
7	Claremont Graduate University	39	Northern Arizona University
8	Clark Atlanta University	40	Northern Illinois University
9	Clark University	41	Ohio University (Main Campus)
10	Clarkson University	42	Oklahoma State University (Main Campus)
11	Clemson University	43	Old Dominion University
12	College of William and Mary	44	Polytechnic University
13	Colorado School of Mines	45	Rutgers University-Newark
14	CUNY Graduate School and University Center	46	Saint Louis University (Main Campus)
15	Drexel University	47	San Diego State University
16	Florida Atlantic University-Boca Raton	48	South Dakota State University
17	Florida Institute of Technology-Melbourne	49	Southern Illinois University Carbondale
18	Florida International University	50	Stevens Institute of Technology
19	Fordham University	51	SUNY-Binghamton
20	George Mason University	52	SUNY College of Environ. Science and Forestry
21	George Washington University	53	Syracuse University
22	Georgia State University	54	Teachers College-Columbia University
23	Howard University	55	Temple University
24	Illinois Institute of Technology	56	Texas Tech University
25	Indiana University-Purdue University-Indianapolis	57	University of Akron (Main Campus)
26	Jackson State University	58	University of Alabama
27	Kent State University (Main Campus)	59	University of Alabama-Huntsville
28	Lehigh University	60	University of Alaska-Fairbanks
29	Loyola University Chicago	61	University of Arkansas (Main Campus)
30	Marquette University	62	University of Central Florida
31	Miami University-Oxford	63	University of Dayton
32	Michigan Technological University	64	University of Denver

Table A-22. Data Corresponding to Table 5-6:
Carnegie Rankings, Based Upon DEPSCoR Eligibility, by State (Continued)

"High Research" Universities (Continued)

Number	Institution	Number	Institution
65	University of Houston-University Park	85	University of Oregon
66	University of Idaho	86	University of Puerto Rico-Rio Piedras Campus
67	University of Louisiana-Lafayette	87	University of Rhode Island
68	University of Louisville	88	University of Southern Mississippi
69	University of Maine	89	University of Texas-Arlington
70	University of Maryland-Baltimore County	90	University of Texas-Dallas
71	University of Memphis	91	University of Texas-El Paso
72	University of Mississippi (Main Campus)	92	University of Toledo
73	University of Missouri-Kansas City	93	University of Tulsa
74	University of Missouri-Rolla	94	University of Vermont and State Agri. College
75	University of Missouri-St. Louis	95	University of Wisconsin-Milwaukee
76	University of Montana-Missoula	96	University of Wyoming
77	University of Nevada-Las Vegas	97	Utah State University
78	University of Nevada-Reno	98	Virginia Commonwealth University
79	University of New Hampshire (Main Campus)	99	Wake Forest University
80	University of New Orleans	100	West Virginia University
81	University of North Carolina-Greensboro	101	Western Michigan University
82	University of North Dakota (Main Campus)	102	Wichita State University
83	University of North Texas	103	Wright State University (Main Campus)
84	University of Oklahoma-Norman Campus		

Source:
http://www.carnegiefoundation.org/classifications/index.asp?key=63&search_flag=true&ref=783&start=783&BASIC2005=16

Note for Table A-21: *The "Number" column is merely a means of tracking the number of colleges/universities. It does not indicate ranking.*

**Table A-23. Data Corresponding to Table 5-6:
Carnegie "Very High" and "High" Research Universities,
by State DEPSCoR Eligibility and FY 2005 DOD Research Funding**

Institution	DEPSCoR Eligibility Status	DOD S&E Research Funding (2005) (K$)
Penn State University (All Campuses)	Not eligible	60,197
University of Southern California	Not eligible	55,878
University of Hawaii System Office	DEPSCoR graduate	38,740
University of Pennsylvania	Not eligible	37,960
Stanford University	Not eligible	37,083
Johns Hopkins University	Not eligible	36,880
Massachusetts Institute of Technology	Not eligible	34,781
University of California-Los Angeles	Not eligible	30,299
University of California-San Diego	Not eligible	30,179
University of Washington	Not eligible	30,116
Georgia Institute of Technology (All Campuses)	Not eligible	28,613
Carnegie Mellon University	Not eligible	27,594
University of California-Santa Barbara	Not eligible	25,746
University of Michigan	Not eligible	25,234
University of Illinois Urbana-Champaign	Not eligible	23,118
University of Texas-Austin	Not eligible	22,113
Harvard University	Not eligible	19,741
Columbia University in the City of New York	Not eligible	19,671
University System of Maryland Office	Not eligible	18,674
Duke University	Not eligible	16,813
Virginia Polytechnic Institute and State University	Not eligible	16,129
University of California-Riverside	Not eligible	15,920
University of Pittsburgh	Not eligible	15,597
Woods Hole Oceanographic Institution	Not eligible	15,253
University of Colorado	Potentially newly eligible	14,542
University of Wisconsin-Madison	Potentially newly eligible	14,367
University of Delaware	DEPSCoR eligible	14,115
Northwestern University	Not eligible	14,040

**Table A-23. Data Corresponding to Table 5-6:
Carnegie "Very High" and "High" Research Universities,
by State DEPSCoR Eligibility and FY 2005 DOD Research Funding (Continued)**

Institution	DEPSCoR Eligibility Status	DOD S&E Research Funding (2005) (K$)
University of Dayton	Not eligible	13,659
University of Texas System Office	Not eligible	13,507
California Institute of Technology	Not eligible	13,360
Princeton University	Not eligible	13,107
University of Alabama-Huntsville	DEPSCoR graduate	12,759
University of Central Florida	Not eligible	12,703
Loma Linda University	Not eligible	12,304
Nevada System of Higher Education	DEPSCoR eligible	11,708
Florida State University	Not eligible	11,669
University of Florida	Not eligible	11,500
Arizona State University (Main Campus)	Potentially newly eligible	11,242
University of California-Berkeley	Not eligible	11,164
University of Texas M.D. Anderson Cancer Center	Not eligible	10,487
University of Miami	Not eligible	10,439
University of North Carolina-Chapel Hill	Not eligible	10,412
Wayne State University	Not eligible	10,288
North Dakota State University	DEPSCoR eligible	9,975
Purdue University	Potentially newly eligible	9,840
Clemson University	DEPSCoR eligible	9,708
University of Minnesota	Potentially newly eligible	9,624
Boston University	Not eligible	9,587
University of Virginia	Not eligible	9,546
Stevens Institute of Technology	Not eligible	9,486
University of Arizona	Potentially newly eligible	9,464
University of North Carolina-Charlotte	Not eligible	9,291
University of California-San Francisco	Not eligible	9,216
University of New Mexico	DEPSCoR graduate	9,103
Auburn University (All Campuses)	DEPSCoR graduate	8,852
George Mason University	Not eligible	8,819
Mt. Sinai School of Medicine	Not eligible	8,791

**Table A-23. Data Corresponding to Table 5-6:
Carnegie "Very High" and "High" Research Universities,
by State DEPSCoR Eligibility and FY 2005 DOD Research Funding(Continued)**

Institution	DEPSCoR Eligibility Status	DOD S&E Research Funding (2005) (K$)
Louisiana State University (All Campuses)	DEPSCoR eligible	8,513
University of Rochester	Not eligible	8,442
University of South Florida	Not eligible	8,421
Ohio State University	Not eligible	8,410
University of Connecticut	Potentially newly eligible	8,300
Washington State University	Not eligible	8,155
North Carolina State University	Not eligible	8,079
Cornell University	Not eligible	7,930
New Mexico Institute of Mining and Technology	DEPSCoR graduate	7,886
Oregon State University	Potentially newly eligible	7,788
University of Alaska-Fairbanks (All Campuses)	DEPSCoR eligible	7,738
Scripps Research Institute	Not eligible	7,674
New York University	Not eligible	7,514
Vanderbilt University	DEPSCoR eligible	7,396
University of Massachusetts-Amherst	Not eligible	7,142
Brown University	DEPSCoR eligible	7,123
University of Illinois-Chicago	Not eligible	6,888
University of Notre Dame	Potentially newly eligible	6,753
Colorado State University	Potentially newly eligible	6,698
University of Iowa	Potentially newly eligible	6,653
University of Nebraska-Lincoln	DEPSCoR eligible	6,648
University of Maine System Office	DEPSCoR eligible	6,446
University f Alabama-Birmingham	DEPSCoR graduate	6,443
South Dakota School of Mines and Technology	DEPSCoR eligible	6,375
Rutgers University (All Campuses)	Not eligible	6,196
Medical University of South Carolina	DEPSCoR eligible	5,963
New School University	Not eligible	5,932
University of California-Davis	Not eligible	5,870
Utah State University	Not eligible	5,815
Rice University	Not eligible	5,760

**Table A-23. Data Corresponding to Table 5-6:
Carnegie "Very High" and "High" Research Universities,
by State DEPSCoR Eligibility and FY 2005 DOD Research Funding(Continued)**

Institution	DEPSCoR Eligibility Status	DOD S&E Research Funding (2005) (K$)
Boston College	Not eligible	5,502
Oregon Health and Science University	Potentially newly eligible	5,243
University of Texas SW Medical Center-Dallas	Not eligible	5,150
Northeastern University	Not eligible	4,964
Michigan Tech University	Not eligible	4,696
College of William and Mary (All campuses)	Not eligible	4,515
University of Rhode Island	DEPSCoR eligible	4,510
University of Idaho	DEPSCoR eligible	4,471
Indiana University Central Office	Potentially newly eligible	4,465
University of Cincinnati	Not eligible	4,377
University of North Texas	Not eligible	4,370
New Mexico State University	DEPSCoR graduate	4,190
North Carolina A&T State University	Not eligible	4,155
Jackson State University	DEPSCoR graduate	4,147
Michigan State University	Not eligible	4,078
University of Arkansas (Main Campus)	DEPSCoR eligible	4,051
University of Oklahoma	DEPSCoR eligible	4,041
Virginia Commonwealth University	Not eligible	3,990
University of Tennessee-Knoxville	DEPSCoR eligible	3,924
University of Louisville	DEPSCoR eligible	3,913
University of California-Santa Cruz	Not eligible	3,871
Boise State University	DEPSCoR eligible	3,659
Florida Atlantic University	Not eligible	3,590
Florida International University	Not eligible	3,567
University of Nevada-Las Vegas	DEPSCoR eligible	3,557
Mississippi State University	DEPSCoR graduate	3,497
Yale University	Potentially newly eligible	3,483
University of Nebraska Medical Center	DEPSCoR-eligible	3,452
Iowa State University	Potentially newly eligible	3,351
Hampton University	Not eligible	3,338

**Table A-23. Data Corresponding to Table 5-6:
Carnegie "Very High" and "High" Research Universities,
by State DEPSCoR Eligibility and FY 2005 DOD Research Funding(Continued)**

Institution	DEPSCoR Eligibility Status	DOD S&E Research Funding (2005) (K$)
Emory University	Not eligible	3,250
SUNY System Office	Not eligible	3,236
Lincoln University (Jefferson City, Missouri)	Potentially newly eligible	3,231
Wake Forest University	Not eligible	3,159
Drexel University	Not eligible	3,155
Miami University (All Campuses)	Not eligible	3,128
Case Western Reserve University	Not eligible	3,119
Yeshiva University New York	Not eligible	3,094
Montana State University-Bozeman	DEPSCoR eligible	3,090
Brigham Young University (All Campuses)	Not eligible	3,040
University of Massachusetts Dartmouth	Not eligible	3,013

Source: IDA analysis of Carnegie rankings, DEPSCoR eligibility criteria, and Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions

D. Section 6

Table A-24 supplements information from Section 6 of this report.

Table A-24. Data Corresponding to Figure 6-1:
DEPSCoR Funding per State, by DEPSCoR Program Year

"Inflation Calculators"

Year	CPI Inflation Calculator (2008 = 1.00)	BRDPI Inflation Calculator (2008 = 1.00)
1994	1.46	1.62
1995	1.42	1.56
1996	1.38	1.52
1997	1.35	1.48
1998	1.33	1.43
1999	1.30	1.39
2000	1.26	1.34
2001	1.22	1.30
2002	1.20	1.26
2003	1.18	1.21
2004	1.15	1.17
2005	1.11	1.13
2006	1.07	1.08
2007	1.04	1.03
2008	1.00	1.00

Sources for "Inflation Calculators": Consumer Price Index calculated using CPI Inflation Calculator, available from http://www.bls.gov/CPI/, last accessed July 14, 2008; NIH-calculated Biomedical Research and Development Price Index (a measure of the cost of biomedical research, specifically) available from http://officeofbudget.od.nih.gov/UI/2008/BRDPI%20Table%20of%20Annual%20Formulas_01_04_2008.xls,%20last%20accessed%20July%2014th,%202008

**Table A-24. Data Corresponding to Figure 6-1:
DEPSCoR Funding per State, by DEPSCoR Program Year (Continued)**

"Data for Figure 6-1"

Competition	Dollars Disbursed (M$)	Number of Eligible States	Ratio of Column 2/ Column 3 (M$/state)	Indexed for Inflation: CPI (M$)	Indexed for Inflation: BRDPI (M$)
1993–1994	20.3	20	1.02	1.48	1.64
1995	20.0	19	1.05	1.49	1.65
1996	18.6	19	0.98	1.35	1.49
1997	17.0	18	0.89	1.21	1.33
1998	18.0	19	0.95	1.26	1.36
1999	19.0	19	1.00	1.30	1.39
2000	23.7	19	1.25	1.57	1.67
2001	21.0	18	1.17	1.42	1.51
2002	15.7	20	0.78	0.94	0.99
2003	15.2	20	0.76	0.90	0.92
2004	8.4	21	0.40	0.46	0.47
2005	11.4	23	0.50	0.55	0.56
2006	11.5	23	0.50	0.54	0.54
2007	7.1	23	0.31	0.32	0.32
2008	15.7	23	0.68	0.68	0.68

Sources for "Data for Figure 6-1": DEPSCoR funding from DEPSCoR program database, number of eligible states from IDA analysis of DEPSCoR news releases

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Appendix B.
Compilations of Databases

Table B-1. Sources for Defense Experimental Program To Stimulate Competitive Research (DEPSCoR) Database

Competition	Nature of Source	Provided By	Format (Electronic/Paper)
1993–1994	"DEPSCoR FY 93 Winners" paper file	Coalition of Experimental Program To Stimulate Competitive Research (EPSCoR)/ Institutional Development Award (IDeA) states	Paper
1995	"FY 1995 Awards for the Defense Experimental Program To Simulate Competitive Research (DEPSCoR)" paper file	Coalition of EPSCoR/IDeA states	Paper
1996	Spreadsheet accompanying press release	DefenseLink	Electronic
1997	Spreadsheet accompanying press release	DefenseLink	Electronic
1998	Spreadsheet accompanying press release	DefenseLink	Electronic
1999	"FY 1999 Awards for the Defense Experimental Program To Simulate Competitive Research (DEPSCoR)" paper file	Coalition of EPSCoR/IDeA states	Paper
2000	Spreadsheet accompanying press release	DefenseLink	Electronic
2001	Spreadsheet accompanying press release	DefenseLink	Electronic
2002	PDF file accompanying press release	DefenseLink	Electronic
2003	PDF file accompanying press release	DefenseLink	Electronic
2004	PDF file accompanying press release	DefenseLink	Electronic
2005	PDF file accompanying press release	DefenseLink	Electronic
2006	PDF file accompanying press release	DefenseLink	Electronic
2007	PDF file accompanying press release	DefenseLink	Electronic
2008	Spreadsheet accompanying press release	DefenseLink	Electronic

Table B-2. Sources for MURI Database

Competition	Nature of Source	Provided By	Format (Electronic/Paper)	Includes Lead Institution Only?
1996	Spreadsheet accompanying press release	DefenseLink	Electronic	Yes
1997	Spreadsheet accompanying press release	DefenseLink	Electronic	Yes
1998	Spreadsheet accompanying press release	DefenseLink	Electronic	Yes
1999	Spreadsheet accompanying press release	DefenseLink	Electronic	Yes
2000 (Army)	Spreadsheet	ARO	Electronic	Also team
2000 (Navy)	Paper copy of "All on-going MURI projects"	ONR	Paper	Also team
2001	PDF file accompanying press release	DefenseLink	Electronic	Also team
2002	PDF file accompanying press release	DefenseLink	Electronic	Yes
2002 (Navy)	Paper copy of "All on-going MURI projects"	ONR	Paper	Also team
2003	PDF file accompanying press release	DefenseLink	Electronic	Yes
2003 (Navy)	Paper copy of, "ONR FY 03 MURIs"	ONR	Paper	Also team
2004	PDF file accompanying press release	DefenseLink	Electronic	Yes
2004 (Navy)	Paper copy of, "ONR FY 04 MURIs"	ONR	Paper	Also team
2005	PDF file accompanying press release	DefenseLink	Electronic	Yes
2005 (Navy)	Paper copy of, "ONR FY 05 MURIs"	ONR	Paper	Also team
2006	PDF file accompanying press release	DefenseLink	Electronic	Yes
2006 (Navy)	Paper copy of, "MURI FY 06"	ONR	Paper	Also team
2007	PDF file accompanying press release	DefenseLink	Electronic	Also team
2008	PDF file accompanying press release	DefenseLink	Electronic	Also team

Note for Table B-2: ARO = Army Research Office; FY = Fiscal Year; MURI = Multidisciplinary University Research Initiative; ONR = Office of Naval Research

Table B-3. Sources for DURIP Database

Competition	Nature of Source	Provided By	Format (Electronic/Paper)
1996	Spreadsheet accompanying press release	DefenseLink	Electronic
1997	Spreadsheet accompanying press release	DefenseLink	Electronic
1998	Spreadsheet accompanying press release	ONR	Electronic
1999 (Army)	Spreadsheet, "Data 1 DURIP 1998_2001"	ARO	Electronic
1999 (Navy)	Spreadsheet, "ONR's FY_1999_DURIP_Recommendations 2/23/99"	ONR	Electronic
2000 (Army)	Spreadsheet, "Data 1 DURIP 1998_2001"	ARO	Electronic
2000 (Navy)	Spreadsheet, "ONR RECOMMENDATIONS FOR FY 2000 DEFENSE UNIVERSITY RESEARCH INSTRUMENTATION PROGRAM, DATE LAST REVISED 2/09/2000"	ONR	Paper
2001	Spreadsheet, "FY 2001 Recommended DURIP Awards by PI Name"	ONR	Electronic
2002	PDF file accompanying press release	DefenseLink	Electronic
2003	PDF file accompanying press release	DefenseLink	Electronic
2004	PDF file accompanying press release	DefenseLink	Electronic
2005	PDF file accompanying press release	DefenseLink	Electronic
2006	PDF file accompanying press release	DefenseLink	Electronic
2007	PDF file accompanying press release	DefenseLink	Electronic
2008	PDF file accompanying press release	DefenseLink	Electronic

Note for Table B-3: DURIP = Defense University Research Instrumentation Program

Table B-4. List of NSF Federal Support to Universities, Colleges, and Nonprofit Institutions Tables[68]

- Table B-11. Federal obligations for science and engineering research and development (R&D) to universities and colleges by state, institution, and agency, fiscal year 1992
- Table B-11. Federal obligations for science and engineering research and development (R&D) to universities and colleges by state, institution, and agency, fiscal year 1993
- Table B-18. Department of Defense obligations for science and engineering research and development (R&D) to universities and colleges by state and institution, fiscal year 1994
- Table B-18. Department of Defense obligations for science and engineering research and development (R&D) to universities and colleges by state and institution, fiscal year 1995
- Table B-17. Federal obligations for science and engineering research and development (R&D) to universities and colleges by state, institution, and agency, fiscal year 1996
- Table B-17. Federal obligations for science and engineering research and development (R&D) to universities and colleges by state, institution, and agency, fiscal year 1997
- Table B-17. Federal obligations for science and engineering research and development (R&D) to universities and colleges by state, institution, and agency, fiscal year 1998
- Table B-17. Federal obligations for science and engineering research and development (R&D) to universities and colleges by state, institution, and agency, fiscal year 1999
- Table B-17. Federal obligations for science and engineering research and development (R&D) to universities and colleges by state, institution, and agency, fiscal year 2000
- Table B-17. Federal obligations for science and engineering research and development (R&D) to universities and colleges by state, institution, and agency, fiscal year 2001
- Table B-17. Federal obligations for science and engineering research and development (R&D) to universities and colleges by state, institution, and agency, fiscal year 2002
- Table 17a. Federal obligations for science and engineering research and development to universities and colleges, by location, institution, and agency (AID–DOL): FY 2003
- Table 17b. Federal obligations for science and engineering research and development to universities and colleges, by location, institution, and agency (DOT-USDA): FY 2003
- Table 13. Federal obligations for science and engineering research and development to universities and colleges, by state and outlying area, institution, and agency (AID–DOL): FY 2004
- Table 14. Federal obligations for science and engineering research and development to universities and colleges, by state and outlying area, institution, and agency (DOT-USDA): FY 2004
- Table 14. Federal obligations for science and engineering research and development to universities and colleges, by state and outlying area, institution, and agency (AID–DOL): FY 2005
- Table 15. Federal obligations for science and engineering research and development to universities and colleges, by state and outlying area, institution, and agency (DOT-USDA): FY 2005

Note for Table B-4: DOT = Department of Transportation; USDA = United States Department of Agriculture; DOL = Department of Labor

68 Tables accessed via http://www.nsf.gov/statistics/fedsupport/

Table B-5. List of Other Documents
Assembled by the DEPSCoR/IDeA Coalition and Provided to IDA, May 2008

- The Department of Defense Report on Geographic Diversity of Support of Research at Academic Institutions, for the Committee on Appropriations, United States Congress, June 1990.
- Prepared Testimony of Dr. Priscilla P. Kilcrease, Assistant Commissioner for Research, Board of Regents, State of Louisiana, on Behalf of the Coalition of EPSCoR States, Wednesday, June 3, 1992.
- "Department of Defense EPSCoR," citing DEPSCoR-related provisions: of the
  - FY 1992 Defense Appropriations Act
  - FY 1992 Defense Appropriations Conference Report (H.R. 102-95)
  - FY 1992–3 Defense Authorization Conference Report (H.R. 102-60).
- Prepared Testimony of Dr. Kerry Davidson, Deputy Commissioner, Academic Affairs and Sponsored Programs, Board of Regents, State of Louisiana, on Behalf of the Coalition of EPSCoR States, Subcommittee on Defense Appropriations, U.S. House of Representatives, Thursday, May 6, 1993.
- Memorandum from Jan Schoonmaker to State EPSCoR Contacts, subject, "FY 92 Defense EPSCoR (DEPSCoR) Announcements," July 13, 1993.
- Presentation by Arthur P. McGregor, Director, Defense Research & Engineering Research and Laboratory Management, 1993.
- Prepared Testimony of Dr. James Henson, on Behalf of the Coalition of EPSCoR States, Subcommittee on Defense Appropriations, U.S. Senate, Wednesday, June 12, 2002.
- Letter from Keith Thompson, OSD, to DEPSCoR State contacts, 2003.
- Prepared Testimony of James Hoehn, Senior Associate, EPSCoR/IDeA Foundation, on behalf of the Coalition of EPSCoR States, Subcommittee on Defense Appropriations, U.S. Senate, Tuesday, May 17, 2004.
- R2 Exhibit, PE Number 0601114D8Z (DEPSCoR) and 0601120D8Z (NDEP), February 2007.
- "EPSCoR/IDeA in Fiscal Year 2009" compilation of information regarding EPSCoR programs, March 2008.
- "Nuggets" from DEPSCoR states describing successful research.
- Concept Paper for DEPSCoR Evaluation (date unknown).

Note for Table B-5: H.R. = House of Representatives; OSD = Office of the Secretary of Defense; NDEP = National Defense Education Program

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Appendix C.
Examining the Time Trend in the Share of Department of Defense (DOD) Funding to Defense Experimental Program To Stimulate Competitive Research (DEPSCoR) States

A. Overview

The positive time trend observed in the share of the DOD university science and engineering (S&E) research and development (R&D) funding received by institutions in DEPSCoR states is potentially the central finding of this assessment. Several further analyses, using both descriptive statistics and econometric techniques, tested the strength of this initial finding:

1. Removing DEPSCoR program funds from the regression analyses
2. Changing the start and end time periods for the regression analyses to account for potential outliers in 1992 and 2005
3. Subdividing DEPSCoR states by current eligibility status to test whether formerly eligible states are responsible for the observed time trend
4. Subdividing DEPSCoR states by time of entry into the DEPSCoR program to test whether changes in National Science Foundation NSF Experimental Program To Stimulate Competitive Research (EPSCoR) eligibility criteria are responsible for the observed time trend
5. State-by-state correlations of DEPSCoR awards with DOD funding to test whether the universities receiving DEPSCoR awards are those receiving the bulk of DOD S&E R&D funds
6. Normalization by state population to observe changes in funding per capita
7. Comparison of DEPSCoR states with non-DEPSCoR states.

B. Further Analyses

1. Removing DEPSCoR Program Funds From the Regression Analyses

The NSF data used in the regression analyses include DEPSCoR funds in their state-level totals. DEPSCoR programmatic data were used to identify annual funding for DEPSCoR. Those funds were then removed from the data and the share of funding to DEPSCoR states was recalculated, as shown in Tables C-1 and C-2.

Table C-1. Share of DOD University S&E R&D to DEPSCoR States

Year	Total S&E R&D (B$)	S&E R&D to DEPSCoR States (B$)	DEPSCoR Funding (M$)	Adjusted S&E R&D (B$)	Adjusted S&E R&D to DEPSCoR States ($B)	DEPSCoR State Share (%)
1992	1.31	0.10	8.75	1.31	0.09	6.69
1993	1.59	0.17	13.19	1.57	0.16	9.85
1994	1.60	0.15	5.49	1.60	0.15	9.28
1995	1.61	0.13	20.00	1.59	0.11	6.94
1996	1.60	0.18	18.63	1.58	0.16	10.08
1997	1.52	0.15	17.00	1.50	0.13	8.95
1998	1.55	0.18	18.00	1.53	0.16	10.70
1999	1.69	0.18	19.05	1.67	0.16	9.52
2000	1.83	0.23	23.74	1.81	0.21	11.66
2001	1.95	0.24	20.99	1.93	0.22	11.57
2002	2.06	0.27	15.70	2.04	0.26	12.67
2003	2.22	0.33	15.22	2.21	0.31	14.14
2004	2.15	0.34	8.41	2.14	0.33	15.42
2005	2.50	0.45	11.43	2.49	0.44	17.47

Note for Table C-1: *DEPSCoR funding to Missouri from the 1992–1995 competitions not included in the DEPSCoR totals.*

Table C-2. Share of DOD University Research to DEPSCoR States

Year	Total Research (B$)	S&E Research to DEPSCoR States (B$)	DEPSCoR Funding (M$)	Adjusted S&E Research (B$)	Adjusted S&E Research to DEPSCoR States ($)	DEPSCoR State Share (%)
1992	0.84	0.07	8.75	0.83	0.06	7.56
1993	1.13	0.15	13.19	1.12	0.13	12.08
1994	1.26	0.12	5.49	1.25	0.12	9.28
1995	1.11	0.10	20.00	1.09	0.08	7.64
1996	1.13	0.16	18.63	1.11	0.14	12.43
1997	1.04	0.12	17.00	1.02	0.10	9.85
1998	1.09	0.14	18.00	1.07	0.12	11.35
1999	1.15	0.12	19.05	1.13	0.10	9.09
2000	1.23	0.16	23.74	1.21	0.14	11.23
2001	1.37	0.17	20.99	1.34	0.15	11.07
2002	1.38	0.18	15.70	1.37	0.16	12.00
2003	1.55	0.24	15.22	1.53	0.22	14.63
2004	1.53	0.23	8.41	1.52	0.22	14.56
2005	1.63	0.29	11.43	1.61	0.27	16.98

Note for Table C-2: *DEPSCoR funding to Missouri from the 1992–1995 competitions not included in the DEPSCoR totals.*

Table C-3 shows the influence on the adjustment on the regression models. While the exclusion of the DEPSCoR funds decreases the constant term by approximately 1%, it has little effect on the slope of the time trend or the model fit parameters (adjusted R-squared, significance levels). These results suggest that DEPSCoR funding alone does not account for the overall positive time trend identified.

Table C-3. Linear Regression Models of the Share of DOD University S&E R&D Funding to DEPSCoR-Eligible States, 1992–2005

Model	Adjusted R-Squared	Constant	Time trend (% Increase/ Year)	95% Confidence Interval for Time Trend	Significance Level (%)
1. S&E R&D: Unadjusted	0.83	0.077	0.64	0.47–0.81	1
2. S&E R&D: Adjusted	0.80	0.068	0.66	0.46–0.86	1
3. Research: Unadjusted	0.77	0.095	0.46	0.22–0.70	1
4. Research: Adjusted	0.54	0.082	0.49	0.23–0.75	1

2. Changing the Start and End Time Periods for the Regression Analyses To Account for Potential Outliers in 1992 and 2005

Tables C-1 and C-2 indicate that 1992 was a relatively low funding year and 2005 a relatively high funding year—especially for the DEPSCoR states. The adjusted data were used to run a second set of models, with the starting year as 1993 and the final year as 2004, to identify whether this change alone would influence the time trend. As shown in Table C-4, changing the start and end years in the analysis does modify the intercept and time trend parameters. The model fit parameter and the significance level on the time trend decrease for the research-only model, although they remain substantial and statistically significant. These results suggest that the start- and end-year change in alone does not account for the overall positive time trend identified. Even more substantial truncating of the data results in the elimination of the time trend. The trend remains when 1996–2004 data are modeled for all DOD S&E R&D, but it becomes impossible to reject the null hypothesis that the time trend for research is equal to zero.

3. Subdividing DEPSCoR States by Current Eligibility Status To Test Whether Formerly Eligible States Are Responsible for the Observed Time Trend

Four states—Alabama, Hawaii, Mississippi, and New Mexico—have "graduated" from the DEPSCoR program by exceeding 1.2% of DOD university S&E R&D. New Mexico was

Table C-4. Linear Regression Models of the Share of DOD University S&E R&D Funding to DEPSCoR-Eligible States, Varying Start and End Year

Model	Adjusted R-Squared	Constant	Time trend (% Increase/ Year)	95% Confidence Interval for Time Trend	Significance Level (%)
1. S&E R&D: Adjusted, 1992–2005	0.80	0.068	0.66	0.46–0.86	1
2. S&E R&D: Adjusted, 1993–2004	0.70	0.078	0.56	0.32–0.80	1
3. S&E R&D: Adjusted, 1996–2004	0.81	0.088	0.72	0.43–1.00	1
4. Research: Adjusted, 1992–2005	0.54	0.082	0.49	0.23–0.75	1
5. Research: Adjusted, 1993–2004	0.30	0.093	0.36	0.03–0.68	5
6. Research: Adjusted, 1996–2004	0.32	0.100	0.43	-0.04–0.90	Not significant at 5% level

only eligible for a single competition (2002), and institutions in Hawaii received only a single DEPSCoR award before Hawaii became ineligible. An alternative hypothesis, therefore, is that the formerly eligible states resulted in the bulk of the time trend.

Table C-5 shows the results of a series of regression models that are based upon subdivisions of the NSF data based upon the eligibility status of participating states. The models show that the eligibility status of the DEPSCoR-participating states in 2008 did not explain the time trend. The null hypothesis that the time trend was equal to zero was rejected for the states that remained eligible for DEPSCoR in 2008, just as it was for those states that had graduated from the program. These results suggest that DEPSCoR "graduation" alone does not account for the overall positive time trend identified.

4. Subdividing DEPSCoR States by Time of Entry Into the DEPSCoR Program To Test Whether Changes in NSF EPSCoR Eligibility Criteria Are Responsible for the Observed Time Trend

To become eligible for DEPSCoR, in addition to remaining below the 1.2% threshold, states needed to participate in the NSF EPSCoR. Seven states—Alaska, Delaware, Hawaii, New Hampshire, New Mexico, Rhode Island, and Tennessee—became EPSCoR eligible between

Table C-5. Linear Regression Models of the Share of DOD University S&E R&D Funding to DEPSCoR-Eligible States, Subdivided by Eligibility Status and DEPSCoR "Graduation"

Model	Adjusted R-Squared	Constant	Time trend (% Increase/ Year)	95% Confidence Interval for Time Trend	Significance Level
1. Formerly Eligible States' S&E R&D: Adjusted, 1992–2005	0.65	0.023	0.38	0.21–0.54	1
2. 2008-Eligible States' S&E R&D Adjusted, 1992–2005	0.60	0.045	0.28	0.15–0.41	1
3. Formerly Eligible States' Research: Adjusted, 1992–2005	0.41	0.030	0.19	0.06–0.31	1
4. 2008-Eligible States' Research: Adjusted, 1992–2005	0.50	0.052	0.31	0.13–0.49	1

Fiscal Years (FYs) 2001 and 2004. An alternative hypothesis to test, therefore, is that participation in EPSCoR (and DEPSCoR) bears no relationship to changes in share. If that were the case, there would be no difference between the time trends of those states that were DEPSCoR eligible in 1992 and those that first became DEPSCoR eligible after 2000.

Table C-6 shows the results of a series of models that tested this hypothesis. The models show that the time trend was stronger for the DEPSCoR-eligible states that were original participants in the program. The trend for research for the states that became eligible after 2000 was not statistically different from zero. Although the originally eligible states were modeled to have a smaller share of DOD university funding than the later eligible states (comparing the constant terms in model 1 with model 2, and model 4 with model 5), by 2005, the original participants had higher shares of DOD university S&E funding (both R&D and research) than the later eligible states. A final set of models (models 3 and 6) test whether there is a statistically significant difference in the time trends of the newly eligible and originally eligible states by testing whether a statistically significant time trend exists in the difference between the shares of

Table C-6. Linear Regression Models of the Share of DOD University S&E R&D Funding to DEPSCoR-Eligible States, Subdivided by Initial DEPSCoR Eligibility Status

Model	Adjusted R-Squared	Constant	Time trend (% Increase/ year)	95% Confidence Interval for Time Trend	Significance Level
1. New States' S&E R&D: Adjusted, 1992–2005	0.38	0.039	0.17	0.05–0.29	5
2. Originally Eligible States' S&E R&D Adjusted, 1992–2005	0.80	0.029	0.49	0.34–0.64	1
3. Combined (Originally Eligible – New States) S&E R&D: Adjusted, 1992–2005	0.50	-0.010	0.31	0.13–0.50	1
4. New States' Research: Adjusted, 1992–2005	0.13	0.048	0.10	-0.03–0.22	Not significant at 5% level
5. Originally Eligible States' Research: Adjusted, 1992–2005	0.60	0.034	0.39	0.20–0.59	1
6. Combined (Originally Eligible – New States) Research: Adjusted, 1992–2005	0.47	-0.014	0.30	0.11–0.48	1

the two groups of states. Both models 3 and 6 show a statistically significant and positive time trend. These findings indicate that the share of DEPSCoR states originally participating in the program was growing faster than the share of the newly eligible states, which suggests that there was a difference between the originally participating and new DEPSCoR states and in the direction confirming that the observed time trend was meaningful.

Table C-7 summarizes these calculations, showing the share of DOD S&E R&D (and research) funding divided among three groups of DEPSCoR-participating states:

1. Those that were eligible for the program at its inception and remain eligible
2. Those that have entered the program since its inception and remain eligible
3. Those that are no longer eligible for the program.

This table shows that even for those states that were, and remain, DEPSCoR eligible, there has been a substantial increase in the share of DOD R&D funding awarded to universities. There has been a substantial increase (especially when both research and development is included) to the formerly eligible states, but not to those states that have become DEPSCoR eligible after 2001.

Table C-7. Share of DOD Science and Engineering to Universities: Breakdown by Subcategory of DEPSCoR State

Year	DOD S&E R&D			DOD Research		
	At Inception, and Currently (%)	Joined and Remain Eligible (%)	Formerly Eligible (%)	At Inception, and Currently (%)	Joined and Remain Eligible (%)	Formerly Eligible (%)
1992	1.1	2.4	3.2	1.3	3.6	2.6
1993	3.4	2.0	4.5	4.1	2.7	5.3
1994	3.2	2.1	3.9	2.8	2.6	3.9
1995	1.4	2.5	3.0	1.1	3.4	3.2
1996	4.8	2.2	3.0	5.7	3.0	3.7
1997	3.8	2.5	2.7	3.5	3.4	2.9
1998	5.3	2.2	3.2	4.8	2.9	3.7
1999	3.8	1.9	3.8	3.7	2.4	3.0
2000	4.2	2.5	5.0	4.0	3.2	4.0
2001	3.9	2.0	5.6	4.0	2.6	4.4
2002	3.9	2.4	6.3	4.0	2.9	5.1
2003	5.6	2.6	6.0	6.2	3.2	5.2
2004	5.2	2.5	7.7	6.0	3.0	5.6
2005	6.0	2.5	9.0	7.2	3.4	6.4
2003–2005 minus 1992–1994	3.0	0.4	3.7	3.7	0.2	1.8

5. State-by-State Correlations of DEPSCoR Awards With DOD Funding To Test Whether the Universities Receiving DEPSCoR Awards Are Those Receiving the Bulk of DOD S&E R&D Funds

While the previous models identify a positive time trend in the DEPSCoR states' share of DOD funding to universities, there is a range of alternative explanations to explore. Since DOD awards are made to investigators at specific institutions, one hypothesis to examine is whether awards made to DEPSCoR institutions are correlated with overall DOD funding to those institutions.

Tables C-8 and C-9 show correlations between the number of DEPSCoR awards received by institutions in DEPSCoR states (excluding those states that received five or fewer awards) and the total DOD S&E R&D funding received by those institutions between FYs 1993 and 2005. The correlation analysis suggests that for most states, there is a strong correlation between overall DOD funding of university R&D and the number of DEPSCoR awards received by those institutions. This finding suggests that those institutions receiving most of DEPSCoR awards are those that also received most of other the DOD funds.

Table C-8. Correlations, by State

State	Correlation Coefficient
Alabama	0.91
Alaska	0.99
Arkansas	0.96
Idaho	0.96
Kansas	0.84
Kentucky	0.98
Louisiana	0.99
Maine	0.97
Mississippi	0.78
Montana	0.99
Nebraska	0.89
Nevada	N/A
North Dakota	0.84
Oklahoma	0.81
Puerto Rico	0.63
South Carolina	0.92
South Dakota	0.97
Vermont	0.99
West Virginia	0.99
Wyoming	N/A

Note for Table C-8: *The NSF data attribute funds to state university system offices in Alabama, Alaska, Arkansas, Louisiana, Maine, Nevada and Puerto Rico. Only one institution in Wyoming (University of Wyoming) received DOD funds 1993–2005. In Nevada, the plurality of funds were attributed to the University of Nevada system office, and so correlations could not be calculated since funds could not be divided among the University of Nevada-Reno and the University of Nevada-Las Vegas.*

Table C-9. DEPSCoR Awards and Total DOD S&E R&D, by Institution

State	University	Total DEPSCoRs (1993–2008)	Total Dollars (1993–2005) (K$)
Alabama	Auburn University (All Campuses)	20	117,103
	University of Alabama Huntsville	6	61,772
	University of Alabama-Birmingham	14	56,392
	Tuskegee University	0	21,705
	Alabama A & M University	7	20,704
	University of Alabama Systems Office	0	6,926
	University of Alabama	5	4,379
	University of South Alabama	1	1,652
	Oakwood College	0	402
	University of North Alabama	0	150
	Troy State University (Main Campus)	0	56
	Talladega College	0	47
Alaska	University of Alaska-Fairbanks (All Campuses)	6	38,997
	University of Alaska-Anchorage (All Campuses)	0	2,380
	University of Alaska System of Higher Education	0	1,692
	Alaska Pacific University	0	108
Arkansas	University of Arkansas (Main Campus)	33	32,128
	University of Arkansas-Little Rock	2	7,912
	Arkansas State University	0	7,128
	University of Arkansas Medical Science	3	3,658
	University of Arkansas Systems Office	0	298
	Arkansas Tech University	0	119
	University of Arkansas-Pine Bluff	0	82
	University of Central Arkansas	0	13
Idaho	University of Idaho	23	22,888
	Boise State University	9	15,214
	Idaho State University	1	2,645
Kansas	Kansas State University	18	32,099
	University of Kansas	10	30,509
	Wichita State University	10	2,490
	Pittsburg State University	0	1,467
	Haskell Indian Nations University	0	602
	Donnelly College	0	505
	Emporia State University	0	5

Table C-9. DEPSCoR Awards and Total DOD S&E R&D, by Institution (Continued)

State	University	Total DEPSCoRs (1993–2008)	Total Dollars (1993–2005) K$)
Kentucky	University of Louisville	16	27,452
	University of Kentucky (All Campuses)	19	22,765
	Western Kentucky University	2	1,368
	Louisville Technical Institute	0	997
	Kentucky State University	0	184
	Morehead State University	0	134
	Murray State University	0	42
Louisiana	Louisiana State University (All Campuses)	20	207,634
	Tulane University	3	35,080
	Southern University and A&M College (All Campuses)	0	12,424
	Grambling State University	0	12,361
	Louisiana Tech University	1	8,904
	Xavier University of Louisiana	0	5,017
	Louisiana Universities Marine Consortium	0	2,716
	Louisiana State University System Office	0	2,504
	Dillard University	0	598
	University of Southwestern Louisiana	2	592
	University of Louisiana-Lafayette	0	463
	University of Louisiana-Monroe	0	255
	Southeastern Louisiana University	1	36
	Northeast Louisiana University	0	28
Maine	University of Maine	20	44,976
	University of Maine System Office	0	7,398
	University of New England	2	906
	University of Southern Maine	3	562
	Maine Maritime Academy	0	54
	Colby College	0	30
Mississippi	Mississippi State University	13	137,493
	University of Mississippi	8	96,745
	University of Southern Mississippi	13	39,236
	Jackson State University	1	20,040
	Rust College	0	659
	Alcorn State University	0	65

Table C-9. DEPSCoR Awards and Total DOD S&E R&D, by Institution (Continued)

State	University	Total DEPSCoRs (1993–2008)	Total Dollars (1993–2005) (K$)
Montana	Montana State University-Bozeman	50	37,611
	University of Montana	4	9,063
	Salish Kootenai College	0	1,462
	Montana Tech of University of Montana	0	1,247
	Fort Belknap College	0	754
	Stone Child College	0	421
	Ft. Peck Community College	0	282
	Montana State University-Billings	0	186
	Little Big Horn College	0	161
	Blackfeet Community College	0	137
Nebraska	University of Nebraska Lincoln	47	53,723
	University of Nebraska Medical Center	0	24,075
	Creighton University	0	4,220
	University f Nebraska-Omaha	2	548
Nevada	Nevada System of Higher Education	0	11,708
	University and Community College System Nevada System Office	0	10,018
	Desert Research Institute	10	9,886
	University of Nevada-Las Vegas	8	8,621
	University of Nevada-Reno	18	4,743
North Dakota	North Dakota State University	17	48,161
	University of North Dakota	11	3,841
	North Dakota State College of Science	0	2,735
	Turtle Mountain Community College	0	1,067
	Ft. Berthold Community College	0	531
	Sitting Bull College	0	464
Oklahoma	Oklahoma St University	18	53,023
	University of Oklahoma	28	30,252
	University of Tulsa	6	3,067
	Southeastern Oklahoma State University	0	496
	Cameron University	0	304
	Northeastern State University	0	24

Table C-9. DEPSCoR Awards and Total DOD S&E R&D, by Institution (Continued)

State	University	Total DEPSCoRs (1993–2008)	Total Dollars (1993–2005) (K$)
Puerto Rico	University of Puerto Rico-Mayaguez	8	13,322
	University of Puerto Rico System	0	3,595
	University of Puerto Rico Humacao University College	0	3,088
	University of Puerto Rico-Rio Piedras	10	2,638
	Universidad Politecnica de Puerto Rico	0	2,095
	University of Puerto Rico Medical Science	0	624
	Universidad del Turabo	0	270
	Pontifical Catholic University of Puerto Rico	0	178
	University of Puerto Rico Cayey University College	0	49
South Carolina	University of South Carolina (All Campuses)	25	77,314
	Clemson University	22	68,022
	Medical University of South Carolina	0	40,437
	South Carolina State University	0	1,245
	Newberry College	0	1,188
	Newberry College	0	1,119
	Claflin College	0	525
	Benedict College	0	470
	College of Charleston	0	144
South Dakota	South Dakota School of Mines and Technology	10	34,562
	South Dakota State University	1	10,052
	Oglala Lakota College	0	2,590
	Sisseton-Wahpeton Community College	0	744
	University of South Dakota	1	528
Vermont	University of Vermont	30	11,855
	St Michaels College	1	117
	Southern Vermont College	0	50
	Middlebury College	0	27
West Virginia	West Virginia University-Morgantown	33	35,509
	Marshall University	5	3,210
	West Virginia State College	0	185
Wyoming	University of Wyoming	41	19,174

6. Normalization by State Population To Observe Changes in Funding per Capita

The identification of a positive time trend among the DEPSCoR states suggested that there should also be a resulting change in per-capita funding trends. Figures C-1 and C-2 show DOD S&E R&D funding to universities per capita for two time periods: 1992–1994 and 2003–2005. In 1992–1994, nine states exceeded the U.S. per-capita average, including three states that were included in the DEPSCoR program (New Mexico, Rhode Island, and Delaware). There was a large group of states that remained well below the U.S. average, most of which were DEPSCoR states. By 2003–2005, however, the distribution had shifted substantially. Seventeen states were above the U.S. average, including all the formerly DEPSCoR states and five states currently eligible for the DEPSCoR program (Delaware, Alaska, Rhode Island, Montana, and South Dakota). While a large group of states remained well below the U.S. average, they were more evenly distributed between those that were DEPSCoR eligible and those that were not. Similar results were observed when only DOD research was plotted (data not shown).

Table C-10 presents the information in tabular form, showing the per-capita average for both all university S&E R&D and for research alone. The table shows that substantial shifting occurred in the rank orderings for both total DOD S&E R&D (Spearman's rank correlation of 0.52) and for research only (Spearman's rank correlation of 0.44). DEPSCoR states (e.g., Hawaii, North Dakota, Alaska, Mississippi, Montana, South Dakota, Maine, Idaho and Nevada) made the largest upward moves between 1992–1994 and 2003–2005, while both DEPSCoR states (e.g., Wyoming, West Virginia, and New Hampshire) and non-DEPSCoR states (e.g., Georgia, Ohio, Colorado, New York, Minnesota, Oregon, Arizona, and Wisconsin) were among those whose ranking in the per-capita tables dropped substantially. With the exception of the District of Columbia (for university S&E R&D only), the ten states receiving the largest absolute per-capita increases in funding were DEPSCoR states, while all of the states receiving the largest relative per-capita increases were affiliated with the DEPSCoR program.

7. Comparison of DEPSCoR States With Non-DEPSCoR States

In 1992, four states (Maryland, Massachusetts, California, and Pennsylvania) received more than half ($0.72 billion of $1.31 billion or 55%) of DOD's S&E R&D funds awarded to universities and nearly half of DOD's research funds ($0.37 billion of $0.84 billion or 44%) to universities. By 2005, the share received by those four states had declined substantially, to less than 40% of all S&E R&D to universities ($0.95 billion of $2.5 billion or 38%) and of research

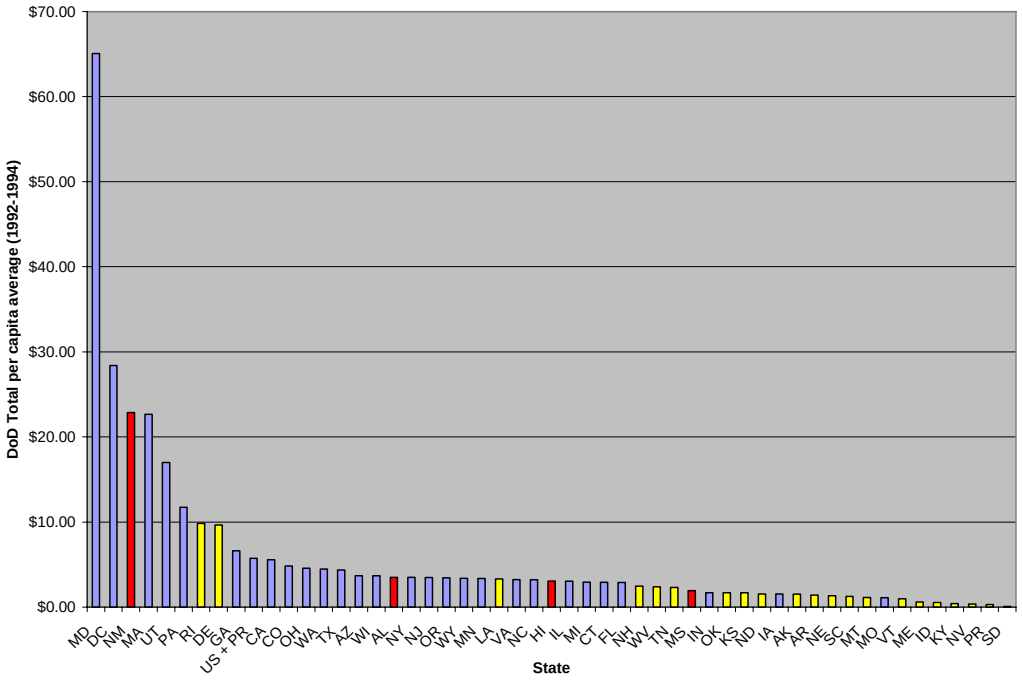

Figure C-1. DOD S&E R&D to Universities, Per-Capita Funding by State, 1992–1994

Note for Figure C-1: *Formerly eligible states in red, current DEPSCoR states in yellow; non-DEPSCoR states in blue.*

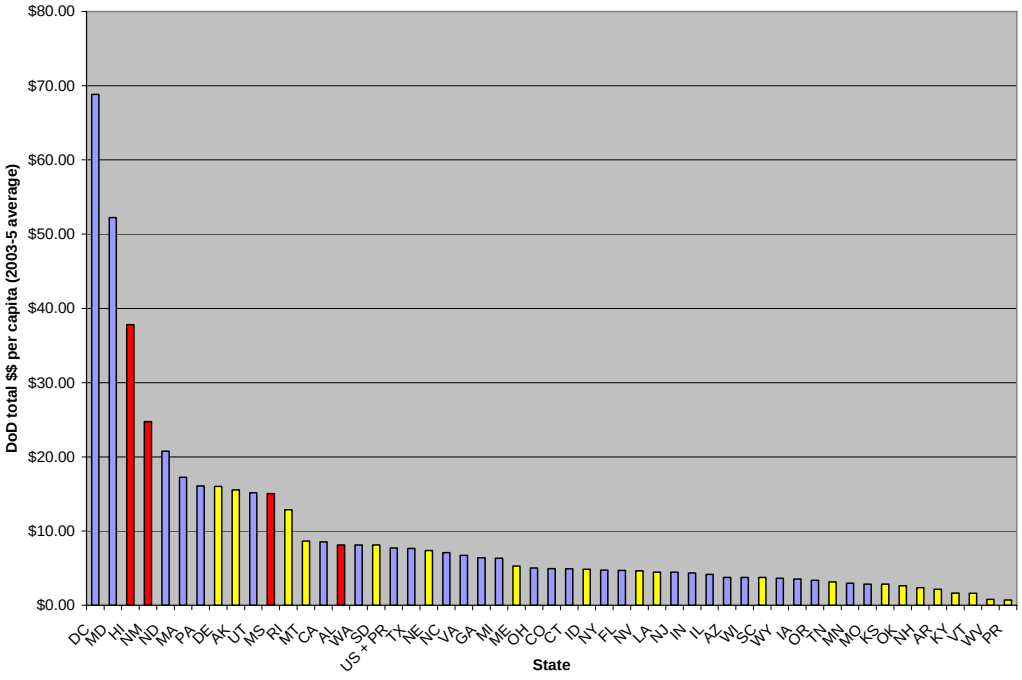

Figure C-2. DOD S&E R&D to Universities, Per-Capita Funding by State, 2003–2005

Note for Figure C-2: *Formerly eligible states in red, current DEPSCoR states in yellow; non-DEPSCoR states in blue.*

Table C-10. Per Capita Funding to Universities, by State, Comparing 1992–1994 and 2003–2005

State	Total DOD: (1992–1994) ($/Person)	Total DOD: (2003–2005) ($/Person)	Rank: 1992–1994	Rank: 2003–2005	DOD Research: (1992–1994) ($/Person)	DOD Research: (2003–2005) ($/Person)	Rank: 1992–1994	Rank: 2003–2005
Washington, DC	28.38	68.83	2	1	27.68	12.66	1	5
Maryland	65.08	52.25	1	2	19.29	10.93	3	9
Hawaii	3.06	37.82	26	3	3.01	25.38	21	1
New Mexico	22.87	24.76	3	4	15.21	12.37	4	6
North Dakota	1.55	20.77	38	5	1.10	20.02	41	2
Massachusetts	22.66	17.23	4	6	20.45	15.85	2	3
Pennsylvania	11.72	16.08	6	7	8.44	10.52	7	10
Delaware	9.65	16.02	8	8	9.49	14.59	6	4
Alaska	1.53	15.56	40	9	1.49	12.22	37	7
Utah	17.00	15.17	5	10	6.76	4.87	8	19
Mississippi	1.94	15.05	34	11	1.80	5.09	34	18
Rhode Island	9.85	12.87	7	12	9.84	12.20	5	8
Montana	1.12	8.65	44	13	1.12	6.37	40	14
California	5.57	8.53	10	14	5.19	7.56	9	12
Alabama	3.50	8.14	17	15	2.86	4.48	24	23
Washington	4.47	8.13	13	16	3.65	6.31	13	15
South Dakota	0.06	8.13	52	17	0.06	8.05	52	11
Texas	4.36	7.67	14	18	2.64	4.05	28	29
Nebraska	1.33	7.36	42	19	1.12	4.10	39	27
North Carolina	3.21	7.11	25	20	2.92	6.51	22	13
Virginia	3.24	6.72	24	21	2.84	5.93	25	16
Georgia	6.63	6.39	9	22	3.78	3.99	11	31
Michigan	2.94	6.34	28	23	2.47	5.56	30	17
Maine	0.60	5.29	47	24	0.60	4.42	46	24
Ohio	4.55	5.04	12	25	3.77	3.78	12	33
Colorado	4.83	4.95	11	26	4.61	4.56	10	22
Connecticut	2.91	4.90	29	27	2.89	4.20	23	25
Idaho	0.54	4.86	48	28	0.54	4.86	47	20
New York	3.50	4.74	18	29	3.29	4.12	17	26
Florida	2.89	4.72	30	30	2.71	4.07	27	28
Nevada	0.35	4.64	50	31	0.35	4.58	50	21
Louisiana	3.30	4.47	23	32	2.59	3.06	29	40

Table C-10. Per Capita Funding to Universities, by State, Comparing 1992–1994 and 2003–2005 (Continued)

State	Total DOD: (1992–1994) ($/Person)	Total DOD: (2003–2005) ($/Person)	Rank: 1992–1994	Rank: 2003–2005	DOD Research: (1992–1994) ($/Person)	DOD Research: (2003–2005) ($/Person)	Rank: 1992–1994	Rank: 2003–2005
New Jersey	3.47	4.47	19	33	3.11	3.63	20	35
Indiana	1.70	4.36	35	34	1.68	4.03	36	30
Illinois	3.04	4.18	27	35	2.82	3.85	26	32
Arizona	3.69	3.75	15	36	3.17	3.55	18	37
Wisconsin	3.69	3.74	16	37	3.64	3.38	14	38
South Carolina	1.26	3.73	43	38	1.05	3.67	43	34
Wyoming	3.39	3.65	21	39	3.39	3.61	15	36
Iowa	1.55	3.55	39	40	1.41	2.80	38	41
Oregon	3.42	3.37	20	41	3.37	3.27	16	39
Tennessee	2.30	3.16	33	42	2.14	2.52	33	43
Minnesota	3.37	2.99	22	43	3.15	1.88	19	45
Missouri	1.11	2.86	45	44	1.10	1.73	42	46
Kansas	1.68	2.86	37	45	1.68	2.60	35	42
Oklahoma	1.69	2.62	36	46	0.97	1.42	44	48
New Hampshire	2.46	2.38	31	47	2.46	2.14	31	44
Arkansas	1.41	2.16	41	48	0.47	1.24	48	49
Kentucky	0.42	1.63	49	49	0.41	0.89	49	50
Vermont	0.99	1.60	46	50	0.85	1.60	45	47
West Virginia	2.39	0.80	32	51	2.38	0.80	32	51
Puerto Rico	0.31	0.71	51	52	0.31	0.71	51	52

Note for Table C-10: *Sorted by DOD university S&E R&D, 2003–2005 per-capita average.*

($0.59 billion of $1.63 billion or 37%).[69] This finding of substantial decentralization of DOD university funding during the 1990s and early 2000s suggested the hypothesis that when the top four states were removed, all other states—whether or not they participated in the DEPSCoR program—increased their shares of DOD university funding. Table C-11 shows the results of time trend regression models that consider the share of DEPSCoR and non-DEPSCoR-eligible states (other than the four largest) for both DOD university S&E R&D and research funding.

69 H-indexes for all S&E R&D declined from 0.088 (1992–1994) to 0.060 (2003–2005) for S&E R&D and from 0.069 (1992–1994) to 0.059 (2003–2005) for research.

Table C-11. Linear Regression Models of the Share of DOD University S&E R&D Funding to DEPSCoR-Eligible and non-DEPSCoR-Eligible States

Model	Adjusted R-squared	Constant	Time Trend (% Increase/ Year)	95% Confidence Interval for Time Trend	Significance Level
1. DEPSCoR States' S&E R&D: Adjusted, 1992–2005	0.80	0.068	0.66	0.46–0.86	1
2. Non-DEPSCoR States' S&E R&D: Adjusted, 1992–2005	0.33	0.403	0.34	0.07–0.86	5
3. Difference between DEPSCoR and non-DEPSCoR States: S&E R&D	0.17	0.335	-0.32	-0.68–0.04	Not significant at 5% level
4. DEPSCoR States' Research: Adjusted, 1992–2005	0.54	0.082	0.49	0.23–0.75	1
5. Non-DEPSCoR States' Research: Adjusted, 1992–2005	-0.02	0.471	0.14	-0.22–0.49	Not significant at 5% level
6. Difference between DEPSCoR and non-DEPSCoR States: Research	0.10	0.389	-0.35	-0.85–0.14	Not significant at 5% level

While the models suggest that the rate of increase for the DEPSCoR states was faster than that of the non-DEPSCoR states, the differences between the two rates of increase were not statistically significant. It was not possible to refute the null hypothesis that both the DEPSCoR and non-DEPSCoR states were drawn from the same statistical distribution.

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Appendix D.
List of Interviewees in Completed Interview Categories

- DOD program managers (April/May 2008)
  - Evelyn Kent (OSD/DUSD)
  - Kurt Preston (ARO)
  - William Lukens (ONR)
  - Edward Lee (AFOSR)
- DEPSCoR state leadership/project directors—initial conference call (April 2008) and follow-on roundtable discussion (May 2008)
  - Prem Paul (Nebraska)
  - Peter Alfonso (Rhode Island)
  - Judith Van Houten (Vermont)
  - Michael Khonsari (Louisiana)
  - Penny Amy (Nevada)
  - F. Fred Choobineh (Nebraska)
  - Jack Carpenter (West Virginia)
- Congressional staff (February/June 2008)
  - Arun Seraphin (SASC/majority)
  - Church Hutton (SASC/minority)
- Department chairs of departments receiving the largest number of DEPSCoR awards (July/August 2008)
  - Surendra Singh (University of Arkansas, Department of Physics)
  - Jerrold Griggs (University of South Carolina, Department of Mathematics)
  - Earl Scime (West Virginia University, Department of Physics)

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14. ABSTRACT

The DoD's Defense Experimental Program to Stimulate Competitive Research (DEPSCoR) was created by Congress in the Fiscal Year (FY) 1991 DoD appropriation and legislatively authorized in 1994 (National Defense Authorization Act for Fiscal Year 1995, P.L. 103-337, §257; Oct. 5, 1994, 108 Stat. 2705). The program is authorized to award research grants and graduate traineeships in support of two objectives: (1) to enhance the capabilities of institutions of higher education in eligible States to develop, plan, and execute science and engineering (S&E) research that is competitive under the peer-review systems used for awarding federal research assistance and (2) to increase the probability of long-term growth in the competitively awarded financial assistance that institutions of higher education in eligible States receive from the Federal Government for S&E research. Section 241 of the FY 2008 Defense Authorization required an assessment of the DEPSCoR program. The assessment includes a description of the tangible results and progress toward the program objectives and an evaluation of the activities undertaken by the DoD and the State planning committees. This volume contains supporting documentation corresponding to the six specific assessments required by the FY 2008 Defense Authorization.

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Experimental Program to Stimulate Competitive Research (EPSCoR), states, university research

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