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Measures of Concentration and Spatial Association

We apply two different indicators of spatial concentration to data on employment and patents by sector and value-chain: the simple location quotient and the local G statistic (G_i). A location quotient is a basic summary measure of relative size:

$$\left(\frac{e_{ij}}{e_{it}} \right) \div \left(\frac{E_j}{E_t} \right)$$

where e represents employment (or patents) in an Appalachian sub-region, E denotes U.S. employment (or patents), i subscripts the areal unit of analysis (the county), j subscripts sector (or value-chain or occupation), and t denotes total. A location quotient of 1.0 indicates that the share of activity in the county matches the comparable share for the nation. Location quotients significantly above one (e.g., 1.1 or higher in the case of industry employment, 1.25 or higher in the case of patent grants and occupational employment) indicate a specialization in the given category, i.e. that the given sub-region has a larger share of activity than what we would expect based on the prevailing national sectoral mix.

Location quotients can be misleading when applied at small spatial scales. They do not account for the volume of activity in any particular place, only the share. As a result, small, narrowly specialized economies often post high location quotients that yield a spurious picture of relative specialization. Clearly absolute size, and not just relative size, is an important dimension of functional industrial specialization. To offset the problem of high location quotients in very small counties, we plot location quotients only for counties with at least fifty workers in the given industry or fifty patents in the given technology area.

A location quotient only measures concentrated activity within a sub-region rather than across or between neighboring sub-regions. Our second measure of local spatial concentration, the G_i statistic,

measures concentrations of activity both within and across jurisdictional boundaries. The G_i is essentially a share-based measure of spatial concentration, i.e. the amount of activity in a multi-unit region divided by the total activity across all units in the nation, measured in standard deviations from the mean. The results are roughly interpretable as z -scores along the normal curve. We use a 95 percent significance level to identify sub-regions with significant concentration in given technology areas. We calculate G_i statistics for both ZIP codes and counties.

The measure for areal unit i for a given industry cluster is calculated as:

$$G_i^* = \frac{\sum_j w_{ij} x_j - W_i \bar{x}}{s \sqrt{(nS_{ii} - W_i^2) / (n-1)}}, \text{ all } j$$

where x is the variable of interest (e.g. employment or patents), $\{w_{ij}\}$ is a spatial weights matrix that defines neighboring areas j to areal unit i , W_i is the sum of weights in $\{w_{ij}\}$, $\bar{x} = \sum_j x_j / (n-1)$, $S_{ii} = \sum_j w_{ij}^2$ and $s^2 = (\sum_j x_j^2 / n - 1) - (\bar{x})^2$. Although the normality of G_i^* depends partially on the number of neighbors (Getis and Ord 1992), we make the common simplifying assumption that G_i^* follows a normal distribution for each county. Significant areas (counties or ZIP codes) are identified as those posting values of 1.96 or greater, the 95 percent significance level from a two-tailed normal distribution.

The first step in calculating G_i^* is to develop a spatial weights matrix $\{w_{ij}\}$. The spatial weights matrix acts first as a filter so that only cluster residual employment of neighboring areas are included in the calculation of local concentration. In this study we use a weighted matrix, with adjacency defined by immediate neighbor areas (counties or ZIP codes) inclusive of the area itself. Non-neighboring areal units are given a weight of zero. The value x of neighboring area j to area i is weighted by the degree of expected interaction between areas j and i :

$$w_j = \frac{X_i X_j}{\sum_j X_i X_j}$$

where upper-case X is total exportable (or basic sector) employment and the denominator is the sum of interactions between areal unit i and all its neighboring areas j . Dividing by the sum of interactions row-standardizes the matrix, turning each cell's weight into a percentage of the total interactions between adjacent areas. The logic behind the weighting scheme is essentially the notion that larger cen-

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1. The gravity specification of the weights is far better at identifying discrete concentrations of activity than the more common binary weights.

ters typically exert a heavier influence on neighbor areas than do smaller centers. There is also an implicit assumption that non-neighboring areas do not interact.¹

To detect unique clusters of activity in and around Appalachia, we also need a means of controlling for the general tendency of industry to concentrate geographically. To the extent that much commerce serves the local population, we should expect more employment in urban centers simply because there is more activity there to begin with. In this study, we are more interested in finding local concentrations of activity beyond those that might be expected by the general distribution of employment and population.

To do this, we use a procedure we developed for a previous study.² The first step is to estimate a linear regression model with sectoral employment (or patents) as the dependent variable and total export-base employment as the sole explanatory variable, where counties or ZIP codes are the units of analysis. The regression predicts local employment (or patents) in the sector or cluster based on the distribution of total export-base employment. The difference between the predicted and actual employment or patents, i.e. the residual, is an estimate of local activity beyond that expected by the overall size of the place. The G_i is then calculated using the residuals to identify areas with significant concentrations of technology-related activity.³ The residuals constitute that portion of employment in the given sector unexplained by the general distribution of economic activity.

Although not infallible, the residual method tends to successfully exclude very small and overly specialized places, because such places are also likely to have small residuals. A downside is that the approach sometimes misses concentrations that are entirely confined within the borders of a single spatial unit. Thus the reason for comparing results using G_i with findings generated with county-level location quotients.⁴ We also calculate G_i based on county-level growth residuals between 1989 and 1998 in an attempt to identify emerging technology clusters.⁵

2. See Feser, Sweeney *et al.* (2001).

3. In the case of patents, G_i statistics are calculated on the residuals of a linear regression with the number of county patents in a technology sector as the dependent variable, and the average county population between 1990 and 1999 as the independent variable. The residuals correspond to the expected county patenting activity beyond that explained by the population of the county. Because patents are coded to the residence of the inventor, population is a better control than employment.

4. G statistics are only calculated for ZIP codes within 60 miles of the ARC region, due to the large number of ZIP codes and the difficulties involved in their computation. Nevertheless, the ZIP codes G_i 's are derived using national totals as a baseline and therefore are relative to activity in the entire continental U.S.

5. Reporting G_i values by county or ZIP code does not violate U.S. BLS confidentiality rules since actual employment volumes cannot be derived by examination of the coefficients. The statistical coefficients are actually more informative than raw employment totals in searching for spatial concentration, because they control for the size of the local economy and spillovers across jurisdictions.

Derivation of High Tech Value-Chains

Our goal was to develop a consistent set of value-chains comprised of linked technology-oriented industries. We began by analyzing value-chain relationships via a factor analysis of 1992 U.S. input-output (I-O) data.⁶ To do this, we first developed a standard 491 by 491 inter-industry transactions matrix from the detailed industry by commodity benchmark input-output accounts. Specifically, following Czamanski (1974) we formed — from the 491 by 491 matrix of inter-industry transactions, \mathbf{A} — two matrices, \mathbf{X} and \mathbf{Y} , with elements:

$$x_{ij} = \frac{a_{ij}}{a_{+j}}, \quad y_{ij} = \frac{a_{ij}}{a_{i+}}$$

where a_{ij} is the dollar value of goods and services sold by industry i in some period to industry j , and a_{+j} and a_{i+} are total intermediate good purchases and sales, respectively, of industries i and j over the same period. x_{ij} is intermediate good purchases by sector j from i as a proportion of j 's total intermediate good purchases. The columns of \mathbf{X} are the intermediate input purchasing pattern of each industry j , while the rows of \mathbf{Y} are the intermediate output sales pattern of each industry i .

For any two industries (A and B) with the column vectors of \mathbf{X} defined as \mathbf{x}_A , and \mathbf{x}_B and the row vectors of \mathbf{Y} defined as \mathbf{y}_A and \mathbf{y}_B , four correlations on the sales and purchasing vectors of any two industries may be derived (again, following Czamanski): 1) $r(\mathbf{x}_A \bullet \mathbf{x}_B)$ measures the similarity in input purchasing patterns of industries A and B; 2) $r(\mathbf{y}_A \bullet \mathbf{y}_B)$ measures the degree to which A and B possess similar output selling patterns, i.e. the degree to which they sell goods to a similar mix of intermediate input buyers; 3) $r(\mathbf{x}_A \bullet \mathbf{y}_B)$ measures the degree to which the buying pattern of industry A is similar to the selling pattern of industry B, i.e. the degree to which industry A purchases inputs from industries in which B supplies (a second-tier linkage); and 4) $r(\mathbf{x}_B \bullet \mathbf{y}_A)$ measures the degree to which the buying pattern of industry B is similar to the selling pattern of industry A, i.e. the degree to which industry B purchases inputs from industries in which A supplies. A linkage matrix, \mathbf{L} , comprising the largest of these four correlations for each pair of sectors, summarizes the degree of linkage between and among

6. The base input-output data are from the *Benchmark Input-Output Accounts of the United States, 1992* (Washington, DC: U.S. Department of Commerce), accessible via the Internet at <http://www.bea.doc.gov/bea/dn2/i-o.htm>.

all 491 sectors. To derive a group of technology-intensive value-chains, we reduced **L** to represent only SIC sectors commonly identified as technology-intensive.⁷

To derive the clusters, we wrote a program using SAS software that conducted a factor analysis on the linkage matrix **L** over multiple times, changing the number of components subject to rotation by one on each iteration.⁸ The program aided the analysis by sorting the rotated factors by loading, attaching detailed SIC industry labels to each I-O sector, and producing scree plots and tables reporting the relative proportion of variance explained by each component and the size of the associated eigenvalues. After inspecting each set of results in terms of indicators of fit, economic plausibility, and general interpretability, we selected a final model revealing eight components.

Associated with a given component is a reduced set of variables — in this case, sectors — which constitute its key statistical element. The indicator for determining this element is the individual loading, which is a measure of the relative strength of the relationship between a given variable and each derived component. The magnitudes of the loadings therefore determine the membership in each cluster. I-O sectors were generally included in the value-chain if their loading was equal to or exceeded 0.35, though in some cases we eliminated sectors after inspecting underlying input-output patterns in each cluster.⁹ All eight components could be interpreted (i.e., labeled) in a straightforward manner by examining underlying input-output linkages. Note that the eight value-chains are not mutually exclusive; any given underlying industry may be a member of multiple chains.

Summary of Data Sources

The following summarizes the principal sources of data used in the report. Manipulations of the data to derive specific indicators are documented in the report proper (and its extensive set of endnotes).

Industry employment and wages. Employment and wage data by sector are from the confidential U.S. Bureau of Labor Statistics Unemployment Insurance Data Base (UDB), used via special permission. The UDB file is constructed from unemployment insurance tax records assembled by the states

7. The following 109 I-O codes concord to 148 technology-intensive SIC industries: I130100, I270100, I270201, I270202, I270300, I270401, I270402, I270403, I270404, I270405, I270406, I280100, I280200, I280300, I280400, I290100, I290201, I290202, I290203, I290300, I300000, I430100, I430200, I450100, I450200, I450300, I460100, I460200, I460300, I460400, I470100, I470200, I470300, I470401, I470402, I470404, I470405, I470500, I480100, I480200, I480300, I480400, I480500, I480600, I490100, I490200, I490300, I490500, I490600, I490700, I490800, I510102, I510103, I510104, I510400, I530200, I530300, I530400, I530500, I530700, I530800, I540100, I540200, I540300, I540400, I540500, I540700, I550100, I550200, I550300, I560100, I560200, I560300, I560500, I570100, I570200, I570300, I580100, I580200, I580400, I580600, I580700, I590100, I590200, I590301, I590302, I600100, I600200, I600400, I610603, I620101, I620102, I620200, I620300, I620400, I620500, I620600, I620800, I620900, I621000, I621100, I630200, I630300, I660100, I730104, I730112, I730302, I770200, I770305.

8. All calculations were performed using SAS Interactive Matrix Language (IML) software as well as the SAS FACTOR procedure. We used a Promax rotation. Promax produces an orthogonal pre-rotation (equivalent to Varimax) followed by an oblique rotation. Oblique rotation is favored when a high degree of overlap across factors is expected.

under the ES-202 program. At the time of study, 1998 was the most recent year available, with reliable data starting in 1989. The primary limitation of ES-202 data is the exclusion of sole proprietorships. ES-202 data are estimated to include some 95 percent of businesses in the U.S. Our national data exclude Alaska, Hawaii, and Wyoming since we lacked permission to use those states' files.

Occupational employment. Metropolitan occupational employment figures are from the 1999 Occupational Employment Statistics files of the U.S. Bureau of Labor Statistics. The data are downloadable from <http://www.bls.gov/oes/home.htm>.

Faculty quality ratings. The faculty quality ratings are from the National Research Council's (NRC) 1995 *National Survey of Graduate Faculty*. The findings of the survey are reported in the NRC publication *Research-Doctorate Programs in the Untied States: Continuity and Change*, which is available online at <http://books.nap.edu/html/researchdoc/>. Institutional rankings by discipline are available at: http://books.nap.edu/html/researchdoc/researchdoc_tables.html.

Reputation measures such as that used to determine faculty quality, are inherently subjective and tend to change only very slowly. The NRC notes, however, that pooling raters' responses generates strong consensus on both the strongest and weakest programs, though considerably less agreement exists on programs in the middle range. Further, the NRC recognizes that, "differences in ranked order between two programs may reflect very small, unreliable, or insignificant differences in the actual quality of a program, and should be regarded by readers with great caution."

University research funding. Data on research and development expenditures were obtained through the National Science Foundation's CASPAR and WebCASPAR Database Systems (<http://caspar.nsf.gov>). The underlying data are from the *Survey of Scientific and Engineering Expenditures at Universities and Colleges*, a survey conducted annually since fiscal year 1972. All science and engineering doctorate-granting institutions and/or all other institutions conducting at least \$50,000 annually in separately budgeted R&D are included in the survey. Over the years, approximately 97 percent of more than 500 institutions nationwide participate in the survey. Moreover, NSF estimates that this survey accounts for approximately 98 percent of all academic R&D expenditures in the United States.

Graduate student enrollments. Graduate science and engineering student enrollment data were obtained from the WebCASPAR Database System. The underlying source is NSF's *Graduate Students and Postdoctorates in Science and Engineering (GSS)* survey. Conducted annually since 1975, the GSS survey collects data from close to 100 percent of all institutions granting masters or higher level degrees in science and engineering disciplines.

University patents and gross license income. Data on the number of patents issued to universities and gross license income are from the Association of University Technology Managers (AUTM 1991, 1995, 1999). Participants in the AUTM survey include U.S. universities, hospitals and research insti-

tutes, Canadian institutions, and third-party patent management firms. Of the nearly 196 universities surveyed in FY 1995, approximately 62 percent responded. Among the top 100 research institutions (as measured by total federal dollar support), 87 percent responded. See http://www.autm.net/index_ie.html.

Non-university research organizations and labs. Derived from our own independent research along with Coburn and Berglund 1995 and the membership directory of the National Business Incubator Association (<http://www.nbia.org>).

Utility patent grants by county. Obtained by special request from the U.S. Patent and Trade Office for states with at least one county in the ARC region. Our analysis utilizes patents awarded between 1990 and 1999 (the most recent year available at the time of the study). A full description of the USPTO patent database (along with technical documentation) is available online at <http://www.uspto.gov>.

SBIR, STTR, and ATP awards by ZIP code. Derived from program competition announcements for fiscal year 2000. See <http://www.sba.gov/SBIR/indexsbir-sttr.html>.

Degree completions. College and university completions data were compiled from the U.S. Department of Education, National Center for Education Statistics' Integrated Postsecondary Education Data System (IPEDS) completions survey (1997–98) and consolidated survey (1998). The IPEDS universe includes all public and private post-secondary educational institutions that have Program Participation Agreements (PPAs) regarding Title IV federal financial aid programs, some 9,519 schools in the U.S. Degree completions in the IPEDS are disaggregated by over 550 Classification of Instructional Programs (CIP) codes. For the 1997–98 survey year, the IPEDS completions survey response rates vary between 89 percent for four-year institutions, 88 percent for two-year schools, and 53 percent for less than two year institutions. Although survey respondents cover the vast the majority degrees granted, the IPEDS completion data technically must be regarded as a slight undercount of total degrees granted. The IPEDS data and associated technical documentation are available online at <http://nces.ed.gov/ipeds/>.

Appendix Table 1

SIC-Technology classification

SIC	Sector title	SIC	Sector title
<i>Very technology-intensive</i>			
2830	Drugs	7373	Computer integrated systems design
3570	Computer and office equipment	7374	Data processing and preparation
3660	Communications equipment	7375	Information retrieval services
3720	Aircraft and parts	7379	Computer related services, nec
3760	Guided missiles, space vehicles, parts	8711	Engineering services
3812	Search and navigation equipment	8731	Commercial physical research
3820	Measuring and controlling devices	8733	Noncommercial research organizations
7371	Computer programming services	8734	Testing laboratories
7372	Prepackaged software		
<i>Moderately technology-intensive</i>			
2810	Industrial inorganic chemicals	3844	X-ray apparatus and tubes
2820	Plastics materials and synthetics	3845	Electromedical equipment
2860	Industrial organic chemicals	3851	Ophthalmic goods
3670	Electronic components and accessories	3861	Photographic equipment and supplies
3711	Motor vehicles and car bodies	8062	General medical and surgical hospitals
3714	Motor vehicle parts and accessories	8071	Medical laboratories
3716	Motor homes	8072	Dental laboratories
3841	Surgical and medical instruments	8090	Health and allied services, n.e.c.
<i>Somewhat technology-intensive</i>			
2840	Soap, cleaners and toilet goods	3630	Household appliances
2851	Paints, varnishes, lacquers, etc.	3640	Electric lighting and wiring equipment
2873	Agricultural chemicals	3650	Household audio and video equipment
2890	Misc chemical products	3690	Misc electrical equipment and supplies
3510	Engines and turbines	3713	Truck and bus bodies
3530	Construction and related machinery	3715	Truck trailers
3540	Metalworking machinery	3821	Laboratory apparatus and furniture
3550	Special industry machinery	3842	Surgical appliances and supplies
3560	General industrial machinery	3843	Dental equipment and supplies
3610	Electric distribution equipment	4899	Communications services, nec
3620	Electrical industrial apparatus		

Classification from the North Carolina Employment Security Commission.

Appendix Table 2

Metropolitan areas within and bordering Appalachia

ID	Metropolitan area	Location	ID	Metropolitan area	Location
1	Akron, OH PMSA	O	32	Hickory-Morganton-Lenoir, NC MSA	B
2	Albany-Schenectady-Troy, NY MSA	B	33	Huntington-Ashland, WV-KY-OH MSA	I
3	Allentown-Bethlehem-Easton, PA MSA	B	34	Huntsville, AL MSA	I
4	Altoona, PA MSA	I	35	Jamestown, NY MSA	I
5	Anniston, AL MSA	I	36	Johnson City-Kingsport-Bristol, TN-VA MSA	I
6	Asheville, NC MSA	I	37	Johnstown, PA MSA	I
7	Athens, GA MSA	B	38	Knoxville, TN MSA	I
8	Atlanta, GA MSA	B	39	Lexington, KY MSA	B
9	Auburn-Opelika, AL MSA	O	40	Lynchburg, VA MSA	O
10	Binghamton, NY MSA	I	41	Mansfield, OH MSA	O
11	Birmingham, AL MSA	I	42	Memphis, TN-AR-MS MSA	O
12	Buffalo-Niagara Falls, NY MSA	O	43	Montgomery, AL MSA	B
13	Canton-Massillon, OH MSA	B	44	Nashville, TN MSA	O
14	Charleston, WV MSA	I	45	Newark, NJ PMSA	O
15	Charlotte-Gastonia-Rock Hill, NC-SC	O	46	Newburgh, NY-PA PMSA	O
16	Chattanooga, TN-GA MSA	I	47	Parkersburg-Marietta, WV-OH MSA	I
17	Cincinnati, OH-KY-IN PMSA	B	48	Pittsburgh, PA MSA	I
18	Cleveland-Lorain-Elyria, OH PMSA	O	49	Reading, PA MSA	O
19	Columbus, GA-AL MSA	O	50	Roanoke, VA MSA	B
20	Columbus, OH MSA	O	51	Rochester, NY MSA	O
21	Cumberland, MD-WV MSA	I	52	Scranton-Wilkes-Barre-Hazleton, PA MSA	I
22	Decatur, AL MSA	I	53	Sharon, PA MSA	I
23	Elmira, NY MSA	I	54	State College, PA MSA	I
24	Erie, PA MSA	I	55	Steubenville-Weirton, OH-WV MSA	I
25	Florence, AL MSA	I	56	Syracuse, NY MSA	O
26	Gadsden, AL MSA	I	57	Tuscaloosa, AL MSA	B
27	Greensboro, Winston-Salem, High Point MSA	B	58	Utica-Rome, NY MSA	O
28	Greenville-Spartanburg-Anderson MSA	I	59	Washington, DC-MD-VA-WV PMSA	B
29	Hagerstown, MD PMSA	I	60	Wheeling, WV-OH MSA	I
30	Hamilton-Middleton, OH PMSA	O	61	Williamsport, PA MSA	I
31	Harrisburg-Lebanon-Carlisle, PA MSA	B	62	Youngstown-Warren, OH MSA	B

Note: I: MSA entirely contained within the Appalachian region; B: MSA spans Appalachian border; O: MSA completely outside Appalachia, with borders at least 10 miles from region boundary. MSA boundaries correspond to the 1999 definitions released by the Office of Management and Budget.

Appendix Table 3

**Spatial concentration of technology-intensive employment in ARC MSAs
(1998, and growth 1989-1998), by degree of technology-intensity**

ID	MSA name	Very				Moderately				Somewhat			
		Cnty	Zips	LQ	Gro	Cnty	Zips	LQ	Gro	Cnty	Zips	LQ	Gro
4	I Altoona, PA MSA												X
5	I Anniston, AL MSA												
6	I Asheville, NC MSA						X	X		X	X	X	
10	I Binghamton, NY MSA		X	X			X	X			X	X	
11	I Birmingham, AL MSA					X	X	X	X				X
14	I Charleston, WV MSA			X			X	X					
16	I Chattanooga, TN-GA MSA										X	X	
21	I Cumberland, MD-WV MSA				X			X					
22	I Decatur, AL MSA	X						X			X	X	
23	I Elmira, NY MSA		X				X	X					X
24	I Erie, PA MSA									X	X	X	
25	I Florence, AL MSA												X
26	I Gadsden, AL MSA												X
28	I Greenville-Spartanburg-Anderson MSA						X	X	X	X	X	X	X
29	I Hagerstown, MD PMSA										X	X	
33	I Huntington-Ashland, WV-KY-OH MSA						X	X					
34	I Huntsville, AL MSA	X	X	X				X			X	X	
35	I Jamestown, NY MSA					X				X	X	X	
36	I Johnson City-Kingsport-Bristol, TN-VA MSA					X		X			X	X	X
37	I Johnstown, PA MSA						X	X		X		X	X
38	I Knoxville, TN MSA		X	X				X			X	X	
47	I Parkersburg-Marietta, WV-OH MSA						X	X					X
48	I Pittsburgh, PA MSA		X			X	X	X		X	X	X	X
52	I Scranton-Wilkes-Barre-Hazleton, PA MSA							X					X
53	I Sharon, PA MSA										X		
54	I State College, PA MSA			X				X					
55	I Steubenville-Weirton, OH-WV MSA						X	X					
60	I Wheeling, WV-OH MSA						X	X					
61	I Williamsport, PA MSA										X	X	
2	B Albany-Schenectady-Troy, NY MSA	X	X	X	X	X	X	X	X		X	X	
3	B Allentown-Bethlehem-Easton, PA MSA	X				X	X	X		X	X	X	
7	B Athens, GA MSA						X	X					X
8	B Atlanta, GA MSA	X	X	X			X	X			X	X	
13	B Canton-Massillon, OH MSA									X	X	X	
17	B Cincinnati, OH-KY-IN PMSA		X	X			X	X	X	X	X	X	
27	B Greensboro, Winston-Salem, High Point MSA						X	X	X	X	X	X	X
31	B Harrisburg-Lebanon-Carlisle, PA MSA						X			X	X	X	
32	B Hickory-Morgantown-Lenoir, NC MSA										X	X	
39	B Lexington, KY MSA		X	X			X	X			X	X	
43	B Montgomery, AL MSA			X			X				X	X	
50	B Roanoke, VA MSA			X			X	X			X	X	
57	B Tuscaloosa, AL MSA					X	X	X	X				
59	B Washington, DC-MD-VA-WV PMSA	X	X	X	X		X	X			X	X	
62	B Youngstown-Warren, OH MSA						X	X		X	X	X	
1	O Akron, OH PMSA				X	X	X		X	X	X	X	
9	O Auburn-Opelika, AL MSA												X
12	O Buffalo-Niagara Falls, NY MSA					X	X	X		X	X	X	

Appendix Table 3 continues next page

**Spatial concentration of technology-intensive employment in ARC MSAs
(1998, and growth 1989-1998), by degree of technology-intensity**

ID	MSA name	Very				Moderately				Somewhat			
		Cnty	Zips	LQ	Gro	Cnty	Zips	LQ	Gro	Cnty	Zips	LQ	Gro
15	O Charlotte-Gastonia-Rock Hill, NC-SC		X				X	X	X			X	X
18	O Cleveland-Lorain-Elyria, OH PMSA				X	X	X			X	X	X	
19	O Columbus, GA-AL MSA			X							X	X	
20	O Columbus, OH MSA		X	X			X	X	X		X	X	
30	O Hamilton-Middleton, OH PMSA						X		X	X	X	X	
40	O Lynchburg, VA MSA			X			X				X	X	
41	O Mansfield, OH MSA						X				X	X	
42	O Memphis, TN-AR-MS MSA										X	X	
44	O Nashville, TN MSA			X				X	X		X	X	
45	O Newark, NJ PMSA		X	X	X		X	X		X	X	X	
46	O Newburgh, NY-PA PMSA					X							X
49	O Reading, PA MSA	X					X			X		X	
51	O Rochester, NY MSA		X		X	X	X	X			X	X	
56	O Syracuse, NY MSA						X	X	X		X	X	
58	O Utica-Rome, NY MSA						X	X			X	X	

Note: I: MSA entirely contained within the Appalachian region; B: MSA spans Appalachian border; O: MSA completely outside Appalachia, with borders at least 10 miles from region boundary. Cnty: Significant employment G for at least one county in the metro area. Significant employment G for at least one zip code in the metro area. Gro: Significant employment growth G for at least one county in the metro area. LQ: Employment location quotient in excess of 1.1 for at least one county in the metro area.

Appendix Table 4

Technology value-chain classification

SIC	Sector title	SIC	Sector title
<i>Chemicals and plastics</i>		<i>Information technology and instruments cont.</i>	
2812	Alkalies and chlorine	3674	Semiconductors and related devices
2813	Industrial gases	3675	Electronic capacitors
2816	Inorganic pigments	3676	Electronic resistors
2821	Plastics materials and resins	3677	Electronic coils and transformers
2822	Synthetic rubber	3678	Electronic connectors
2823	Cellulosic manmade fibers	3679	Electronic components, nec
2824	Organic fibers, noncellulosic	3694	Engine electrical equipment
2841	Soap and other detergents	3699	Electrical equipment & supplies, nec
2842	Polishes and sanitation goods	3812	Search and navigation equipment
2843	Surface active agents	3821	Laboratory apparatus and furniture
2844	Toilet preparations	3822	Environmental controls
2851	Paints, varnishes, lacquers, enamels, etc.	3823	Process control instruments
2865	Cyclic crudes and intermediates	3824	Fluid meters and counting devices
2869	Industrial organic chemicals, nec	3825	Instruments to measure electricity
2873	Nitrogenous fertilizers	3826	Analytical instruments
2874	Phosphatic fertilizers	3827	Optical instruments and lenses
2875	Fertilizers, mixing only	3829	Measuring & controlling devices, nec
2879	Agricultural chemicals, nec	3844	X-ray apparatus and tubes
2891	Adhesives and sealants	3845	Electromedical equipment
2893	Printing ink	7371	Computer programming services
2899	Chemical preparations, nec	7372	Prepackaged software
3559	Special industry machinery, nec	7373	Computer integrated systems design
3624	Carbon and graphite products	7374	Data processing and preparation
3692	Primary batteries, dry and wet	7375	Information retrieval services
3843	Dental equipment and supplies	7379	Computer related services, nec
8071	Medical laboratories		
8072	Dental laboratories	<i>Industrial machinery</i>	
8092	Kidney dialysis centers	3511	Turbines and turbine generator sets
8093	Specialty outpatient facilities, nec	3532	Mining machinery
8099	Health and allied services, nec	3535	Conveyors and conveying equipment
3610	Electric distribution equipment	3536	Hoists, cranes, and monorails
3620	Electrical industrial apparatus	3541	Machine tools, metal cutting types
		3542	Machine tools, metal forming types
		3546	Power-driven handtools
<i>Information technology and instruments</i>		3547	Rolling mill machinery
3571	Electronic computers	3549	Metalworking machinery, nec
3572	Computer storage devices	3553	Woodworking machinery
3575	Computer terminals	3555	Printing trades machinery
3577	Computer peripheral equipment, nec	3556	Food products machinery
3578	Calculating and accounting equipment	3559	Special industry machinery, nec
3579	Office machines, nec	3561	Pumps and pumping equipment
3625	Relays and industrial controls	3563	Air and gas compressors
3629	Electrical industrial apparatus, nec	3564	Blowers and fans
3631	Household cooking equipment	3565	Packaging machinery
3643	Current-carrying wiring devices	3612	Transformers, except electronic
3644	Noncurrent-carrying wiring devices	3621	Motors and generators
3661	Telephone and telegraph apparatus		
3663	Radio & TV communications equipment		
3669	Communications equipment, nec		
3672	Printed circuit boards		

Appendix Table 4 continues next page

Appendix Table 4 *continued***Technology value-chain classification**

SIC	Sector title	SIC	Sector title
<i>Motor vehicle manufacturing</i>		<i>Communications services and software</i>	
2851	Paints, varnishes, lacquers, enamels, etc.	4899	Communications services, nec
2893	Printing ink	7371	Computer programming services
3519	Internal combustion engines, nec	7372	Prepackaged software
3531	Construction machinery	7373	Computer integrated systems design
3534	Elevators and moving stairways	7374	Data processing and preparation
3537	Industrial trucks and tractors	7375	Information retrieval services
3548	Welding apparatus	7379	Computer related services, nec
3641	Electric lamps	8711	Engineering services
3645	Residential lighting fixtures	8712	Architectural services
3646	Commercial lighting fixtures	8713	Surveying services
3647	Vehicular lighting equipment	8731	Commercial physical research
3648	Lighting equipment, nec	8732	Commercial nonphysical research
3651	Household audio and video equipment	8734	Testing laboratories
3691	Storage batteries		
3694	Engine electrical equipment	<i>Pharmaceuticals and medical technologies</i>	
3711	Motor vehicles and car bodies	2833	Medicinals and botanicals
3713	Truck and bus bodies	2834	Pharmaceutical preparations
3714	Motor vehicle parts and accessories	2835	Diagnostic substances
3715	Truck trailers	2836	Biological products exc. diagnostic
		3634	Electric housewares and fans
<i>Aerospace</i>		3841	Surgical and medical instruments
3544	Special dies, tools, jigs & fixtures	3842	Surgical appliances and supplies
3545	Machine tool accessories	8731	Commercial physical research
3721	Aircraft	8732	Commercial nonphysical research
3724	Aircraft engines and engine parts	8734	Testing laboratories
3728	Aircraft parts and equipment, nec		
3761	Guided missiles and space vehicles		
3764	Space propulsion units and parts		
3769	Space vehicle equipment, nec		
<i>Household appliances</i>			
3632	Household refrigerators and freezers		
3633	Household laundry equipment		
3635	Household vacuum cleaners		
3639	Household appliances, nec		
3716	Motor homes		

Source: Factor analysis of input-output data; see Methods Appendix.

Appendix Table 5

Spatial concentration of value-chain employment in ARC MSAs (1998, and growth 1989-1998)

ID	MSA name	Chemicals and plastics				Information technology				Industrial machinery			
		Cnty	Zips	LQ	Gro	Cnty	Zips	LQ	Gro	Cnty	Zips	LQ	Gro
4	I Altoona, PA MSA												
5	I Anniston, AL MSA												
6	I Asheville, NC MSA		X	X				X			X	X	X
10	I Binghamton, NY MSA		X	X			X	X		X	X	X	
11	I Birmingham, AL MSA	X	X	X	X							X	
14	I Charleston, WV MSA	X	X	X									
16	I Chattanooga, TN-GA MSA		X	X				X					
21	I Cumberland, MD-WV MSA												
22	I Decatur, AL MSA		X	X		X							
23	I Elmira, NY MSA						X			X		X	
24	I Erie, PA MSA		X	X							X	X	
25	I Florence, AL MSA			X									
26	I Gadsden, AL MSA												
28	I Greenville-Spartanburg-Anderson MSA	X	X	X			X			X	X	X	X
29	I Hagerstown, MD PMSA										X		
33	I Huntington-Ashland, WV-KY-OH MSA		X	X				X			X	X	
34	I Huntsville, AL MSA		X			X	X	X					
35	I Jamestown, NY MSA	X			X					X			
36	I Johnson City-Kingsport-Bristol, TN-VA MSA	X	X	X							X	X	
37	I Johnstown, PA MSA									X		X	
38	I Knoxville, TN MSA			X								X	
47	I Parkersburg-Marietta, WV-OH MSA	X	X	X									
48	I Pittsburgh, PA MSA	X	X	X						X	X	X	
52	I Scranton-Wilkes-Barre-Hazleton, PA MSA		X	X									
53	I Sharon, PA MSA									X	X	X	
54	I State College, PA MSA		X	X			X	X			X	X	
55	I Steubenville-Weirton, OH-WV MSA												
60	I Wheeling, WV-OH MSA		X	X									
61	I Williamsport, PA MSA												
2	B Albany-Schenectady-Troy, NY MSA		X	X		X	X		X	X	X		
3	B Allentown-Bethlehem-Easton, PA MSA	X		X	X		X	X		X	X	X	
7	B Athens, GA MSA		X	X						X		X	
8	B Atlanta, GA MSA		X	X			X	X	X	X	X	X	X
13	B Canton-Massillon, OH MSA	X	X	X	X					X	X	X	
17	B Cincinnati, OH-KY-IN PMSA	X	X	X			X	X	X	X	X	X	
27	B Greensboro, Winston-Salem, High Point MSA	X	X	X	X						X	X	
31	B Harrisburg-Lebanon-Carlisle, PA MSA		X					X		X	X		
32	B Hickory-Morgantown-Lenoir, NC MSA		X	X									
39	B Lexington, KY MSA			X			X	X			X	X	
43	B Montgomery, AL MSA		X	X				X			X	X	
50	B Roanoke, VA MSA		X	X				X			X	X	
57	B Tuscaloosa, AL MSA	X			X								
59	B Washington, DC-MD-VA-WV PMSA		X	X	X	X	X	X				X	X
62	B Youngstown-Warren, OH MSA									X	X	X	
1	O Akron, OH PMSA	X	X	X	X				X	X	X	X	
9	O Auburn-Opelika, AL MSA												
12	O Buffalo-Niagara Falls, NY MSA	X	X	X	X		X			X	X	X	
15	O Charlotte-Gastonia-Rock Hill, NC-SC		X	X			X	X		X	X	X	
18	O Cleveland-Lorain-Elyria, OH PMSA	X	X	X	X			X	X	X		X	
19	O Columbus, GA-AL MSA		X	X									
20	O Columbus, OH MSA		X	X	X		X	X			X	X	
30	O Hamilton-Middleton, OH PMSA	X	X							X	X	X	
40	O Lynchburg, VA MSA		X				X	X		X	X	X	
41	O Mansfield, OH MSA									X	X	X	
42	O Memphis, TN-AR-MS MSA	X	X	X							X	X	
44	O Nashville, TN MSA		X	X	X			X			X	X	X
45	O Newark, NJ PMSA	X	X	X	X			X	X		X	X	
46	O Newburgh, NY-PA PMSA	X	X	X									
49	O Reading, PA MSA	X			X							X	
51	O Rochester, NY MSA		X	X	X		X	X	X	X		X	
56	O Syracuse, NY MSA				X			X			X	X	
58	O Utica-Rome, NY MSA		X	X				X			X	X	

Note: I: MSA entirely contained within the Appalachian region; B: MSA spans Appalachian border; O: MSA completely outside Appalachia, with borders at least 10 miles from region boundary.

Appendix Table 5 continues next page

Appendix Table 5 *continued*

Spatial concentration of value-chain employment in ARC MSAs
(1998, and growth 1989-1998)

ID	MSA name	Motor vehicles				Aerospace				Household appliances			
		Cnty	Zips	LQ	Gro	Cnty	Zips	LQ	Gro	Cnty	Zips	LQ	Gro
4	I Altoona, PA MSA												
5	I Anniston, AL MSA												
6	I Asheville, NC MSA		X										
10	I Binghamton, NY MSA		X										
11	I Birmingham, AL MSA			X									
14	I Charleston, WV MSA			X									
16	I Chattanooga, TN-GA MSA			X									
21	I Cumberland, MD-WV MSA							X					
22	I Decatur, AL MSA		X							X	X	X	X
23	I Elmira, NY MSA		X					X					
24	I Erie, PA MSA							X					
25	I Florence, AL MSA							X			X		
26	I Gadsden, AL MSA							X					
28	I Greenville-Spartanburg-Anderson MSA		X	X	X						X	X	
29	I Hagerstown, MD PMSA		X	X									
33	I Huntington-Ashland, WV-KY-OH MSA												
34	I Huntsville, AL MSA		X	X			X	X			X		
35	I Jamestown, NY MSA		X	X				X					
36	I Johnson City-Kingsport-Bristol, TN-VA MSA		X	X	X			X		X	X	X	
37	I Johnstown, PA MSA				X								
38	I Knoxville, TN MSA		X	X				X					
47	I Parkersburg-Marietta, WV-OH MSA												
48	I Pittsburgh, PA MSA			X	X			X					
52	I Scranton-Wilkes-Barre-Hazleton, PA MSA			X									
53	I Sharon, PA MSA	X					X						
54	I State College, PA MSA												
55	I Steubenville-Weirton, OH-WV MSA												
60	I Wheeling, WV-OH MSA												
61	I Williamsport, PA MSA							X					
2	B Albany-Schenectady-Troy, NY MSA								X				
3	B Allentown-Bethlehem-Easton, PA MSA		X	X									
7	B Athens, GA MSA												
8	B Atlanta, GA MSA		X	X	X	X		X			X	X	X
13	B Canton-Massillon, OH MSA		X										
17	B Cincinnati, OH-KY-IN PMSA	X	X	X	X	X	X	X				X	
27	B Greensboro, Winston-Salem, High Point MSA		X	X	X								
31	B Harrisburg-Lebanon-Carlisle, PA MSA		X										
32	B Hickory-Morganton-Lenoir, NC MSA		X	X									
39	B Lexington, KY MSA		X	X	X			X				X	
43	B Montgomery, AL MSA			X				X		X	X	X	X
50	B Roanoke, VA MSA												
57	B Tuscaloosa, AL MSA		X	X									
59	B Washington, DC-MD-VA-WV PMSA		X	X				X					
62	B Youngstown-Warren, OH MSA	X	X	X	X			X		X			
1	O Akron, OH PMSA	X	X	X			X	X		X	X	X	
9	O Auburn-Opelika, AL MSA			X									
12	O Buffalo-Niagara Falls, NY MSA	X	X	X									
15	O Charlotte-Gastonia-Rock Hill, NC-SC		X	X	X								
18	O Cleveland-Lorain-Elyria, OH PMSA	X	X	X				X		X	X		
19	O Columbus, GA-AL MSA		X					X					
20	O Columbus, OH MSA		X	X									
30	O Hamilton-Middleton, OH PMSA	X				X	X	X					
40	O Lynchburg, VA MSA												
41	O Mansfield, OH MSA		X	X									
42	O Memphis, TN-AR-MS MSA			X									
44	O Nashville, TN MSA		X	X	X			X				X	
45	O Newark, NJ PMSA		X										
46	O Newburgh, NY-PA PMSA			X									
49	O Reading, PA MSA		X	X									
51	O Rochester, NY MSA	X	X	X									
56	O Syracuse, NY MSA		X	X									
58	O Utica-Rome, NY MSA												

Note: I: MSA entirely contained within the Appalachian region; B: MSA spans Appalachian border; O: MSA completely outside Appalachia, with borders at least 10 miles from region boundary.

Appendix Table 5 continues next page

Appendix Table 5 *continued*

Spatial concentration of value-chain employment in ARC MSAs
(1998, and growth 1989-1998)

ID	MSA name	Comm svcs, software				Pharm, med techs			
		Cnty	Zips	LQ	Gro	Cnty	Zips	LQ	Gro
4	I Altoona, PA MSA								
5	I Anniston, AL MSA								
6	I Asheville, NC MSA								
10	I Binghamton, NY MSA								
11	I Birmingham, AL MSA				X				
14	I Charleston, WV MSA				X				
16	I Chattanooga, TN-GA MSA								
21	I Cumberland, MD-WV MSA		X						
22	I Decatur, AL MSA	X				X			
23	I Elmira, NY MSA								
24	I Erie, PA MSA						X		
25	I Florence, AL MSA								
26	I Gadsden, AL MSA								X
28	I Greenville-Spartanburg-Anderson MSA						X	X	
29	I Hagerstown, MD PMSA								
33	I Huntington-Ashland, WV-KY-OH MSA								X
34	I Huntsville, AL MSA	X	X	X		X	X	X	
35	I Jamestown, NY MSA								
36	I Johnson City-Kingsport-Bristol, TN-VA MSA						X	X	
37	I Johnstown, PA MSA				X		X	X	
38	I Knoxville, TN MSA		X	X			X	X	
47	I Parkersburg-Marietta, WV-OH MSA								
48	I Pittsburgh, PA MSA		X	X			X	X	
52	I Scranton-Wilkes-Barre-Hazleton, PA MSA								
53	I Sharon, PA MSA								
54	I State College, PA MSA			X				X	
55	I Steubenville-Weirton, OH-WV MSA								
60	I Wheeling, WV-OH MSA								
61	I Williamsport, PA MSA								
2	B Albany-Schenectady-Troy, NY MSA	X	X	X	X	X	X	X	X
3	B Allentown-Bethlehem-Easton, PA MSA					X			X
7	B Athens, GA MSA								
8	B Atlanta, GA MSA	X	X	X	X		X	X	
13	B Canton-Massillon, OH MSA								
17	B Cincinnati, OH-KY-IN PMSA		X	X	X	X	X	X	
27	B Greensboro, Winston-Salem, High Point MSA						X	X	
31	B Harrisburg-Lebanon-Carlisle, PA MSA		X	X				X	X
32	B Hickory-Morganton-Lenoir, NC MSA						X		
39	B Lexington, KY MSA							X	
43	B Montgomery, AL MSA								
50	B Roanoke, VA MSA								
57	B Tuscaloosa, AL MSA								
59	B Washington, DC-MD-VA-WV PMSA	X	X	X	X	X	X	X	X
62	B Youngstown-Warren, OH MSA								
1	O Akron, OH PMSA				X				X
9	O Auburn-Opelika, AL MSA								
12	O Buffalo-Niagara Falls, NY MSA							X	
15	O Charlotte-Gastonia-Rock Hill, NC-SC		X	X	X			X	
18	O Cleveland-Lorain-Elyria, OH PMSA				X		X	X	
19	O Columbus, GA-AL MSA		X	X					
20	O Columbus, OH MSA	X	X	X	X		X	X	
30	O Hamilton-Middleton, OH PMSA				X				
40	O Lynchburg, VA MSA								
41	O Mansfield, OH MSA								
42	O Memphis, TN-AR-MS MSA								
44	O Nashville, TN MSA			X			X	X	
45	O Newark, NJ PMSA	X	X	X	X	X	X	X	X
46	O Newburgh, NY-PA PMSA				X				
49	O Reading, PA MSA				X	X	X	X	
51	O Rochester, NY MSA		X		X		X	X	
56	O Syracuse, NY MSA						X	X	
58	O Utica-Rome, NY MSA								

Note: I: MSA entirely contained within the Appalachian region; B: MSA spans Appalachian border; O: MSA completely outside Appalachia, with borders at least 10 miles from region boundary.

Appendix Table 6

Science and technology occupational classification

Aggregated Group	OES Code	OES Title	Defini- tion 1	Defini- tion 2
IT scientists, engineers and programmers	15-1011	Computer & Information Scientists, Research	X	X
	15-1021	Computer Programmers	X	X
	15-1031	Computer Software Engineers, Applications	X	X
	15-1032	Computer Software Engineers, Systems Software	X	X
	15-1041	Computer Support Specialists	X	
	15-1051	Computer Systems Analysts	X	
	15-1061	Database Administrators	X	
	15-1071	Network & Computer Systems Administrators	X	
	15-1081	Network Systems & Data Communications Analysts	X	
	17-2061	Computer Hardware Engineers	X	X
Mathematicians, statisticians, and physicists	15-2021	Mathematicians	X	X
	15-2031	Operations Research Analysts	X	X
	15-2041	Statisticians	X	X
	15-2091	Mathematical Techs	X	
	19-2012	Physicists	X	X
Agricultural scientists and engineers	17-2021	Agricultural Engineers	X	X
	19-1010	Agricultural & Food Scientists	X	X
	19-4011	Agricultural & Food Science Techs	X	
Biological scientists and technicians	19-1021	Biochemists & Biophysicists	X	X
	19-1022	Microbiologists	X	X
	19-4021	Biological Techs	X	
	19-1041	Epidemiologists	X	X
Chemists and chemical engineers	19-4031	Chemical Techs	X	
	17-2041	Chemical Engineers	X	X
	19-2031	Chemists	X	X
Environmental and resource scientists and technicians	19-2041	Environmental Scientists & Specialists, Incl. Health	X	X
	19-1023	Zoologists & Wildlife Biologists	X	X
	19-1031	Conservation Scientists	X	X
	19-4091	Environmental Science & Protection Techs, Incl. Health	X	
	19-4093	Forest & Conservation Techs	X	
	17-2081	Environmental Engineers	X	X
	17-3025	Environmental Engineering Techs	X	
Medical scientists and engineers	19-1042	Medical Scientists, Except Epidemiologists	X	X
	17-2031	Biomedical Engineers	X	X
	51-9082	Medical Appliance Techs	X	
Electrical engineers and technicians	17-2071	Electrical Engineers	X	X
	17-2072	Electronics Engineers, Except Computer	X	X
	17-3023	Electrical & Electronic Engineering Techs	X	
	17-3024	Electro-Mechanical Techs	X	
Materials engineers and scientists	17-2131	Materials Engineers	X	X
	19-2032	Materials Scientists	X	X
Aerospace engineers and technicians	19-2021	Atmospheric & Space Scientists	X	X
	17-2011	Aerospace Engineers	X	X
	17-3021	Aerospace Engineering & Operations Techs	X	
	49-2091	Avionics Techs	X	
Geoscientists and engineers	19-2043	Hydrologists	X	X
	19-4041	Geological & Petroleum Techs	X	
	19-2042	Geoscientists, Except Hydrologists & Geographers	X	X
	17-2171	Petroleum Engineers	X	X
	17-2151	Mining & Geological Engineers, Incl. Mining Safety Engineers	X	X
Nuclear engineers and technicians	19-4051	Nuclear Techs	X	
	17-2161	Nuclear Engineers	X	X
Industrial and mechanical engineers and technicians	17-2112	Industrial Engineers	X	X
	17-2141	Mechanical Engineers	X	X
	17-3026	Industrial Engineering Techs	X	
	17-3027	Mechanical Engineering Techs	X	

Source: Selected from 709 total occupations included in 1999 Occupational Employment Statistics data (U.S. Bureau of Labor Statistics). Definition 1 includes all occupations; Definition 2 excludes technicians.

Appendix Table 7

Location quotients: Scientists and engineers, 1999

Employment location quotients for scientists and engineers only

ID	MSA	IT	Math	AgSci	Bio	Chem	Enviro	Med	Elect	Matrl	Aero	Geo	Nucl	Indust
4	I Altoona, PA	0.4												0.5
5	I Anniston, AL								0.4					0.3
6	I Asheville, NC	0.1					1.0		0.3					0.4
11	I Binghamton, NY	1.5							2.5					1.1
12	I Birmingham, AL	0.9	0.3			0.3	0.6		0.3	1.6		0.2		0.9
15	I Charleston, WV	0.5				1.3								
17	I Chattanooga, TN-GA	0.4					0.3		0.1					0.8
22	I Cumberland, MD-WV													
23	I Decatur, AL	0.1				1.5								0.8
24	I Elmira, NY	0.1												0.9
25	I Erie, PA	0.3								1.8				1.0
26	I Florence, AL								0.6					0.8
27	I Gadsden, AL													
29	I Greenville-Spartanburg-Anderson, SC	0.4	0.3			1.7	0.3		0.7					1.5
30	I Hagerstown, MD	0.1												
34	I Huntington-Ashland, WV-KY-OH	0.1				0.6			0.2					0.1
35	I Huntsville, AL	1.8				0.6	0.5		4.3		32.8			3.1
36	I Jamestown, NY													0.6
37	I Johnson City-Kingsport-Bristol, TN-VA	0.2					0.5							0.4
38	I Johnstown, PA	0.0												0.2
39	I Knoxville, TN	0.3					1.0		0.6			0.4		0.6
48	I Parkersburg-Marietta, WV-OH						0.5							0.8
49	I Pittsburgh, PA	0.7	1.2	0.3		0.3	0.5		0.8	2.6		0.2		0.9
53	I Scranton-Wilkes-Barre-Hazleton, PA	0.5				0.1			0.3					0.6
54	I Sharon, PA													0.4
55	I State College, PA								0.9					0.3
56	I Steubenville-Weirton, OH-WV								0.6					
61	I Wheeling, WV-OH													
62	I Williamsport, PA	0.1												
2	B Albany-Schenectady-Troy, NY	0.3					1.3			0.4		0.3		0.1
3	B Allentown-Bethlehem-Easton, PA	0.4	0.2			2.3			0.4	1.0				0.8
7	B Athens, GA	0.1							0.8					0.6
8	B Atlanta, GA	1.7	1.3		1.2	1.0	1.4	0.6	1.4	0.4		0.3		0.8
14	B Canton-Massillon, OH	0.0							0.2					1.1
18	B Cincinnati, OH-KY-IN	0.9			0.9	1.3	0.7		0.5	1.0				1.2
28	B Greensboro-Winston-Salem-High Point, NC	0.8	0.1			1.0	0.0		1.3	2.8				0.8
32	B Harrisburg-Lebanon-Carlisle, PA	0.5	0.2				0.5		0.3	0.4				0.8
33	B Hickory-Morganton-Lenoir, NC	0.2				0.4				0.7				0.6
40	B Lexington, KY	0.4				0.4	0.3		0.5			0.4		1.0
44	B Montgomery, AL	0.5	0.5											0.1
51	B Roanoke, VA	0.8	0.5						0.8					0.7
58	B Tuscaloosa, AL													0.2
60	B Washington, DC-MD-VA-WV	2.2	4.9	1.3	2.4	0.2	1.8	3.2	2.3	0.5	1.8	1.1		0.8
64	B Youngstown-Warren, OH	0.2				0.2	0.3		0.2	2.8				0.9

Appendix Table 7 continues next page

Appendix Table 7 *continued***Location quotients: Scientists and engineers, 1999**

Employment location quotients for scientists and engineers only

ID	MSA	IT	Math	AgSci	Bio	Chem	Enviro	Med	Elect	Matrl	Aero	Geo	Nucl	Indust
1	O Akron, OH	0.5				1.2	0.1		0.9					1.4
9	O Auburn-Opelika, AL													
10	O Baltimore, MD	0.7	1.4	0.4	1.2	0.6	0.6	1.2	0.8	0.8		0.2		1.1
13	O Buffalo-Niagara Falls, NY	0.5				1.2			0.4	1.2				1.0
16	O Charlotte-Gastonia-Rock Hill, NC-SC	1.0	0.5			0.8	0.6		0.6				2.8	1.0
19	O Cleveland-Lorain-Elyria, OH	0.6	0.1			1.8	0.6	0.3	1.3	1.4				1.8
20	O Columbus, GA-AL	0.1												0.2
21	O Columbus, OH	1.6	0.5			0.8	0.7	0.2	0.9	0.3				1.0
31	O Hamilton-Middletown, OH	0.5				0.4			0.8					0.4
41	O Lynchburg, VA	0.2							0.2					
42	O Mansfield, OH	0.1							0.9					2.0
43	O Memphis, TN-AR-MS	0.3	0.9			0.9	0.4	0.4	0.3	0.2		0.3		0.5
45	O Nashville, TN	0.5		0.6	2.3	0.3	2.0		0.3	0.2	0.1			0.4
46	O Newark, NJ	1.4				4.7	1.5		1.1	0.5				0.9
47	O Newburgh, NY-PA						0.6							0.3
50	O Reading, PA	0.0				1.1			0.8	1.6				0.9
52	O Rochester, NY	0.6				1.4	0.1		0.4	2.0				1.8
57	O Syracuse, NY	0.6				0.1	1.1		1.0	0.7				1.1
59	O Utica-Rome, NY	0.4	0.5						0.3					0.3
63	O York, PA	0.1				0.2			0.3	0.8				2.1

Source: Occupational Employment Statistics, U.S. Bureau of Labor Statistics. I: MSA entirely contained within the Appalachian region; B: MSA spans Appalachian border; O: MSA completely outside Appalachia, with borders at least 10 miles from region boundary. N/A: Missing. Blank: No estimate available (see text for explanation). Values > 1.2 shaded.

Appendix Table 8

Location quotients: Location quotients: Technicians, 1999

Employment location quotients for technicians only

ID	MSA	IT	Math	AgSci	Bio	Chem	Enviro	Med	Elect	Matri	Aero	Geo	Nucl	Indust
4	I Altoona, PA	0.7												
5	I Anniston, AL													
6	I Asheville, NC	0.5							0.8					0.3
11	I Binghamton, NY	0.7							0.4					
12	I Birmingham, AL	1.3				0.2		8.1	1.2					0.5
15	I Charleston, WV	0.0							0.5					
17	I Chattanooga, TN-GA	0.3				0.3			0.6					0.3
22	I Cumberland, MD-WV													
23	I Decatur, AL	0.1				2.9			0.6					
24	I Elmira, NY	0.1							0.3					0.9
25	I Erie, PA	0.3				1.8			0.5					
26	I Florence, AL	0.2				1.0								
27	I Gadsden, AL	0.1												
29	I Greenville-Spartanburg-Anderson, SC	0.5				2.5	0.3		1.3					1.2
30	I Hagerstown, MD	0.1							0.7					
34	I Huntington-Ashland, WV-KY-OH	0.3				1.7			0.4					
35	I Huntsville, AL	1.6							2.5					1.6
36	I Jamestown, NY	0.1												
37	I Johnson City-Kingsport-Bristol, TN-VA	0.3							0.5					
38	I Johnstown, PA	0.1							0.2					
39	I Knoxville, TN	0.5				1.0			1.2					0.8
48	I Parkersburg-Marietta, WV-OH	0.0							0.7					
49	I Pittsburgh, PA	1.0		0.6			0.2		0.8					1.1
53	I Scranton-Wilkes-Barre-Hazleton, PA	0.5				0.7	0.2		1.0					0.3
54	I Sharon, PA													
55	I State College, PA	0.2							2.1					
56	I Steubenville-Weirton, OH-WV	0.1				1.1			0.6					
61	I Wheeling, WV-OH	0.2												
62	I Williamsport, PA	0.2							1.1					
2	B Albany-Schenectady-Troy, NY	1.2							0.3					
3	B Allentown-Bethlehem-Easton, PA	0.8				2.5	0.4		0.6					0.3
7	B Athens, GA	0.1				0.8			0.3					
8	B Atlanta, GA	1.7		0.5	0.3	0.8	0.2		0.8		0.7			1.1
14	B Canton-Massillon, OH	0.5							0.3					0.3
18	B Cincinnati, OH-KY-IN	1.0		0.4		0.9	1.4		0.5					0.3
28	B Greensboro-Winston-Salem-High Point, NC	0.7			0.2	0.8	0.4		1.0					0.6
32	B Harrisburg-Lebanon-Carlisle, PA	1.5		0.7			0.8		0.7					0.4
33	B Hickory-Morganton-Lenoir, NC	0.3				1.0	0.6		0.4					0.4
40	B Lexington, KY	0.8					0.6		0.3					
44	B Montgomery, AL	1.1							0.5					
51	B Roanoke, VA	0.8				0.9	0.9		0.8					1.3
58	B Tuscaloosa, AL	0.0												
60	B Washington, DC-MD-VA-WV	2.6	3.4		2.8	0.0	0.8		0.9		0.6			0.7
64	B Youngstown-Warren, OH	0.2												0.8

Appendix Table 8 continues next page

Location quotients: Location quotients: Technicians, 1999

Employment location quotients for technicians only

ID	MSA	IT	Math	AgSci	Bio	Chem	Enviro	Med	Elect	Matrl	Aero	Geo	Nucl	Indust
1	O Akron, OH	0.7				1.6	0.3							0.5
9	O Auburn-Opelika, AL													
10	O Baltimore, MD	1.1				0.7	0.9	0.5						1.2
13	O Buffalo-Niagara Falls, NY	0.5				1.2	0.5	0.5						1.1
16	O Charlotte-Gastonia-Rock Hill, NC-SC	1.2				1.1	0.8	0.4	1.0		0.6			1.6
19	O Cleveland-Lorain-Elyria, OH	1.1				1.0	0.4		0.9					1.5
20	O Columbus, GA-AL	0.5				2.1			0.3					
21	O Columbus, OH	1.3				1.0			0.4					0.1
31	O Hamilton-Middletown, OH	0.4				1.3								
41	O Lynchburg, VA	0.6							0.7					
42	O Mansfield, OH	0.3							0.6					
43	O Memphis, TN-AR-MS	0.9			0.3	1.7	0.4		0.6					0.9
45	O Nashville, TN	0.7			0.3		0.2		1.1		0.5			0.7
46	O Newark, NJ	0.6				5.2			0.6					0.8
47	O Newburgh, NY-PA	0.4				2.6			0.4					
50	O Reading, PA	0.2				2.5	0.8		1.4					
52	O Rochester, NY	1.1			0.2		0.4							1.7
57	O Syracuse, NY	1.1					0.6		0.6					1.4
59	O Utica-Rome, NY	0.3							0.8					
63	O York, PA	0.3					0.4		0.6					0.6

Source: Occupational Employment Statistics, U.S. Bureau of Labor Statistics. I: MSA entirely contained within the Appalachian region; B: MSA spans Appalachian border; O: MSA completely outside Appalachia, with borders at least 10 miles from region boundary. N/A: Missing. Blank: No estimate available (see text for explanation). Values > 1.2 shaded.

Appendix Table 9

Concordance: Patents to technology groups

Product Field	SIC	Chemicals and plastics	Information technology	Instruments	Industrial machinery	Motor vehicles	Aerospace	Household appliances	Pharmaceuticals	Pharma + K25 + med techs	Metals	Other
Food & kindred products	20											X
Textile mill products	22											X
Industrial inorganic chemistry	281	X										
Industrial organic chemistry	286	X										
Plastics materials & synthetic resins	282	X										
Agricultural chemicals	287	X										
Soaps, detergents, cleaners, perfumes, cosmetics & toiletries	284	X										
Paints, varnishes, lacquers, enamels, & allied products	285	X				X						
Miscellaneous chemical products	289	X										
Drugs & medicines	283								X	X		
Petroleum & natural gas extraction & refining	13, 29	X										
Rubber & miscellaneous plastics products	30	X										
Stone, clay, glass & concrete products	32											X
Primary ferrous products	A*										X	
Primary & secondary non-ferrous metals	B*										X	
Fabricated metal products	C*										X	
Engines & turbines	351				X	X						
Farm & garden machinery & equipment	352				X							
Construction, mining & material handling machinery & equipment	353				X	X						
Metal working machinery & equipment	354				X		X					
Office computing & accounting machines	357		X									
Special industry machinery, except metal working	355				X							
General industrial machinery & equipment	356				X							
Refrigeration & service industry machinery	358				X							
Miscellaneous machinery, except electrical	359				X							
Electrical transmission & distribution equipment	361, 3825	X										
Electrical industrial apparatus	362	X			X							
Household appliances	363							X		X		
Electrical lighting & wiring equipment	364					X						
Miscellaneous electrical machinery, equipment & supplies	369	X				X						
Radio & television receiving equipment except communication types	365	X				X						
Electronic components & accessories & communications equipment	366-367	X										
Motor vehicles & other motor vehicle equipment	371					X						
Guided missiles & space vehicles & parts	376						X					
Ship & boat building & repairing	373					X						
Railroad equipment	374					X						
Motorcycles, bicycles, & parts	375					X						
Miscellaneous transportation equipment	D*					X						
Ordinance except missiles	348, 3795	X										
Aircraft & parts	372						X					
Professional & scientific instruments	E*			X					X			
All other SIC's	99											X

* Note; patent to SIC assignment is from the US PTO based on the 1972 Standard Industrial Classifications. A: SICs 331, 332, 3399, 3462; B: SICs 333-336, 339 (ex. 3399), 3463; C: SICs 34 (ex. 3462, 3463, 348); D: SICs 379 (except 3795); E: SICs 38 (except 3825).

Appendix Table 10

Spatial concentration of patenting activity by technology area, (1990-1999)

ID	MSA name	Chemicals, plastics		Information technology		Instruments		Industrial machinery		Motor vehicles	
		Cnty	LQ	Cnty	LQ	Cnty	LQ	Cnty	LQ	Cnty	LQ
4	I Altoona, PA MSA								X		
5	I Anniston, AL MSA										
6	I Asheville, NC MSA		X						X		
10	I Binghamton, NY MSA			X	X			X			
11	I Birmingham, AL MSA			X							
14	I Charleston, WV MSA		X								
16	I Chattanooga, TN-GA MSA								X		X
21	I Cumberland, MD-WV MSA										
22	I Decatur, AL MSA										
23	I Elmira, NY MSA										
24	I Erie, PA MSA								X		X
25	I Florence, AL MSA		X								
26	I Gadsden, AL MSA										
28	I Greenville-Spartanburg-Anderson MSA		X					X	X		X
29	I Hagerstown, MD PMSA										
33	I Huntington-Ashland, WV-KY-OH MSA										
34	I Huntsville, AL MSA				X		X				
35	I Jamestown, NY MSA							X			
36	I Johnson City-Kingsport-Bristol, TN-VA MSA		X								X
37	I Johnstown, PA MSA										
38	I Knoxville, TN MSA						X		X		
47	I Parkersburg-Marietta, WV-OH MSA		X								X
48	I Pittsburgh, PA MSA				X			X	X		X
52	I Scranton-Wilkes-Barre-Hazleton, PA MSA								X		X
53	I Sharon, PA MSA										
54	I State College, PA MSA										
55	I Steubenville-Weirton, OH-WV MSA										
60	I Wheeling, WV-OH MSA		X								
61	I Williamsport, PA MSA								X		X
2	B Albany-Schenectady-Troy, NY MSA	X	X	X	X			X	X	X	X
3	B Allentown-Bethlehem-Easton, PA MSA	X	X	X	X			X		X	
7	B Athens, GA MSA		X								
8	B Atlanta, GA MSA		X		X				X		X
13	B Canton-Massillon, OH MSA							X	X	X	X
17	B Cincinnati, OH-KY-IN PMSA	X	X			X		X	X	X	X
27	B Greensboro, Winston-Salem, High Point MSA								X		
31	B Harrisburg-Lebanon-Carlisle, PA MSA				X				X		
32	B Hickory-Morganton-Lenoir, NC MSA										
39	B Lexington, KY MSA				X						
43	B Montgomery, AL MSA								X		
50	B Roanoke, VA MSA				X		X		X		X
57	B Tuscaloosa, AL MSA										
59	B Washington, DC-MD-VA-WV PMSA	X		X	X	X					
62	B Youngstown-Warren, OH MSA				X				X		
1	O Akron, OH PMSA	X	X					X	X	X	X
9	O Auburn-Opelika, AL MSA		X								
12	O Buffalo-Niagara Falls, NY MSA							X	X		
15	O Charlotte-Gastonia-Rock Hill, NC-SC		X						X		X
18	O Cleveland-Lorain-Elyria, OH PMSA		X					X	X	X	X
19	O Columbus, GA-AL MSA										
20	O Columbus, OH MSA		X								
30	O Hamilton-Middleton, OH PMSA	X	X					X	X	X	X
40	O Lynchburg, VA MSA				X				X		X
41	O Mansfield, OH MSA								X		
42	O Memphis, TN-AR-MS MSA					X					
44	O Nashville, TN MSA					X			X		
45	O Newark, NJ PMSA										
46	O Newburgh, NY-PA PMSA	X	X	X				X		X	
49	O Reading, PA MSA	X		X				X		X	
51	O Rochester, NY MSA	X		X	X	X	X	X	X	X	X
56	O Syracuse, NY MSA				X			X	X	X	X
58	O Utica-Rome, NY MSA					X					

Note: I: MSA entirely contained within the Appalachian region; B: MSA spans Appalachian border; O: MSA completely outside Appalachia but adjacent to region.

Appendix Table 10 continues next page

Appendix Table 10 *continued***Spatial concentration of patenting activity by technology area, (1990-1999)**

ID	MSA name	Aerospace		Household appliances		Pharma ceuticals		Metals		Other	
		Cnty	LQ	Cnty	LQ	Cnty	LQ	Cnty	LQ	Cnty	LQ
4	I Altoona, PA MSA										
5	I Anniston, AL MSA										
6	I Asheville, NC MSA										X
10	I Binghamton, NY MSA	X									
11	I Birmingham, AL MSA					X					
14	I Charleston, WV MSA										
16	I Chattanooga, TN-GA MSA							X			X
21	I Cumberland, MD-WV MSA										
22	I Decatur, AL MSA										
23	I Elmira, NY MSA		X					X		X	X
24	I Erie, PA MSA		X					X			
25	I Florence, AL MSA										
26	I Gadsden, AL MSA										
28	I Greenville-Spartanburg-Anderson MSA	X	X							X	X
29	I Hagerstown, MD PMSA										
33	I Huntington-Ashland, WV-KY-OH MSA										
34	I Huntsville, AL MSA										
35	I Jamestown, NY MSA							X			
36	I Johnson City-Kingsport-Bristol, TN-VA MSA										
37	I Johnstown, PA MSA							X			
38	I Knoxville, TN MSA										
47	I Parkersburg-Marietta, WV-OH MSA										
48	I Pittsburgh, PA MSA	X	X					X	X		X
52	I Scranton-Wilkes-Barre-Hazleton, PA MSA										X
53	I Sharon, PA MSA							X			
54	I State College, PA MSA										
55	I Steubenville-Weirton, OH-WV MSA							X			
60	I Wheeling, WV-OH MSA										
61	I Williamsport, PA MSA							X			
2	B Albany-Schenectady-Troy, NY MSA	X	X	X	X		X	X	X		X
3	B Allentown-Bethlehem-Easton, PA MSA			X		X		X	X		X
7	B Athens, GA MSA						X				
8	B Atlanta, GA MSA			X	X			X	X	X	X
13	B Canton-Massillon, OH MSA	X	X					X	X		
17	B Cincinnati, OH-KY-IN PMSA	X		X		X	X	X		X	
27	B Greensboro, Winston-Salem, High Point MSA										X
31	B Harrisburg-Lebanon-Carlisle, PA MSA	X	X								
32	B Hickory-Morganton-Lenoir, NC MSA							X			
39	B Lexington, KY MSA										
43	B Montgomery, AL MSA										
50	B Roanoke, VA MSA										
57	B Tuscaloosa, AL MSA										
59	B Washington, DC-MD-VA-WV PMSA					X	X		X		X
62	B Youngstown-Warren, OH MSA							X			
1	O Akron, OH PMSA	X	X	X				X		X	
9	O Auburn-Opelika, AL MSA										
12	O Buffalo-Niagara Falls, NY MSA			X	X			X	X		X
15	O Charlotte-Gastonia-Rock Hill, NC-SC			X				X			X
18	O Cleveland-Lorain-Elyria, OH PMSA	X		X				X	X	X	X
19	O Columbus, GA-AL MSA										
20	O Columbus, OH MSA			X					X		X
30	O Hamilton-Middleton, OH PMSA	X	X	X		X	X	X		X	X
40	O Lynchburg, VA MSA										
41	O Mansfield, OH MSA										
42	O Memphis, TN-AR-MS MSA						X				
44	O Nashville, TN MSA						X		X		X
45	O Newark, NJ PMSA										
46	O Newburgh, NY-PA PMSA			X		X		X		X	X
49	O Reading, PA MSA					X		X	X		X
51	O Rochester, NY MSA	X		X				X			X
56	O Syracuse, NY MSA		X	X	X				X		
58	O Utica-Rome, NY MSA										

Note: I: MSA entirely contained within the Appalachian region; B: MSA spans Appalachian border; O: MSA completely outside Appalachia but adjacent to region.

Appendix Table 11

SBIR/STTR/ATP award winners in ARC region, FY 2000

Company Name	City	St.	Type	Amount	Technology
TENSION SYSTEMS L.L.C.	Madison	AL	SBIR		Aerospace
ADVANCED OPTICAL SYSTEMS, INC.	Huntsville	AL	SBIR		Aerospace
CFD Research Corp.	Huntsville	AL	SBIR		Aerospace
EAST WEST ENTERPRISES INC.	Huntsville	AL	SBIR		Aerospace
EAST WEST ENTERPRISES INC.	Huntsville	AL	SBIR		Aerospace
EAST WEST ENTERPRISES, INC.	Huntsville	AL	SBIR		Aerospace
GOMEZ RESEARCH ASSOC., INC.	Huntsville	AL	SBIR		Aerospace
SIMULATION TECHNOLOGIES, INC.	Huntsville	AL	SBIR		Aerospace
Aegis Technologies Group, Inc.	Huntsville	AL	SBIR		Aerospace
Aegis Technologies Group, Inc.	Huntsville	AL	SBIR		Aerospace
PLASMA PROCESSES, INC.	Huntsville	AL	SBIR		Aerospace
NEOTERIC TECHNOLOGIES, INC.	Huntsville	AL	SBIR		Aerospace
AI Signal Research, Inc.	Huntsville	AL	SBIR		Aerospace
Jaycor, Inc.	Huntsville	AL	SBIR		Aerospace
SRS Technologies	Huntsville	AL	SBIR		Aerospace
CUSTOM ANALYTICAL ENGINEERING SYSTEM	Flintstone	MD	SBIR		Aerospace
Odyssey Research Associates, Inc.	Ithaca	NY	SBIR		Aerospace
LANCORP Advanced Systems, Inc.	Imperial	PA	SBIR	\$68,769	Aerospace
NANOMAT, INC.	Somerset	PA	SBIR		Aerospace
COMBUSTION PROPULSION & BALLISTIC	State College	PA	SBIR		Aerospace
PRESCHUTTI & ASSOC., INC.	State College	PA	SBIR		Aerospace
TRS Ceramics, Inc.	State College	PA	SBIR		Aerospace
TRS Ceramics, Inc.	State College	PA	SBIR		Aerospace
HVS TECHNOLOGIES, INC.	STATE COLLEGE	PA	SBIR		Aerospace
LYTEC LLC	TULLAHOMA	TN	SBIR		Aerospace
Accurate Automation Corp.	Chattanooga	TN	SBIR		Aerospace
Accurate Automation Corp.	Chattanooga	TN	SBIR		Aerospace
Luna Innovations, Inc.	Blacksburg	VA	SBIR		Aerospace
NanoSonic, Inc.	Christiansburg	VA	SBIR		Aerospace
F&S, Inc.	Blacksburg	VA	SBIR		Aerospace
Information Systems Laboratories, Inc.	Huntsville	AL	STTR		Aerospace
Accurate Automation Corp.	Chattanooga	TN	STTR		Aerospace
Luna Innovations, Inc.	Blacksburg	VA	SBIR		Aerospace, Industrial Machinery
Technology in Blacksburg, Inc.	Blacksburg	VA	SBIR		Aerospace, Industrial Machinery
Innovative Dynamics, Inc.	Ithaca	NY	SBIR		Aerospace, Motor Vehicles
AZ TECHNOLOGY	Huntsville	AL	SBIR		Chemicals
Physitron, Inc.	Huntsville	AL	SBIR		Chemicals
CAT Flight Services, Inc.	Huntsville	AL	SBIR		Chemicals
Super-Pulse	Ithaca	NY	SBIR	\$100,000	Chemicals
E. H. Hall/Westfield Tanning Company	Westfield	PA	SBIR	\$58,694/6 Months	Chemicals
EXPORTech Company Inc	New Kensington	PA	SBIR	\$400,000	Chemicals
EXPORTech Company Inc	New Kensington	PA	SBIR	\$96,202	Chemicals
EXPORTech Company, Inc.	New Kensington	PA	SBIR		Chemicals
Media and Process Technology, Inc.	Pittsburgh	PA	SBIR		Chemicals
Nanomat, Inc.	North Huntingdon	PA	SBIR		Chemicals
SURFACE TREATMENT TECHNOLOGIES, INC.	Tullahoma	TN	SBIR		Chemicals
White Cliff Biosystems Co.	Kingsport	TN	SBIR		Chemicals
ATMOSPHERIC GLOW TECHNOLOGIES	Rockford	TN	SBIR		Chemicals
PETNet Pharmaceutical Services, Inc.	Knoxville	TN	SBIR		Chemicals
Cryogenic Applications F, Inc.	Clinton	TN	SBIR		Chemicals
Luna Innovations, Inc.	Blacksburg	VA	SBIR		Chemicals
NanoSonic, Inc.	Christiansburg	VA	SBIR		Chemicals
NanoSonic, Inc.	Christiansburg	VA	SBIR		Chemicals
HY-Tech Research Corp	Radford	VA	SBIR	\$399,996	Chemicals
Luna Innovations, Inc.	Blacksburg	VA	SBIR		Chemicals
F&S, Inc./Luna Innovations, Inc.	Blacksburg	VA	SBIR	\$69,974	Chemicals

Appendix Table 11 continues next page

Appendix Table 11 *continued***SBIR/STTR/ATP award winners in ARC region, FY 2000**

Company Name	City	St.	Type	Amount	Technology
TOUCHSTONE RESEARCH LABORATORY, LTD.	Triadelphia	WV	SBIR		Chemicals
RJ Lee Group, Incorporated	Monroeville	PA	STTR		Chemicals
SDR Plastics, Inc.	Ravenswood	WV	STTR		Chemicals
Time Domain Corporation	Huntsville	AL	ATP	\$6,801,000	Communications services, software
Medical Archival Systems Incorporated	Pittsburgh	PA	ATP	\$3,535,000	Communications services, software
CompAS Controls Inc.	Indiana	PA	ATP	\$5,706,000	Communications services, software
Pennsylvania State University	University Park	PA	ATP		Communications services, software
Engineering Sciences Inc	Huntsville	AL	SBIR	\$100,000	Communications services, software
CFD Research Corp.	Huntsville	AL	SBIR		Communications services, software
CFD Research Corp.	Huntsville	AL	SBIR	\$399,985	Communications services, software
CFD Research Corp.	Huntsville	AL	SBIR	\$399,946	Communications services, software
CFD Research Corp.	Huntsville	AL	SBIR	\$99,984	Communications services, software
CFD Research Corp.	Huntsville	AL	SBIR	\$99,947	Communications services, software
OPTICAL SCIENCES CORP.	Huntsville	AL	SBIR		Communications services, software
FlowLynx, Inc.	Huntsville	AL	SBIR		Communications services, software
Physitron, Inc.	Huntsville	AL	SBIR	\$50,000	Communications services, software
AZ Technology, Inc.	Huntsville	AL	SBIR		Communications services, software
Earth Mapping International, Inc.	Gainesville	GA	SBIR	\$99,996	Communications services, software
SEARCH TECHNOLOGY, INC.	Norcross	GA	SBIR		Communications services, software
MPI Software Technology, Inc.	Starkville	MS	SBIR	\$75,000	Communications services, software
MPI SOFTWARE TECHNOLOGY, INC.	Starkville	MS	SBIR		Communications services, software
MPI Software Technology	Starkville	MS	SBIR	\$400,000	Communications services, software
MPI Software Technology	Starkville	MS	SBIR	\$400,000	Communications services, software
WETSTONE TECHNOLOGIES, INC.	Freeville	NY	SBIR		Communications services, software
3DVIS TECHNOLOGIES, INC.	Vestal	NY	SBIR		Communications services, software
DIAMOND VISIONICS LLC	Vestal	NY	SBIR		Communications services, software
Munex, Inc.	Ithaca	NY	SBIR	\$69,011/6 Months	Communications services, software
Odyssey Research Associates, Inc.	Ithaca	NY	SBIR		Communications services, software
MAYA Design Group, Inc.	Pittsburgh	PA	SBIR		Communications services, software
TerraSim, Inc.	Pittsburgh	PA	SBIR		Communications services, software
Quantum Simulations, Inc.	Murrysville	PA	SBIR	\$50,000	Communications services, software
Discovery Machine, Inc.	Montgomery	PA	SBIR		Communications services, software
Platform Digital, LLC	Pittsburgh	PA	SBIR		Communications services, software
Psychology Software Tools	Pittsburgh	PA	SBIR	\$99,558	Communications services, software
TELE-TRACKING TECHNOLOGIES	PITTSBURGH	PA	SBIR	\$100,000	Communications services, software
Q-CHEM, INC.	EXPORT	PA	SBIR	\$551,979	Communications services, software
QSI	Murrysville	PA	SBIR	\$100,000	Communications services, software
Accurate Automation Corp	Chattanooga	TN	SBIR	\$399,999	Communications services, software
Genome Informatics Corporation	Oak Ridge	TN	SBIR		Communications services, software
IntraSpec, Inc.	Oak Ridge	TN	SBIR		Communications services, software
American Research Corporation of Virginia	Radford	VA	SBIR	\$50,000	Communications services, software
D.N. American, Inc.	Fairmont	WV	SBIR		Communications services, software
Kraus Communication LLC	Fairmont	WV	SBIR	\$299,974	Communications services, software
GammaTech, Inc.	Ithaca	NY	STTR		Communications services, software
Torrington Company	Norcross	GA	ATP		Industrial Machinery
Hardinge, Inc.	Elmira	NY	ATP	\$11,747,000	Industrial Machinery
Carnegie-Mellon University	Pittsburgh	PA	ATP	\$13,720,000	Industrial Machinery
Kennametal	Latrobe	PA	ATP		Industrial Machinery
Aegis Technologies Group, Inc.	Huntsville	AL	SBIR		Industrial Machinery
CFD Research Corp.	Huntsville	AL	SBIR		Industrial Machinery
SRS Technologies	Huntsville	AL	SBIR		Industrial Machinery
Plasma Processes, Inc.	Huntsville	AL	SBIR		Industrial Machinery
Thortek	Irvine	KY	SBIR		Industrial Machinery
Global Aircraft Corp.	Starkville	MS	SBIR	\$100,000	Industrial Machinery
AGILE SYSTEMS, INC.	Bethel	OH	SBIR		Industrial Machinery
LANCORP Advanced Engineering & Syst	Pittsburgh	PA	SBIR		Industrial Machinery

Appendix Table 11 continues next page

Appendix Table 11 *continued***SBIR/STTR/ATP award winners in ARC region, FY 2000**

Company Name	City	St.	Type	Amount	Technology
Surface Treatment Technologies, Inc.	Tullahoma	TN	SBIR		Industrial Machinery
VPT, Inc.	Blacksburg	VA	SBIR		Industrial Machinery
NanoSonic, Inc.	Christiansburg	VA	SBIR		Industrial Machinery
NanoSonic, Inc.	Christiansburg	VA	SBIR	\$399,800	Industrial Machinery
Rainbow Displays, Inc.	Endicott	NY	ATP	\$4,568,000	IT and instruments
CFD Research Corp.	Huntsville	AL	SBIR		IT and instruments
CFD Research Corp.	Huntsville	AL	SBIR		IT and instruments
CFD Research Corp.	Huntsville	AL	SBIR		IT and instruments
Morgan Research Corporation	Huntsville	AL	SBIR		IT and instruments
Physitron	Huntsville	AL	SBIR	\$100,000	IT and instruments
Aegis Technologies Group, Inc.	Huntsville	AL	SBIR		IT and instruments
United Applied Technologies, Inc.	Huntsville	AL	SBIR		IT and instruments
United Applied Technologies, Inc.	Huntsville	AL	SBIR		IT and instruments
Alabama Cryogenic Engineering, Inc.	Huntsville	AL	SBIR		IT and instruments
AI Signal Research, Inc.	Huntsville	AL	SBIR		IT and instruments
Photon-X, Inc.	Huntsville	AL	SBIR		IT and instruments
Search Technology, Inc.	Norcross	GA	SBIR		IT and instruments
GESAC, Inc.	Boonsboro	MD	SBIR	\$97,897	IT and instruments
Applied Pulsed Power, Inc.	Ithaca	NY	SBIR		IT and instruments
Sunpower, Inc.	Athens	OH	SBIR		IT and instruments
Chemlcon Inc.	Pittsburgh	PA	SBIR		IT and instruments
TRS CERAMICS, INC.	STATE COLLEGE	PA	SBIR	\$98,942	IT and instruments
Atolytics, Inc.	State College	PA	SBIR	\$300,000	IT and instruments
Licom Technologies, Inc.	State College	PA	SBIR		IT and instruments
Licom Technologies, Inc.	State College	PA	SBIR		IT and instruments
SPECTRUMEDIX CORPORATION	STATE COLLEGE	PA	SBIR	\$374,937	IT and instruments
LANCORP Advanced Engineering & Syst	Pittsburgh	PA	SBIR		IT and instruments
Nuclear Safeguards and Security Systems, LLC	Clinton	TN	SBIR		IT and instruments
CRYOMAGNETICS, INC.	OAK RIDGE	TN	SBIR	\$152,260	IT and instruments
IntraSpec, Inc.	Oak Ridge	TN	SBIR		IT and instruments
LAMBDA INSTRUMENTS	Blacksburg	VA	SBIR		IT and instruments
LAMBDA INSTRUMENTS	Blacksburg	VA	SBIR		IT and instruments
Luna Innovations, Inc.	Blacksburg	VA	SBIR		IT and instruments
Luna Innovations, Inc.	Blacksburg	VA	SBIR		IT and instruments
Luna Innovations, Inc.	Blacksburg	VA	SBIR		IT and instruments
Luna Innovations, Inc.	Blacksburg	VA	SBIR		IT and instruments
PhotoSonic, Inc.	Blacksburg	VA	SBIR		IT and instruments
PRIME PHOTONICS, INC.	Blacksburg	VA	SBIR		IT and instruments
World Physics Tech., Inc.	Blacksburg	VA	SBIR	\$100,000	IT and instruments
F&S, Inc.	Blacksburg	VA	SBIR		IT and instruments
F&S, Inc.	Blacksburg	VA	SBIR		IT and instruments
NanoSonic, Inc.	Christiansburg	VA	SBIR		IT and instruments
NanoSonic, Inc.	Christiansburg	VA	SBIR		IT and instruments
NanoSonic, Inc.	Christiansburg	VA	SBIR		IT and instruments
NanoSonic, Inc.	Christiansburg	VA	SBIR	\$74,999	IT and instruments
Luna Innovations, Inc.	Blacksburg	VA	SBIR		IT and instruments
F&S, Inc.	Blacksburg	VA	SBIR		IT and instruments
Airak Engineering	New Castle	VA	SBIR	\$100,000	IT and instruments
American Research Corporation of Virginia	Radford	VA	SBIR		IT and instruments
Touchstone Research Laboratory, Ltd	Triadelphia	WV	SBIR		IT and instruments
American Magnetics, Inc.	Oak Ridge	TN	STTR		IT and instruments
Envir Eng Group, Inc	Knoxville	TN	STTR	\$448,547	IT and instruments
Luna Innovations, Inc.	Blacksburg	VA	STTR	\$99,981	IT and instruments
Luna Innovations, Inc.	Blacksburg	VA	STTR	\$99,962	IT and instruments
NanoSonic, Inc.	Christiansburg	VA	STTR		IT and instruments
Luna Innovations, Inc.	Blacksburg	VA	STTR		IT and instruments

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Appendix Table 11 *continued***SBIR/STTR/ATP award winners in ARC region, FY 2000**

Company Name	City	St.	Type	Amount	Technology
PPL Therapeutics, Inc.	Blacksburg	VA	ATP	\$2,695,000	Pharm. and Medical Technologies
GEM PHARMACEUTICALS, INC.	PELHAM	AL	SBIR	\$134,283	Pharm. and Medical Technologies
SOUTHERN BIOTECHNOLOGY	BIRMINGHAM	AL	SBIR	\$106,000	Pharm. and Medical Technologies
VECTORLOGICS, INC.	BIRMINGHAM	AL	SBIR	\$344,294	Pharm. and Medical Technologies
CFD Research Corp.	Huntsville	AL	SBIR	\$500,766	Pharm. and Medical Technologies
X-RAY IMAGING INNOVATIONS	BIRMINGHAM	AL	SBIR	\$113,923	Pharm. and Medical Technologies
BIOELASTICS RESEARCH, LTD	BIRMINGHAM	AL	SBIR	\$373,079	Pharm. and Medical Technologies
IBBEX, INC.	BIRMINGHAM	AL	SBIR	\$357,791	Pharm. and Medical Technologies
SOUTHERN BIOSYSTEMS, INC.	BIRMINGHAM	AL	SBIR	\$99,579	Pharm. and Medical Technologies
VINE BROOK RESEARCH CORPORATION	BIRMINGHAM	AL	SBIR	\$99,935	Pharm. and Medical Technologies
TRANSMOLECULAR, INC.	BIRMINGHAM	AL	SBIR	\$260,053	Pharm. and Medical Technologies
ELGAVISH PARAMAGNETICS, INC.	BIRMINGHAM	AL	SBIR	\$348,846	Pharm. and Medical Technologies
CYTRX CORPORATION	NORCROSS	GA	SBIR	\$206,051	Pharm. and Medical Technologies
COMPUTER SOURCE	GAINESVILLE	GA	SBIR	\$99,212	Pharm. and Medical Technologies
GLYCOBIOTICS, INC.	COMER	GA	SBIR	\$100,000	Pharm. and Medical Technologies
BIOLINX, LLC	HAGERSTOWN	MD	SBIR	\$114,270	Pharm. and Medical Technologies
Anasazi BioMedical Research, Inc.	WINSTON-SALEM	NC	SBIR	\$105,000	Pharm. and Medical Technologies
Anasazi BioMedical Research, Inc.	Winston-Salem	NC	SBIR		Pharm. and Medical Technologies
CIELO INSTITUTE, INC	ASHEVILLE	NC	SBIR	\$374,982	Pharm. and Medical Technologies
RED TAIL HAWK CORPORATION	BINGHAMTON	NY	SBIR	\$98,797	Pharm. and Medical Technologies
BIOLIFE SOLUTIONS	BINGHAMTON	NY	SBIR	\$189,747	Pharm. and Medical Technologies
BioLife Technologies Inc.	Binghamton	NY	SBIR	\$100,000	Pharm. and Medical Technologies
TRANSONIC SYSTEMS, INC.	ITHACA	NY	SBIR	\$531,710	Pharm. and Medical Technologies
BIOMED RESEARCH & TECHNOLOGIES	WEXFORD	PA	SBIR	\$199,781	Pharm. and Medical Technologies
DYNAMIC CONTOURS, LLC	ALLISON PARK	PA	SBIR	\$103,515	Pharm. and Medical Technologies
SEQUEL GENETICS, INC.	PITTSBURGH	PA	SBIR	\$98,960	Pharm. and Medical Technologies
PROLX PHARMACEUTICALS, LP	PITTSBURGH	PA	SBIR	\$1,087,690	Pharm. and Medical Technologies
BIOPORE, INC.	STATE COLLEGE	PA	SBIR	\$98,925	Pharm. and Medical Technologies
REMCOM, INC.	State College	PA	SBIR		Pharm. and Medical Technologies
FOX FARSIGHT PRODUCTIONS, INC.	BRIDGEVILLE	PA	SBIR	\$221,872	Pharm. and Medical Technologies
COMPUTATIONAL DIAGNOSTICS, INC.	PITTSBURGH	PA	SBIR	\$237,525	Pharm. and Medical Technologies
CYBERGENETICS COMPANY	PITTSBURGH	PA	SBIR	\$176,582	Pharm. and Medical Technologies
NEO GEN SCREENING, INC.	PITTSBURGH	PA	SBIR	\$456,662	Pharm. and Medical Technologies
PSYCHOLOGY SOFTWARE TOOLS, INC.	PITTSBURGH	PA	SBIR	\$382,079	Pharm. and Medical Technologies
AUTOMATED CELL, INC.	PITTSBURGH	PA	SBIR	\$375,573	Pharm. and Medical Technologies
Clinical & Industrial Tech	Seneca	SC	SBIR	\$399,892	Pharm. and Medical Technologies
ATOM SCIENCES, INC.	OAK RIDGE	TN	SBIR	\$133,783	Pharm. and Medical Technologies
ATMOSPHERIC GLOW TECHNOLOGIES	KNOXVILLE	TN	SBIR	\$102,430	Pharm. and Medical Technologies
SCI-TEC, INC.	KNOXVILLE	TN	SBIR	\$124,251	Pharm. and Medical Technologies
BioNeutrics, Inc.	Knoxville	TN	SBIR		Pharm. and Medical Technologies
PETNet Pharmaceutical Services, Inc.	Knoxville	TN	SBIR		Pharm. and Medical Technologies
ApoCom, Inc.	Knoxville	TN	SBIR		Pharm. and Medical Technologies
TECHLAB, INC.	BLACKSBURG	VA	SBIR	\$300,000	Pharm. and Medical Technologies
F&S, Inc./Luna Innovations, Inc.	Blacksburg	VA	SBIR	\$69,953	Pharm. and Medical Technologies
American Research Corporation of Virginia	Radford	VA	SBIR	\$200,000	Pharm. and Medical Technologies
SUMMIT CROSSROADS PRESS	BERKELEY	WV	SBIR	\$98,166	Pharm. and Medical Technologies
Touchstone Research Laboratory, Ltd.	Triadelphia	WV	SBIR		Pharm. and Medical Technologies
CHEM-SPACE ASSOCIATES	PITTSBURGH	PA	SBIR	\$99,844	Pharm. and Medical Technologies
F & S, Incorporated	Blacksburg	VA	STTR	\$449,464	Pharm. and Medical Technologies
Automatika, Inc.	Pittsburgh	PA	SBIR		Other
Diamond Visionics Company	Vestal	NY	Tibbetts		Other
Transonic Systems, Inc.	Ithaca	NY	Tibbetts		Other
Cryomagnetics, Inc.	Oak Ridge	TN	Tibbetts		Other

Appendix Table 12

State-funded technology agencies and programs in ARC region

Name	City/Town	St.	Technology	Funding 2000	Type
Army Space and Missile Defense Command	Huntsville	AL	Aerospace		Research
NASA MSFC Tech Transfer Program	Huntsville	AL	Aerospace	\$13,427,000	SBIR/STTR nationally
Army Aviation and Missile Command	Redstone Arsenal	AL	Aerospace	\$95,000,000	Research
Center for Commercial Space Communications	Blacksburg	VA	Aerospace		Research
NSF Center for Materials Research,	Lexington	KY	Chemicals		Research
Center for Advanced Ceramic Technology	Alfred	NY	Chemicals		Research
Ceramics Corridor Innovation Center	Alfred	NY	Chemicals		Incubator
Material Research Science and Eng Center	Pittsburgh	PA	Chemicals	\$900,000	Research
Center for Advanced Ceramic Materials	Blacksburg	VA	Chemicals		Research
Entrepreneurial Center,	Birmingham	AL	Comm. services, software	\$600,000	Incubator
EBusiness Labs	Alpharetta	GA	Comm. services, software		Incubator
IT Alliance of Appalachian Ohio*	Athens	OH	Comm. services, software		N/A Tech Cntr
Pittsburgh Digital Greenhouse	Pittsburgh	PA	Comm. services, software	\$3,500,000	Research
Virtual Environments Lab	Morgantown	WV	Comm. services, software		Research
Byrd Center for Educational Technologies	Wheeling	WV	Comm. services, software		Research
Challenger Learning Center,	Wheeling	WV	Comm. services, software		Research
Center for Identification Technical Research (CITER) a NSF Center		WV	Comm. services, software		Research
Auburn Industrial Extension Service	Auburn	AL	Industrial Machinery	\$900,000	MEP
Metropolitan Manufacturing Technology Center	Birmingham	AL	Industrial Machinery	\$779,000	MEP
Bevill Manufacturing Technology Center	Gadsden	AL	Industrial Machinery	\$1,083,000	MEP
Center for Automation and Robotics	Huntsville	AL	Industrial Machinery	\$1,170,000	MEP
Alabama Productivity Center	Tuscaloosa	AL	Industrial Machinery	\$569,000	MEP
Georgia Manufacturing Extension Partnership	Atlanta	GA	Industrial machinery		MEP
Georgia Tech, Econ Dev Institute Reg. Office	Carrollton	GA	Industrial machinery		MEP
Georgia Tech, Econ Dev Institute Reg. Office	Cartersville	GA	Industrial machinery		MEP
Georgia Tech, Econ Dev Institute Reg. Office	Dalton	GA	Industrial machinery		MEP
Georgia Tech, Econ Dev Institute Reg. Office	Gainesville	GA	Industrial machinery		MEP
Georgia Tech, Econ Dev Institute Reg. Office	Newman	GA	Industrial machinery		MEP
Georgia Tech, Econ Dev Institute Reg. Office	Rome	GA	Industrial machinery		MEP
Center for Manufacturing Systems	Lexington	KY	Industrial machinery		Research
Center for Robotics and Manufacturing Systems	Lexington	KY	Industrial machinery		Research
Kentucky Technology Service	Morehead	KY	Industrial machinery		MEP/SBIR
Kentucky Technology Service	Somerset	KY	Industrial machinery		MEP/SBIR
Technology Extension Service	Hagerstown	MD	Industrial machinery		MEP
NC Industrial Extension Service, MEP	Kings Mountain	NC	Industrial machinery		MEP
Alliance for Manufacturing and Technology	Binghamton	NY	Industrial machinery		MEP
Great Lakes Manufacturing Center***	Cleveland	OH	Industrial machinery		N/A MEP
Manufacturing Resource Office***	Columbus	OH	Industrial machinery		N/A MEP
NW PA Industrial Resource Center	Erie	PA	Industrial machinery		MEP
SW PA Industrial Resource Center	Pittsburgh	PA	Industrial machinery		MEP
Penn State Engineering Research Center	University Park	PA	Industrial machinery	\$1,000,000	Research
Penn State Semiconductor Mfg Tech Initiative	University Park	PA	Industrial machinery	\$2,000,000	Research
Manufacturing Technology Center	York	PA	Industrial machinery		MEP
Manufacturing Field Office	Greenville	SC	Industrial machinery		MEP
University of Tennessee Center for Industrial Services	Chattanooga	TN	Industrial machinery		MEP
The Manufacturing Center at Tennessee Technical Univ	Cookeville	TN	Industrial machinery		Research
University of Tennessee Center for Industrial Services	Knoxville	TN	Industrial machinery		MEP
Center for Coal and Mining Technologies	Blacksburg	VA	Industrial machinery		Research
NSF Center for Power Electronics	Blacksburg	VA	Industrial machinery		Research
VPMEP	Harrisonburg	VA	Industrial machinery		MEP
VPMEP	Roanoke	VA	Industrial machinery		MEP
Manufacturing Technology Center of SW VA	Wytheville	VA	Industrial machinery		MEP
WV MEP	Bridgeport	WV	Industrial machinery		MEP
Byrd Institute for Advanced Flexible Manufacturing	Huntington	WV	Industrial machinery		Research
WV MEP	Huntington	WV	Industrial machinery		MEP
WV MEP	Rocket Center	WV	Industrial machinery		MEP
WV MEP	South Charleston	WV	Industrial machinery		MEP
Lehigh Univ Center for Optical Technologies			Industrial machinery	\$1,000,000	Research
Lehigh Univ Visteam Systems/PennState			Industrial machinery	\$1,000,000	Research
BizTech	Huntsville	AL	IT and instruments	\$225,000	Incubator
Integrated Electronics Engineering Center	Binghamton	NY	IT and instruments		Research
Fiber and Electro-optics Research Center	Blacksburg	VA	IT and instruments		Research
Center for Wireless Telecommunications	Blacksburg	VA	IT, instruments, Comm. services, software		Research

Appendix Table 12 continues next page

Appendix Table 12 *continued***State-funded technology agencies and programs in ARC region**

Name	City/Town	St.	Technology	Funding 2000	Type
Ohio SBDC at Ohio University	Athens	OH	N/A	\$222,823	SBIR
Ohio SBDC at OMEGA	Cambridge	OH	N/A	\$16,755	SBIR
Ohio SBDC at Kent State U., Columbiana	East Liverpool	OH	N/A	\$87,234	SBIR
Ohio SBDC at Southern State Community College	Hillsboro	OH	N/A	\$74,930	SBIR
Ohio ITAC at Marietta College	Marietta	OH	N/A	\$48,862	SBIR
SBDC at Marietta College	Marietta	OH	N/A	\$159,653	SBIR
Ohio SBDC at Kent State U., Tuscarawas	New Philadelphia	OH	N/A	\$101,129	SBIR
Ohio Mfg. SBDC at OSU Piketon	Piketon	OH	N/A	\$26,688	SBIR
Southeast Ohio SBDC	Southpoint	OH	N/A	\$160,344	SBIR
Ohio SBDC at Jefferson County	Steubenville	OH	N/A	\$153,459	SBIR
Shoals Entrepreneurship Center	Florence	AL	Other	\$330,000	Incubator
Center for Environmental Technology	Muscle Shoals	AL	Other	\$779,000	MEP
Learning and Performance Support Lab,	Athens	GA	Other		Research
Center for Agriculture		MD	Other		Research
Georgia Biotechnology Center	Athens	GA	Pharm. and Medical Technologies		Research
Medical Imaging Development Center	Atlanta	GA	Pharm. and Medical Technologies		Research
Cornell Institute for Biotechnology & Life Sciences Technology	Ithaca	NY	Pharm. and Medical Technologies		Research
Edison Biotechnology Institute	Athens	OH	Pharm. and Medical Techn	\$2,300,000	Res Cntr
Ohio University Innovation Center**	Athens	OH	Pharm. and Medical Techn	\$111,000	Incubator
OADI Technology Center	Birmingham	AL	Pharm. and Medical Techn	\$266,000	Incubator
Center for Textile and Apparel Technology	Alexander City	AL	Textile and Apparel	\$595,000	MEP
Alabama EPSCOR	statewide	AL		\$14,200,000	Research
Alabama Research Institute	statewide	AL		\$400,000	Research
Technology Assistance Program	statewide	AL		in-kind only	SBIR
Carroll Business Incubator	Carrollton	GA			Incubator
SBIR Resource Program at Kennesaw State Univ.	Kennesaw	GA			SBIR
EPSCOR program		KY			Research
Hagerstown Community College Technology Innovation Ctr	Hagerstown	MD			Incubators
Allegheny-Garrett ATC		MD			Research
Challenge Investment Program (Western winners?)		MD			Research
Maryland Industrial Partnership Program (Western winners?)		MD			Research
Potomac ATC		MD			Research
Regional Managers of DBED		MD			SBIR
Strategic Investment Fund (Western winners?)		MD			Research
Western MD SBDC		MD			SBIR
Northeast Business Incubator System	Corinth	MS			Incubator
North Mississippi Entrepreneurship Institute	Oxford	MS			Incubator
Mississippi Research Consortium (EPSCOR)	Starkville	MS			Research
Mississippi Technology Center	Starkville	MS			Incubator
NC SBTDC	Asheville	NC			SBIR
NC SBTDC	Boone	NC			SBIR
Haywood Community College	Clyde	NC			MEP
NC SBTDC	Cullowhee	NC			SBIR
Catawba Valley Community College	Hickory	NC			MEP
NC SBTDC	Hickory	NC			SBIR
NC SBTDC	Winston-Salem	NC			SBIR
MVATC Technology and Incubator Center	Utica	NY			Incubator
Ben Franklin Partnership – North East	Bethlehem	PA			Incubator/SBIR
Innovation Works, Inc.	Pittsburgh	PA			Incubator/SBIR
Ben Franklin Partnership– Central and Northern	University Park	PA			Incubator/SBIR
PENNTAP, Penn State Technical Assistance Program	University Park	PA		\$655,014	MEP
Clemson Research Park	Clemson	SC			Research
SBDC-Clemson University Region	Clemson	SC			SBIR
First Base Ventures	Greenville	SC			Incubator
SBDC-Greenville Area	Greenville	SC			SBIR
SBDC-Spartanburg Area	Greenville	SC			SBIR
SBDC-Upper Savannah Area	Greenwood	SC			SBIR
EPSCOR		SC			Research
Chattanooga/Hamilton Business Development Center	Chattanooga	TN			SBIR
SE Development District	Chattanooga	TN			SBIR
Cleveland State Community College	Cleveland	TN			SBIR
Regional Business Technology Incubator	Cookeville	TN			Incubator
East Tennessee State University	Johnson City	TN			SBIR

Appendix Table 12 continues next page

Appendix Table 12 *continued***State-funded technology agencies and programs in ARC region**

Name	City/Town	St.	Technology	Funding 2000 Type
Fairview Technology Center	Knoxville	TN		Incubator
Pellissippi State Technical Community College	Knoxville	TN		SBIR
Tennessee Technology Development Corporation	Knoxville	TN		Research
Oak Ridge Incubation Center	Oak Ridge	TN		Incubator
Technology 2020	Oak Ridge	TN		Incubator
Tennessee Research Institute		TN		
TSBDCs		TN		
Business-Technology Center	Blacksburg	VA		Incubator
CIT	Blacksburg	VA		SBIR
CIT	Roanoke	VA		SBIR
CIT	Wise	VA		SBIR
PROMISE		WV		SBIR
W.Va. EPSCOR		WV		Research

Appendix Table 13

Science and engineering CIP codesScience and engineering *Classification of Instructional Programs* codes by major disciplinary areas

Aggregated disciplinary area	CIP code title	CIP code
Aerospace Engineering, Aviation Science & Astrophysics	Aerospace, Aeronautical & Astronautic	14.0201
	Aeronautical & Aerospace Engineering Tech	15.0801
	Aviation & Airway Science	49.0101
	Astrophysics	40.0301
Biochemistry & Biomedical Engineering	Biochemistry	26.0202
	Biophysics	26.0203
	Bioengineering & Biomedical Engineering	14.0501
	Biological & Physical Sciences	30.0101
	Biopsychology	30.1001
Botany, Biology, Bacteriology & Biotechnology	Botany, General	26.0301
	Plant Pathology	26.0305
	Plant Physiology	26.0307
	Botany, Other	26.0399
	Cell Biology	26.0401
	Molecular Biology	26.0402
	Cell & Molecular Biology, Other	26.0499
	Biology, General	26.0101
	Biological Sciences/life Sciences, Other	26.9999
	Biological Tech./technician	41.0101
	Microbiology/bacteriology	26.0501
	Anatomy	26.0601
	Ecology	26.0603
	Marine/aquatic Biology	26.0607
	Neuroscience	26.0608
	Nutritional Sciences	26.0609
	Parasitology	26.0610
	Radiation Biology/radiobiology	26.0611
	Toxicology	26.0612
	Genetics, Plant & Animal	26.0613
Biometrics	26.0614	
Biostatistics	26.0615	
Biotechnology Research	26.0616	
Evolutionary Biology	26.0617	
Biological Immunology	26.0618	
Virology	26.0619	
Misc. Biological Specializations, Oth.	26.0699	
Communications & Computer Sciences & Technologies	Educational/instructional Media Tech.	10.0101
	Photographic Tech./technician	10.0103
	Radio & Television Broadcasting Tech.	10.0104
	Communications Technol./technicians, Oth	10.0199
	Computer & Information Sciences, Gen.	11.0101
	Computer Programming	11.0201
	Data Processing Tech./technician	11.0301
	Information Sciences & Systems	11.0401
	Computer Systems Analysis	11.0501
	Computer Science	11.0701
	Computer & Information Sciences, Other	11.9999
	Computer Engineering	14.0901
	Computer Engineering Tech./technician	15.0301
	Electrical, Electronics & Communication	14.1001
	Elec., Electronic & Comm. Engin. Tech.	15.0303
	Laser & Optical Tech./technician	15.0304
Electrical & Electronic Engin.-rel. Tech	15.0399	

Appendix Table 13 continues next page

Appendix Table 13 *continued*

Science and engineering CIP codes

Science and engineering *Classification of Instructional Programs* codes by major disciplinary areas

Aggregated disciplinary area	CIP code title	CIP code
Environmental Engineering & Controls	Water Quality/wastewater Treatment Tech	15.0506
	Environmental & Pollution Control Tech.	15.0507
	Environmental Control Tech, Oth.	15.0599
	Environmental/environmental Health Engin	14.1401
Agricultural Sciences & Technology	Agricultural Engineering	14.0301
	Agriculture/agricultural Sciences, Gen.	02.0101
	Agriculture/agricultural Sciences, Other	02.9999
	Animal Sciences, General	02.0201
	Agricultural Animal Breeding & Genetics	02.0202
	Agricultural Animal Health	02.0203
	Agricultural Animal Nutrition	02.0204
	Agricultural Animal Physiology	02.0205
	Dairy Science	02.0206
	Poultry Science	02.0209
	Animal Sciences, Other	02.0299
	Food Sciences & Tech.	02.0301
	Plant Sciences, General	02.0401
	Agronomy & Crop Science	02.0402
	Horticulture Science	02.0403
	Plant Breeding & Genetics	02.0405
	Agricultural Plant Pathology	02.0406
	Agricultural Plant Physiology	02.0407
	Plant Protection (pest Management)	02.0408
	Range Science & Management	02.0409
	Plant Sciences, Other	02.0499
	Soil Sciences	02.0501
	Zoology, General	26.0701
	Entomology	26.0702
	Pathology, Human & Animal	26.0704
	Pharmacology, Human & Animal	26.0705
Physiology, Human & Animal	26.0706	
Zoology, Other	26.0799	
Forestry Science & Forestry Technology	Forest Harvesting & Production Tech.	03.0401
	Forest Products Tech./technician	03.0404
	Forestry Sciences	03.0502
	Wood Science & Pulp/paper Tech.	03.0509
	Forestry & Related Sciences, Other	03.0599
Geological & Geophysical Engineering	Atmospheric Sciences & Meteorology	40.0401
	Geology	40.0601
	Geochemistry	40.0602
	Geophysics & Seismology	40.0603
	Geological & Related Sciences, Other	40.0699
	Earth & Planetary Sciences	40.0703
	Geological Engineering	14.1501
	Geophysical Engineering	14.1601
	Mining Tech./technician	15.0901
	Petroleum Tech./technician	15.0903
	Mining & Petroleum Technol./tech, Other	15.0999
	Mining & Mineral Engineering	14.2101
	Ocean Engineering	14.2401
<i>Appendix Table 13 continues next page</i>	Petroleum Engineering	14.2501

Appendix Table 13 *continued*

Science and engineering CIP codes

Science and engineering *Classification of Instructional Programs* codes by major disciplinary areas

Aggregated disciplinary area	CIP code title	CIP code
Mathematics	Operations Research	27.0302
	Applied Mathematics, Other	27.0399
	Mathematical Statistics	27.0501
	Mathematics, Other	27.9999
	Mathematics	27.0101
	Applied Mathematics, General	27.0301
	Mathematics & Computer Science	30.0801
Basic Medical Science	Medical Anatomy	51.1301
	Medical Biochemistry	51.1302
	Medical Physics/biophysics	51.1304
	Medical Cell Biology	51.1305
	Medical Genetics	51.1306
	Medical Immunology	51.1307
	Medical Microbiology	51.1308
	Medical Molecular Biology	51.1309
	Medical Neurobiology	51.1310
	Medical Nutrition	51.1311
	Medical Pathology	51.1312
	Medical Physiology	51.1313
	Medical Toxicology	51.1314
	Basic Medical Sciences, Other	51.1399
Physics & Nuclear Engineering	Nuclear Engineering	14.2301
	Physical Sciences, General	40.0101
	Miscellaneous Physical Sciences, Other	40.0799
	Physical Sciences, Other	40.9999
	Physical Science Technol./technicians, Oth	41.0399
	Science Technol./technicians, Other	41.9999
	Physics, General	40.0801
	Chemical & Atomic/molecular Physics	40.0802
	Elementary Particle Physics	40.0804
	Plasma & High-temperature Physics	40.0805
	Nuclear Physics	40.0806
	Optics	40.0807
	Solid State & Low-temperature Physics	40.0808
	Acoustics	40.0809
	Theoretical & Mathematical Physics	40.0810
	Physics, Other	40.0899
	Industrial Engineering & Technology	Industrial/manufacturing Tech/technician
Plastics Tech./technician		15.0607
Metallurgical Tech./technician		15.0611
Industrial Product. Technol./techn, Oth		15.0699
Quality Control Tech./technician		15.0702
Hydraulic Tech./technician		15.1103
Industrial/manufacturing Engineering		14.1701
Industrial Radiologic Tech./technician		41.0204
Nuclear/nuclear Power Tech./technician		41.0205
Nuclear & Industrial Radiologic Tech.,other		41.0299
Appendix Table 13 continues next page	Textile Sciences & Engineering	14.2801

Appendix Table 13 *continued*

Science and engineering CIP codes

Science and engineering *Classification of Instructional Programs* codes by major disciplinary areas

Aggregated disciplinary area	CIP code title	CIP code
Mechanical Engineering, Engineering Physics & Science, & Systems Engineering	Biomedical Engineering-related Tech.	15.0401
	Computer Main. Tech./technician	15.0402
	Electromechanical Tech./technician	15.0403
	Instrumentation Tech./technician	15.0404
	Robotics Tech./technician	15.0405
	Electromechanical Instrum. & Maint. Tech	15.0499
	Heating, Air Condition. & Refrig. Tech.	15.0501
	Energy Management & Systems Tech./techn	15.0503
	Engineering Design	14.2901
	Engineering Mechanics	14.1101
	Engineering Physics	14.1201
	Engineering Science	14.1301
	Engineering, General	14.0101
	Engineering-related Tech/technician, Gen	15.1101
	Engineering, Other	14.9999
	Engineering-related Technol./techn, Oth	15.9999
	Mechanical Engineering	14.1901
	Automotive Engineering Tech./technician	15.0803
	Mechanical Engineering/mechanical Tech.	15.0805
	Mechanical Engineering-related Tech, Oth	15.0899
	Systems Engineering	14.2701
	Systems Science & Theory	30.0601
	Materials Engineering & Science	Ceramic Sciences & Engineering
Material Engineering		14.1801
Materials Science		14.3101
Metallurgical Engineering		14.2001
Metallurgy		40.0701
Chemical Engineering & Technology	Polymer/plastics Engineering	14.3201
	Chemical Engineering	14.0701
	Organic Chemistry	40.0504
	Chemistry, General	40.0501
	Analytical Chemistry	40.0502
	Inorganic Chemistry	40.0503
	Medicinal/pharmaceutical Chemistry	40.0505
	Physical & Theoretical Chemistry	40.0506
	Polymer Chemistry	40.0507
	Chemistry, Other	40.0599
Chemical Tech./technician	41.0301	

Appendix Table 14

Selected excluded CIP codes

CIPs considered, but not included, in final list of science & engineering programs

CIP code title	CIP code	CIP code title	CIP code
Agricultural Business And Mgmt., General	01.0101	Financial Services Marketing Operations	08.0401
Agricultural Business/agribusiness Oper	01.0102	Floristry Marketing Operations	08.0503
Agricultural Economics	01.0103	Food Products Retail And Wholesale Opns	08.0601
Farm And Ranch Management	01.0104	Auctioneering	08.0701
Agricultural Business & Management, Oth	01.0199	General Buying Operations	08.0704
Agricultural Mechanization, General	01.0201	General Retailing Operations	08.0705
Agricultural Power Machinery Operator	01.0204	General Selling Skills And Sales Opns.	08.0706
Agricultural Mechanization, Other	01.0299	General Marketing Operations	08.0708
Ag. Prod. Workers And Managers, Gen.	01.0301	General Distribution Operations	08.0709
Ag. Animal Husbandry & Prod. Mgmt.	01.0302	Gen. Retail & Whlsale Opns. & Skills,oth	08.0799
Aquaculture Operations And Prod. Mgmt.	01.0303	Home Products Marketing Operations	08.0809
Crop Production Operations & Management	01.0304	Home & Office Products Mrkting Opns, Oth	08.0899
Ag. Prod. Workers And Managers, Other	01.0399	Hospitality & Rec. Marketing Opns, Gen	08.0901
Ag. & Food Products Process. Op. & Mgmt	01.0401	Hotel/motel Serv. Marketing Operation	08.0902
Ag. Supplies Retailing & Wholesaling	01.0501	Recreation Products/serv. Marketing Opns	08.0903
Animal Trainer	01.0505	Food Sales Operations	08.0906
Eques./equine Stds., Horse Mgmt. & Trgn	01.0507	Hospitality & Recrtn. Market. Opns, Oth	08.0999
Ag. Supplies And Related Svcs, Other	01.0599	Insurance Marketing Operations	08.1001
Horticulture Svcs. Ops. And Mgmt., Gen.	01.0601	Tourism Promotion Operations	08.1104
Ornamental Horticulture Ops. And Mgmt.	01.0603	Travel Services Marketing Operations	08.1105
Greenhouse Operations And Management	01.0604	Tourism & Travel Serv. Market. Opns,oth	08.1199
Landscaping Operations And Management	01.0605	Vehicle Parts & Accessories Market. Opn	08.1203
Nursery Operations And Management	01.0606	Vehicle Marketing Operations	08.1208
Turf Management	01.0607	Vehicle & Petrol. Prods. Market. Ops, Oth	08.1299
Horticulture Svcs. Ops. And Mgmt., Oth.	01.0699	Health Products & Services Marketing Ops	08.1301
International Agriculture	01.0701	Marketing Opns/market. & Distrib.,other	08.9999
Agricultural Business & Production, Oth	01.9999	Communications, General	09.0101
Agricultural Extension	02.0102	Advertising	09.0201
Natural Resources Conservation, General	03.0101	Journalism	09.0401
Environmental Science/studies	03.0102	Broadcast Journalism	09.0402
Natural Resources Management And Policy	03.0201	Mass Communications	09.0403
Nat. Resrcs. Law Enforce. & Protect. Svc	03.0203	Journalism And Mass Communication, Other	09.0499
Nat. Resrcs. Mgmt. & Protectv Svcs, Oth	03.0299	Public Relations & Organizational Comm.	09.0501
Fishing And Fisheries Sciences And Mgmt	03.0301	Radio And Television Broadcasting	09.0701
Forest Production And Processing, Other	03.0499	Communications, Other	09.9999
Forestry, General	03.0501	Card Dealer	12.0203
Forest Management	03.0506	Gaming & Sports Officiating Serv., Oth.	12.0299
Wildlife And Wildlands Management	03.0601	Funeral Services And Mortuary Science	12.0301
Conservation & Renewable Nat. Resrs, Other	03.9999	Cosmetic Services, General	12.0401
Apparel & Accessories Market. Opns, Gen	08.0101	Barber/hairstylist	12.0402
Fashion Merchandising	08.0102	Cosmetologist	12.0403
Fashion Modeling	08.0103	Electrolysis Technician	12.0404
Apparel & Accessories Market. Opns, Other	08.0199	Massage	12.0405
Business Services Marketing Operations	08.0204	Make-up Artist	12.0406
Personal Svcs Marketing Operations	08.0205	Cosmetic Services, Other	12.0499
Bus. & Personal Ser. Market. Opns, Oth	08.0299	Baker/pastry Chef	12.0501
Entrepreneurship	08.0301	Bartender/mixologist	12.0502
Culinary Arts/chef Training	12.0503	Aircraft Mechanic/technician, Airframe	47.0607
Food & Beverage/restaurant Opns. Manager	12.0504	Aircraft Mechanic/technician, Powerplant	47.0608
Kitchen Personnel/cook & Asst. Trng.	12.0505	Aviation Systems And Avionics Main. Tech	47.0609
Meatcutter	12.0506	Motorcycle Mechanic And Repairer	47.0611
Waiter/waitress And Dining Room Manager	12.0507	Vehicle & Mobile Equip. Mechanics & Repair	47.0699

Appendix Table 14 continues next page

Appendix Table 14 *continued*

Selected excluded CIP codes

CIPs considered, but not included, in final list of science & engineering programs

CIP code title	CIP code	CIP code title	CIP code
Culinary Arts & Related Services, Other	12.0599	Mechanics And Repairers, Other	47.9999
Personal & Miscellaneous Services, Other	12.9999	Drafting, General	48.0101
Architectural Engineering	14.0401	Architectural Drafting	48.0102
Civil Engineering, General	14.0801	Civil/structural Drafting	48.0103
Geotechnical Engineering	14.0802	Electrical/electronics Drafting	48.0104
Structural Engineering	14.0803	Mechanical Drafting	48.0105
Transportation And Highway Engineering	14.0804	Drafting, Other	48.0199
Water Resources Engineering	14.0805	Graphic & Printing Equip. Operator, Gen	48.0201
Civil Engineering, Other	14.0899	Mechanical Typesetter And Composer	48.0205
Naval Architecture & Marine Engineering	14.2201	Lithographer And Platemaker	48.0206
Engineering/Industrial Management	14.3001	Printing Press Operator	48.0208
Architectural Engineering Techno/tech	15.0101	Computer Typography & Composition Equip	48.0211
Civil Engineering/civil Tech./technician	15.0201	Desktop Publishing Equipment Operator	48.0212
Occupational Safety & Health Tech./techn	15.0701	Graphic & Printing Equip. Operator, Oth	48.0299
Quality Control & Safety Technol./tech.	15.0799	Upholsterer	48.0303
Construction/building Tech./technician	15.1001	Shoe, Boot And Leather Repairer	48.0304
Surveying	15.1102	Leatherworkers And Upholsterers, Other	48.0399
Astronomy	40.0201	Machinist/machine Technologist	48.0501
Paleontology	40.0604	Machine Shop Assistant	48.0503
Oceanography	40.0702	Sheet Metal Worker	48.0506
Electrical And Electronics Equipment Ins	47.0101	Tool And Die Maker/technologist	48.0507
Business Machine Repairer	47.0102	Welder/welding Technologist	48.0508
Communication Sys. Installer & Repairer	47.0103	Precision Metal Workers, Other	48.0599
Computer Installer And Repairer	47.0104	Woodworkers, General	48.0701
Indus. Electronics Installer & Repairer	47.0105	Furniture Designer And Maker	48.0702
Major Appliance Installer And Repairer	47.0106	Cabinet Maker And Millworker	48.0703
Electrical And Electronics Equipment Ins	47.0199	Woodworkers, Other	48.0799
Heating, Air Conditioning And Refrigerat	47.0201	Precision Production Trades, Other	48.9999
Heavy Equipment Main. And Repairer	47.0302	Aircraft Pilot And Navigator (professional)	49.0102
Industrial Machinery Main. And Repairer	47.0303	Aviation Management	49.0104
Indus. Equip. Main. And Repairers, Oth.	47.0399	Air Traffic Controller	49.0105
Instrument Calibration And Repairer	47.0401	Flight Attendant	49.0106
Gunsmith	47.0402	Aircraft Pilot (private)	49.0107
Locksmith And Safe Repairer	47.0403	Air Transportation Workers, Other	49.0199
Musical Instrument Repairer	47.0404	Construction Equipment Operator	49.0202
Watch, Clock And Jewelry Repairer	47.0408	Truck, Bus & Oth. Commercial Vehicle Op	49.0205
Miscellaneous Mechanics & Repairers, Oth	47.0499	Vehicle And Equipment Operators, Other	49.0299
Stationary Energy Sources Installer/oper	47.0501	Fishing Tech/comm Fishing	49.0303
Auto/automotive Body Repairer	47.0603	Diver (professional)	49.0304
Auto/automotive Mechanic/technician	47.0604	Marine Main. And Ship Repairer	49.0306
Diesel Engine Mechanic And Repairer	47.0605	Marine Science/merchant Marine Officer	49.0309
Small Engine Mechanic And Repairer	47.0606	Water Transportation Workers, Other	49.0399
Transportation And Materials Moving Work	49.9999	Medical Laboratory Technician	51.1004
Chiropractic (d.c., D.c.m.)	51.0101	Medical Technology	51.1005
Communication Disorders, General	51.0201	Optometric/ophthalmic Laboratory Tech.	51.1006
Audiology/hearing Sciences	51.0202	Health & Medical Laboratory Tech., Oth.	51.1099
Speech-language Pathology	51.0203	Pre-dentistry Studies	51.1101
Speech-language Pathology And Audiology	51.0204	Pre-medicine Studies	51.1102
Sign Language Interpreter	51.0205	Pre-pharmacy Studies	51.1103
Communication Disorders Sci & Serv, Oth	51.0299	Pre-veterinary Studies	51.1104
Community Health Liaison	51.0301	Health & Med. Preparatory Programs, Oth	51.1199
Dentistry (d.d.s., D.m.d.)	51.0401	Medicine (m.d.)	51.1201

Appendix Table 14 continues next page

Appendix Table 14 *continued***Selected excluded CIP codes**

CIPs considered, but not included, in final list of science & engineering programs

CIP code title	CIP code	CIP code title	CIP code
Dental Clinical Sciences/graduate Dentis	51.0501	Medical Clinical Sciences (m.s., Ph.d.)	51.1401
Dental Assistant	51.0601	Alcohol/drug Abuse Counseling	51.1501
Dental Hygienist	51.0602	Psychiatric/mental Health Services Tech	51.1502
Dental Laboratory Technician	51.0603	Clinical And Medical Social Work	51.1503
Dental Services, Other	51.0699	Mental Health Services, Other	51.1599
Health System/health Services Admin.	51.0701	Nursing (r.n. Training)	51.1601
Hospital/health Facilities Admin.	51.0702	Nursing Administration (post-r.n.)	51.1602
Health Unit Coordinator/ward Clerk	51.0703	Nursing, Adult Health (post-r.n.)	51.1603
Health Unit Manager/ward Supervisor	51.0704	Nursing Anesthetist (post-r.n.)	51.1604
Medical Office Management	51.0705	Nursing, Family Practice (post-r.n.)	51.1605
Medical Records Administration	51.0706	Nursing, Maternal/child Health (post-r.	51.1606
Medical Records Tech./technician	51.0707	Nursing Midwifery (post-r.n.)	51.1607
Medical Transcription	51.0708	Nursing Science (post-r.n.)	51.1608
Health & Medical Admin. Services, Oth.	51.0799	Nursing, Pediatric (post-r.n.)	51.1609
Medical Assistant	51.0801	Nursing, Psych./mental Health (post-r.n	51.1610
Medical Laboratory Assistant	51.0802	Nursing, Public Health (post-r.n.)	51.1611
Occupational Therapy Assistant	51.0803	Nursing, Surgical (post-r.n.)	51.1612
Ophthalmic Medical Assistant	51.0804	Practical Nurse (l.p.n. Training)	51.1613
Pharmacy Technician/assistant	51.0805	Nurse Assistant/aide	51.1614
Physical Therapy Assistant	51.0806	Home Health Aide	51.1615
Physician Assistant	51.0807	Nursing, Other	51.1699
Veterinarian Assistant/animal Health Tec	51.0808	Optometry (o.d.)	51.1701
Health And Medical Assistants, Other	51.0899	Opticianry/dispensing Optician	51.1801
Cardiovascular Tech./technician	51.0901	Optical Technician/assistant	51.1802
Electrocardiograph Tech./technician	51.0902	Ophthalmic Medical Technologist	51.1803
Electroencephalograph Tech./technician	51.0903	Orthoptics	51.1804
Emergency Medical Tech./technician	51.0904	Ophthalmic/optometric Services, Other	51.1899
Nuclear Medical Tech./technician	51.0905	Osteopathic Medicine (d.o.)	51.1901
Perfusion Tech./technician	51.0906	Pharmacy (b. Pharm., Pharm.d.)	51.2001
Medical Radiologic Tech./technician	51.0907	Pharmacy Administration & Pharmaceutics	51.2002
Respiratory Therapy Technician	51.0908	Medical Pharmacology & Pharmaceutical Sci	51.2003
Surgical/operating Room Technician	51.0909	Pharmacy, Other	51.2099
Diagnostic Medical Sonography	51.0910	Podiatry (d.p.m., D.p., Pod.d.)	51.2101
Health & Med. Diagnostic & Treat Svc, Ot	51.0999	Public Health, General	51.2201
Blood Bank Tech./technician	51.1001	Environmental Health	51.2202
Cytotechnologist	51.1002	Epidemiology	51.2203
Hematology Tech./technician	51.1003	Health And Medical Biostatistics	51.2204
Health Physics/radiologic Health	51.2205	Franchise Operation	52.0702
Occupational Health & Industrial Hygiene	51.2206	Enterprise Management & Operation, Oth.	52.0799
Public Health Education And Promotion	51.2207	Finance, General	52.0801
Public Health, Other	51.2299	Actuarial Science	52.0802
Art Therapy	51.2301	Banking And Financial Support Services	52.0803
Dance Therapy	51.2302	Financial Planning	52.0804
Hypnotherapy	51.2303	Insurance And Risk Management	52.0805
Movement Therapy	51.2304	International Finance	52.0806
Music Therapy	51.2305	Investments And Securities	52.0807
Occupational Therapy	51.2306	Public Finance	52.0808
Orthotics/prosthetics	51.2307	Financial Management And Services, Other	52.0899
Physical Therapy	51.2308	Hospitality/administration Management	52.0901
Recreational Therapy	51.2309	Hotel/motel And Restaurant Management	52.0902
Vocational Rehabilitation Counseling	51.2310	Travel-tourism Management	52.0903
Rehabilitation/therapeutic Services, Oth	51.2399	Hospitality Services Management, Other	52.0999

Appendix Table 14 continues next page

Appendix Table 14 *continued*

Selected excluded CIP codes

CIPs considered, but not included, in final list of science & engineering programs

CIP code title	CIP code	CIP code title	CIP code
Veterinary Medicine (d.v.m.)	51.2401	Human Resources Management	52.1001
Veterinary Clinical Sciences (m.s., Ph.d.)	51.2501	Labor/personnel Relations And Studies	52.1002
Health Aide	51.2601	Organizational Behavior Studies	52.1003
Acupuncture And Oriental Medicine	51.2701	Human Resources Management, Other	52.1099
Medical Dietician	51.2702	International Business	52.1101
Medical Illustrating	51.2703	Mgmt. Info. Systems & Bus. Data Process	52.1201
Naturopathic Medicine	51.2704	Business Computer Programming/programmer	52.1202
Psychoanalysis	51.2705	Business Systems Analysis And Design	52.1203
Health Professions & Rel. Sciences, Oth	51.9999	Business Systems Networking And Telecomm	52.1204
Business, General	52.0101	Business Computer Facilities Operator	52.1205
Business Administration & Mgmt., Gen.	52.0201	Business Information And Data Processing	52.1299
Purchasing, Procurement & Contracts Mgmt	52.0202	Management Science	52.1301
Logistics And Materials Management	52.0203	Business Statistics	52.1302
Office Supervision And Management	52.0204	Bus. Quantitative Methods & Mgmt.,oth.	52.1399
Operations Management And Supervision	52.0205	Business Marketing/marketing Management	52.1401
Non-profit And Public Management	52.0206	Marketing Research	52.1402
Business Administration & Mgmt., Oth.	52.0299	International Business Marketing	52.1403
Accounting	52.0301	Marketing Management And Research, Other	52.1499
Accounting Technician	52.0302	Real Estate	52.1501
Accounting, Other	52.0399	Taxation	52.1601
Administrative Assistant/secretarial Sci	52.0401	Business Management & Admin. Serv., Oth	52.9999
Executive Assistant/secretary	52.0402		
Legal Administrative Assistant/secretary	52.0403		
Medical Administrative Asst./secretary	52.0404		
Court Reporter	52.0405		
Receptionist	52.0406		
Information Processing/data Entry Tech.	52.0407		
General Office/clerical & Typing Serv.	52.0408		
Administrative & Secretarial Serv., Oth	52.0499		
Business Communications	52.0501		
Business/managerial Economics	52.0601		
Enterprise Management & Operation, Gen.	52.0701		

Note: Specific codes were selected from the following major CIP categories: 01 (Agricultural business and production), 02 (Agricultural sciences), 03 (Conservation and renewable natural resources), 08 (Marketing operations, marketing and distribution), 09 (Communications), 10 (Communications technologies), 11 (Computer and information sciences), 12 (Personal and miscellaneous services), 14 (Engineering), 15 (Engineering-related technologies), 26 (Biological sciences/life sciences), 27 (Mathematics), 40 (Physical sciences), 41 (Science technologies), 47 (Mechanics and repairers), 48 (Precision production trades), 49 (transportation and materials moving workers), 51 (Health professions and related sciences), and 52 (business management and administrative services). See text discussion of criteria of selection within each category.