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# CENTERS·OF EXCELLENCE

## *Report to the Utah State Legislature*

1 November 1994

## UTAH CENTERS OF EXCELLENCE PROGRAM
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# UTAH CENTERS OF EXCELLENCE PROGRAM

## Report to the Legislature

## 1994

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# SUMMARY INFORMATION

# UTAH CENTERS OF EXCELLENCE PROGRAM

## Background

The Utah Centers of Excellence program was initiated in 1986 with the intent of encouraging the transfer of university based research and technology projects into the commercial sector. The economic impact of these technology transfers is measured in new companies created, companies assisted, jobs created (both in the centers and in the commercial sector), and license agreements signed. In addition, the proprietary value of technologies created is indicated by patents pending and issued. On-going funding of the program is based on the real economic impact which the Centers of Excellence program has had upon the State of Utah.

Upon approval, new centers are funded with a requirement for minimum 2:1 matching funds from the private and federal sectors. Matching funds are reported and audited on a regular basis. Centers are also audited regularly for the achievement of technical and commercial milestones. Centers directors are required to submit semi-annual reports to the centers program director. The Centers of Excellence Annual Report, here attached, is prepared based on submitted reports and upon information gathered in site visits, audits and other data sources.

Centers are normally expected to be self-sustaining through license contract royalties at the end of five years and are then graduated. Centers with especially noteworthy histories and on-going technological impact are designated as Distinguished Centers and thereafter may be funded on a project by project basis as requests are approved. Two distinguished centers, the Center for Advanced Combustion Engineering and Research (ACERC) and the Center for Supercritical Fluid Separations (CSFS) were funded in the 1994-95 period.

Since its inception, the program has created 51 Centers of Excellence, 7 of which have been designated as Distinguished Centers, 24 have been graduated, and 20 are active during this reporting period. This report summarizes centers status and achievements during 1994.

## 1994 Highlights

1. **STATISTICAL SUMMARY**

| | |
|---|---|
| State Funds Granted, 1994-95 | $1,939,927 |
| Matching Funds | $28,437,790 |
| 1994-95 Matching Fund Ratio | 1:14.7 |
| Cumulative State Funds | $21,868,868 |
| Cumulative Matching Funds | $264,271,992 |
| Cumulative Matching Fund Ratio | 1:12.1 |
| Total Centers Jobs Created | 965 |
| Total Industry Jobs Created | 921 |
| Total Companies Assisted | 368 |
| Patents Pending | 37 |
| Patents Issued | 76 |

2. **CENTER FOR CANCER GENETIC EPIDEMIOLOGY (CCGE)**
Established in 1991, CCGE is researching the genetic components of several common cancers including breast, melanoma and prostate through the mapping and isolation of suspected contributing genes. In the April edition of Science magazine, Myriad Genetics, a spin-off company of the center, announced the identification of a tumor suppressing gene known as p16 that is suspected to be involved in a wide variety of cancers. Significant research will still be required to determine the causative involvement of the gene but the discovery is of potentially great importance in the understanding of cancerous tumor growth. Myriad Genetics also occupied expanded facilities at the University of Utah Research Park in November of 1994.

3. **CENTER FOR SELF-ORGANIZING AND INTELLIGENT SYSTEMS (CSOIS)**
Established in 1993, CSOIS assists Utah companies in developing marketable products using intelligent systems concepts. Intelligent systems are defined as devices or software that attempt to artificially replicate the unique cognizance and control abilities of the human mind. These would include artificial neural networks, "fuzzy" logic circuits that emulate reasoning processes, and virtual environment simulators. The center completed design contracts on two major projects during 1994. The first, under contract with Campbell Scientific, is an intelligent controller for automated irrigation systems. The second, for ProForm Fitness Products includes intelligent controllers using fuzzy logic for application in treadmills and weight lifting machines.

(Highlights Continued...)

4. **CENTER FOR ADVANCED COMBUSTION ENGINEERING AND RESEARCH (ACERC)**
ACERC was established as a center in 1986 and designated as a Distinguished Center in 1991. The center investigates the clean and efficient use of low-grade fossil fuels found abundantly in Utah. The center has an international reputation in efficient combustion processes and computer simulations. The center has announced that one of its member companies, CoalPlex International in Las Vegas has acquired 1700 acres of waste mine dumpings (coal fines) near the Wellington coal mine. CoalPlex intends to construct a coal fines pelletizing facility and an electric power production plant using the pellets as fuel. The facility will generate about 200 short-term jobs during the construction phase and about 100 permanent jobs. Technologies in both the coal fines pellets and the fuel burning processes have been developed at ACERC in cooperation with CoalPlex.

5. **CENTER FOR RAPID PRODUCT REALIZATION (CRPR)**
The Center for Rapid Product Realization was created this year to provide design, prototyping, and manufacturing process assistance to young and emerging companies in the state. Since its inception this year, 130 inquiries for center services have been received, 60 of these resulted in formal requests for service, and 10 projects are currently under contract. This response was significantly higher that was anticipated and the center is establishing review and approval procedures to streamline the process.

6. **COMMERCIALIZATION CONSULTING PROGRAM**
During 1994, the Centers of Excellence program initiated a commercialization consulting program through the Utah Small Business Development Center to assist centers in the creation of commercialization milestones. The program, which has since been expanded to include the development of commercialization strategies, has resulted in the identification of several significant new market opportunities for centers technologies and the development of a least one strategic plan for the creation of a major new Utah based business. Although these activities are still in the formative stage, it is clear that the assistance provided by consultants with strong business and entrepreneurial experience can significantly enhance the commercialization of centers products and technologies. The program will be expanded during 1995 with a small portion of each centers funding identified to execute the program. It is anticipated that as this initiative gains momentum it will have significant impact on the success of the centers program.

# New Companies

Created in 1994

**Center for Advanced Composites** (BYU)

| | |
|---|---|
| Fiber Dynamics | 5217 S. 300 W., SLC 263-1718, Wayne Johnson |
| Potter Mgmt. | (startup) Thomas Potter, 855 E. 700 No. Provo, 84606, 374-8301 |
| Sound Composites | (startup) 1280 No. Forbes Parkway St. C, SLC UT 84116, 595-0400, Kenneth MacInnes |

**Center for Chemical Technology** (WSU)

| | |
|---|---|
| Linco Industries | P O Box 1591, Ogden UT 84402, 394-9488, Darrell Saunders |
| ZymeQuest, Inc. | 300 Park Ave, Suite 1714, New York NY 10022, 801-626-7638, Ron Torres, Sr. Chemist |

**Center for Self Organizing Intelligent Systems** (USU)

| | |
|---|---|
| Monetary Svs.Inc. | 250 E. 100 N., Smithfield, Ut 84335, 563-5739, V. Gordon Lind (7) |

**Center for MultiMedia Education and Technology/UVSC**

Cela Solutions Inc.
$MC^2$
Memory Lane Productions

**Center for Rapid Product Realization** (BYU)

| | |
|---|---|
| Accuserve | (startup) 30 N. Redwood Rd. Bldg H. No SL 84054 298-9161 Mont Bigler |
| GWH | (startup) 375-5615, Wm Bolick, 3359 N. Cherokee Lane, Provo, Ut. 84604 |

**3D Computer Graphics** (Dixie)

| | |
|---|---|
| InfoWest | 1845 W. Sunset, St. George, Ut 674-5638 |

CENTERS OF EXCELLENCE - FINANCIAL SUMMARY - NOVEMBER 1993 THROUGH OCTOBER 1994

| Center of Excellence | 1994-1995 Contract | Cum. State Investment | 1994 Cash Match | 1994 In-Kind Match | 1994 Total Match | Cumulative Cash Match | Cumulative In-Kind Match | Cumulative Total Match |
|---|---|---|---|---|---|---|---|---|
| ACTIVE CENTERS: | | | | | | | | |
| Advanced Composites Manufacturing | $150,000 | $465,000 | $636,600 | $165,882 | $802,482 | $847,100 | $3,635,050 | $4,482,150 |
| Advanced Construction Materials | $0 | $100,000 | $86,000 | $10,000 | $96,000 | $86,000 | $10,000 | $96,000 |
| Aerospace Science Technology | $91,000 | $387,600 | $49,493 | $196,595 | $246,088 | $660,501 | $2,475,747 | $3,136,248 |
| Cancer Genetic Epidemiology | $20,000 | $279,323 | $4,952,618 | $0 | $4,952,618 | $17,711,601 | $0 | $17,711,601 |
| Chemical Technology | $115,500 | $389,500 | $247,591 | $8,734 | $256,325 | $1,481,539 | $108,511 | $1,590,050 |
| Computer Graphics and Scientific Visualization | $100,000 | $300,000 | $1,566,000 | $260,000 | $1,826,000 | $4,409,000 | $1,240,256 | $5,649,256 |
| Dairy Foods Technology | $59,227 | $348,737 | $555,000 | $0 | $555,000 | $2,308,000 | $5,000 | $2,313,000 |
| Design of Molecular Function - Biocatalysis | $0 | $820,200 | $688,745 | $0 | $688,745 | $2,867,825 | $637,705 | $3,505,530 |
| Design of Molecular Function - Environmental | $0 | $100,000 | $559,000 | $11,000 | $570,000 | $1,083,745 | $74,000 | $1,157,745 |
| Developmental and Molecular Biology | $107,480 | $210,880 | $244,162 | $0 | $244,162 | $366,240 | $0 | $366,240 |
| Environmental Technologies | $100,000 | $220,000 | $623,486 | $10,000 | $633,486 | $623,486 | $10,000 | $633,486 |
| Genetic Improvement of Livestock | $98,500 | $197,000 | $149,500 | $0 | $149,500 | $347,500 | $0 | $347,500 |
| Meat Processing Technology | $203,220 | $472,860 | $103,000 | $0 | $103,000 | $432,840 | $0 | $432,840 |
| Multi-Media Education and Technology - U/U | $125,000 | $237,500 | $94,750 | $326,000 | $420,750 | $94,750 | $326,000 | $420,750 |
| Multi-Media Education and Technology - UVSC | $100,000 | $212,500 | $30,179 | $473,692 | $503,871 | $30,179 | $473,692 | $503,871 |
| Rapid Product Realization | $200,000 | $200,000 | $125,000 | $278,000 | $403,000 | $125,000 | $278,000 | $403,000 |
| Self-Organizing and Intelligent Systems | $150,000 | $250,000 | $412,904 | $132,000 | $544,904 | $691,904 | $132,000 | $823,904 |
| Software Science | $0 | $370,938 | $10,500 | $0 | $10,500 | $3,747,089 | $2,598,304 | $6,345,393 |
| Value-Added Seed Technology | $70,000 | $210,000 | $329,788 | $0 | $329,788 | $613,454 | $0 | $613,454 |
| 3-D Computer Graphics | $50,000 | $150,000 | $125,000 | $0 | $125,000 | $192,000 | $279,431 | $471,431 |
| DISTINGUSHED CENTERS: | | | | | | | | |
| Advanced Combustion Engineering Research | $100,000 | $700,000 | $9,975,821 | $0 | $9,975,821 | $55,267,444 | $4,933,423 | $60,200,867 |
| Artificial Heart | $0 | $475,000 | $0 | $0 | $0 | $10,755,877 | $0 | $10,755,877 |
| Biopolymers at Interfaces | $0 | $670,000 | $1,750,588 | $0 | $1,750,588 | $8,235,231 | $301,500 | $8,536,731 |
| Controlled Chemical Delivery | $0 | $646,000 | $785,609 | $0 | $785,609 | $12,126,754 | $0 | $12,126,754 |
| Engineering Design | $0 | $893,000 | $2,352,121 | $0 | $2,352,121 | $24,165,113 | $0 | $24,165,113 |
| Space Engineering | $0 | $1,530,000 | $0 | $0 | $0 | $7,857,408 | $0 | $7,857,408 |
| Supercritical Fluid | $100,000 | $576,400 | $112,432 | $0 | $112,432 | $3,441,526 | $0 | $3,441,526 |
| TOTALS: | $1,939,927 | $11,412,438 | $26,565,887 | $1,871,903 | $28,437,790 | $160,569,106 | $17,518,619 | $178,087,725 |

372,860

CENTERS OF EXCELLENCE - STATE IMPACT SUMMARY - NOVEMBER 1993 THROUGH OCTOBER 1994

| Center of Excellence | Center Jobs | Average Salary | Industry Jobs | Average Salary | New Spin-Off Companies | Cum. Spin-Off Companies | Companies Assisted | Patents Pending | Patents Issued | License Agreements |
|---|---|---|---|---|---|---|---|---|---|---|
| ACTIVE CENTERS: | | | | | | | | | | |
| Advanced Composites Manufacturing | 27 | $20,444 | 3 | $26,667 | 3 | 44 | 22 | 5 | 3 | 2 |
| Advanced Construction Materials | 7 | $40,400 | 0 | $0 | 0 | 0 | 3 | 1 | 0 | 0 |
| Aerospace Science Technology | 9 | $14,555 | 2 | $45,000 | 0 | 1 | 2 | 1 | 0 | 0 |
| Cancer Genetic Epidemiology | 35 | $29,633 | 50 | $35,200 | 0 | 1 | 1 | 2 | 1 | 1 |
| Chemical Technology | 10 | $27,050 | 22 | $30,000 | 2 | 2 | 20 | 3 | 4 | 3 |
| Computer Graphics and Scientific Visualization | 22 | $36,909 | 6 | $45,000 | 0 | 1 | 2 | 0 | 0 | 1 |
| Dairy Foods Technology | 7 | $29,429 | 4 | $21,000 | 0 | 2 | 4 | 0 | 1 | 0 |
| Design of Molecular Function - Biocatalysis | 22 | $15,727 | 6 | n/a | 0 | 2 | 3 | 8 | 0 | 1 |
| Design of Molecular Function - Environmental | 11 | $34,091 | 1 | n/a | 0 | 0 | 1 | 1 | 0 | 1 |
| Developmental and Molecular Biology | 13 | $29,000 | 0 | $0 | 0 | 0 | 1 | 1 | 0 | 0 |
| Environmental Technologies | 8.5 | $41,418 | 6 | $78,833 | 0 | 0 | 18 | 0 | 0 | 2 |
| Genetic Improvement of Livestock | 9 | $21,778 | 0 | $0 | 0 | 0 | 4 | 1 | 0 | 1 |
| Meat Processing Technology | 12 | $11,500 | 25 | $19,471 | 0 | 3 | 8 | 1 | 2 | 3 |
| Multi-Media Education and Technology - U/U | 12 | $38,750 | 0 | $0 | 0 | 0 | 9 | 1 | 0 | 0 |
| Multi-Media Education and Technology - UVSC | 2 | $29,000 | 8 | $25,817 | 3 | 3 | 13 | 0 | 0 | 6 |
| Rapid Product Realization | 12 | $25,200 | 8 | $35,000 | 2 | 2 | 10 | 4 | 0 | 3 |
| Self-Organizing and Intelligent Systems | 14 | $29,753 | 0 | $0 | 1 | 1 | 4 | 2 | 0 | 2 |
| Software Science | 20 | $54,100 | 0 | $0 | 0 | 1 | 1 | 0 | 0 | 1 |
| Value-Added Seed Technology | 13.3 | $35,034 | 0 | $0 | 0 | 0 | 9 | 1 | 0 | 0 |
| 3-D Software | 8 | $23,125 | 4 | $20,667 | 1 | 2 | 8 | 0 | 0 | 5 |
| DISTINGUSHED CENTERS: | | | | | | | | | | |
| Advanced Combustion Engineering Research | 163 | $25,509 | 12 | $65,000 | 0 | 3 | 163 | 0 | 2 | 55 |
| Artificial Heart | 8 | $30,323 | 0 | $0 | 0 | 0 | 0 | 0 | 2 | 3 |
| Biopolymers at Interfaces | 40 | $13,106 | 10 | n/a | 0 | 2 | 6 | 2 | 11 | 8 |
| Controlled Chemical Delivery | 45 | $22,880 | 118 | $25,000 | 0 | 2 | 4 | 0 | 2 | 4 |
| Engineering Design | 32.5 | $38,308 | 61 | $46,275 | 0 | 4 | 5 | 3 | 5 | 2 |
| Space Engineering | 8 | $33,000 | 265 | n/a | 0 | 6 | 2 | 0 | 1 | 7 |
| Supercritical Fluid | 17 | $25,823 | 21 | $43,333 | 0 | 2 | 2 | 0 | 9 | 3 |
| TOTALS: | 587.3 | $27,163 | 632 | $33,527 | 12 | 84 | 305 | 37 | 43 | 114 |

CENTERS OF EXCELLENCE - GRADUATED CENTERS SUMMARY - NOVEMBER 1993 THROUGH OCTOBER 1994

| Center of Excellence | Cum. State Investment | Total Matching Dollars | Center Jobs | Average Salary | Industry Jobs | Average Salary | Spin-Off Companies | Companies Assisted | Patents Issued | License Agreements |
|---|---|---|---|---|---|---|---|---|---|---|
| GRADUATED CENTERS: | | | | | | | | | | |
| Base Tech Education | $112,000 | $546,415 | 8 | n/a | 5 | n/a | 2 | n/a | n/a | n/a |
| Biotechnology | $950,000 | $5,153,648 | n/a | n/a | n/a | n/a | 1 | n/a | n/a | n/a |
| CA2EDM | $200,000 | $369,029 | 41 | $45,000 | 0 | 0 | 0 | 10 | 0 | 1 |
| CAD/CAM | $423,123 | $7,905,917 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| CIM/CAM | $222,119 | $871,150 | n/a | n/a | 38 | n/a | 7 | n/a | n/a | n/a |
| CINR | $100,000 | $658,707 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Chemical Separations | $797,436 | $1,678,360 | 16 | $7,831 | 25 | $25,800 | 1 | 9 | 9 | 1 |
| Coal | $655,000 | $2,713,337 | 10 | $16,000 | 16 | n/a | 2 | 3 | 9 | 4 |
| Comms. Research | $215,120 | $2,127,476 | 13 | n/a | 7 | n/a | 0 | 1 | 4 | 1 |
| Computer Based Ed. | $510,000 | $676,997 | 8 | $15,340 | 21 | $20,426 | 1 | 1 | 0 | 0 |
| Energy Solids Interaction | $150,000 | $1,345,632 | 24 | $34,750 | 0 | $0 | 0 | 0 | 0 | 0 |
| Information Technology | $436,325 | $6,003,254 | 52 | $26,333 | 28 | $35,333 | 1 | 4 | 0 | 2 |
| Laser Institute | $676,000 | $7,302,000 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Materials | $999,780 | $13,536,985 | 9 | $45,444 | 45 | $63,222 | 0 | 9 | 1 | 0 |
| Pyrometallurgical | $100,640 | $286,790 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Qual. & Integrity Design | $260,000 | $547,650 | 16 | $14,250 | 8 | $10,750 | 2 | 2 | 0 | 2 |
| Sensor Technology | $85,000 | $170,567 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Signal Processing | $776,334 | $3,507,434 | 14 | n/a | 41 | n/a | 3 | 4 | 1 | 7 |
| Solid Waste Recycling | $70,000 | $400,000 | 5 | $24,400 | 2 | n/a | 1 | 0 | 0 | 0 |
| Supercomputer | $925,000 | $21,600,000 | 17 | $34,882 | n/a | n/a | 0 | 9 | 0 | 1 |
| Tomography | $267,400 | $1,902,307 | 20 | $27,750 | 12 | $50,500 | 2 | 7 | 5 | 4 |
| Utah Research Institute | $740,000 | $5,743,980 | 87 | $27,244 | n/a | n/a | 0 | 0 | 0 | 0 |
| VLSI Design | $225,153 | $819,000 | 18 | $31,277 | 5 | $27,659 | 1 | 4 | 0 | 1 |
| X-Ray Imaging | $560,000 | $317,632 | 20 | $55,500 | 36 | $34,917 | 1 | 0 | 4 | 1 |
| TOTALS: | $10,456,430 | $86,184,267 | 378 | $30,340 | 289 | $32,090 | 25 | 63 | 33 | 25 |

# Utah Centers of Excellence Program

Spin-Off Companies 1986-1994
Total: 108 Companies

| Active Centers | Spin-Off Companies |
|---|---|
| Advanced Composites (BYU)<br>Dir. Brent Strong 378-7878 | ACI Technology<br>Advanced Laminate<br>American Polymer<br>American Vitrolite<br>Ashton Aerospace<br>Automated Process Control<br>B&M Enterprises<br>Baal<br>Beckwith Technology Group<br>Behavioral Technology Inc.<br>Blue Cow, Inc.<br>Claytech<br>Controlled Composite Tech.<br>Creative Composites<br>Curecrete<br>DAH, Inc.<br>Dimensional Research<br>DMS<br>Emily Rose<br>Fiber Dynamics*<br>Futura Propulsion Systems<br>H K Corporation<br>Haelan Medical<br>Ideas to Products<br>International Biokenetics<br>LCC Fabrications<br>Medilight<br>Merrell Enterprises<br>Mountain High Engineering<br>Mountain Land Support<br>Performance Composites<br>Potter Management*<br>ProDesign<br>Red Hawk, Inc.<br>Ridgeway and Fautz<br>Rocky Mountain Engineering<br>Rotomolding of Utah<br>Sound Composites*<br>Strauss, Kerry |
| (continued) Advanced Composites (BYU) | Synergy Marketing<br>Utah Rocketry<br>Van Patten Corporation<br>Wasatch Engineering<br>Wasatch Technology Group |
| Aerospace (WSU)<br>Dir. Kermit Reister 626-6302 | Wasatch Aerospace |
| Cancer Genetics (U/U)<br>Dir. Mark Skolnick 581-5070 | Myriad Genetics |
| Chemical Technology (WSU)<br>Dir. Edward Walker 626-6162 | Linco Industries*<br>ZymeQuest, Inc.* |
| Graphics & Scientific Vis. (U/U)<br>Dir. Cohen/Riesenfeld 581-7026 | Engineering Geometry Systems |
| Dairy Foods (USU)<br>Dir. Paul Savello 797-3618 | Food Research & Dev. Group<br>Dairy Res. Consulting of Utah |
| Intelligent Systems (USU)<br>Dir. Robert Gunderson 797-2924 | Monetary Services Inc.* |
| Meat Processing (USU)<br>Dir. Von Mendenhall 797-3463 | Mountain Land Co-op<br>Timpanogos Meats<br>Canyon Rayas |
| Molecular Function (Biocatalysis) (USU)<br>Dir. Linda Powers 797-2033 | Whetstone<br>Envirol, Inc. |
| MultiMedia Ed & Tech (UVSC)<br>Dir. Gary Phelps 222-8000x594 | Cela Solutions, Inc.*<br>$MC^{2}$*<br>Memory Lane Productions* |
| Rapid Product Realization (BYU)<br>Dir. David Sorenson 378-9000 | Accuserve*<br>GWH* |
| Software Science (U/U)<br>Dir. Robert Kessler 581-4653 | Hippo Software Inc. |
| 3-D Software (Dixie)<br>Dir. Eric Pedersen 673-4811 | Illustrative Impressions<br>InfoWest* |

***NEW THIS YEAR**

| Distinguished Centers | Spin-Off Companies |
|---|---|
| Advanced Combustion Research (BYU)<br>Dir. Douglas Smoot 378-4326 | Reaction Engineering Intntl<br>GMH Engineering<br>Combustion Services Inc. |
| Biopolymers (U/U)<br>Dir. Karin Caldwell 581-5455 | Protein Solutions |
| Controlled Chemical Delivery (U/U)<br>Dir. Sung Wan Kim 581-6801 | Insutech<br>TheraTech, Inc. |
| Engineering Design (U/U)<br>Dir. Stephen Jacobsen 581-6499 | Animate Systems, Inc.<br>Sarcos Research Corp.<br>Sarcos, Inc.<br>MicroJect, Inc. |
| Space Engineering (USU)<br>Dir. Frank Redd 750-2905 | Space Dynamics Lab<br>ICOMP<br>Globesat Holding Company<br>Medcom, Inc.<br>CXT, Inc.<br>Interactive Resources |
| Supercritical Fluid (BYU)<br>Dir. Milton Lee 378-2135 | Lee Scientific<br>Sensar Corporation |

Note: These companies have been reported by Center Directors as having spun out of their centers. The Office of Technology Development is aware of the viability of many of these companies and their relationship to the centers. If a center has been discontinued, the viability of the company reported is uncertain.

| Graduated or Discontinued Centers | Spin-Off Companies |
|---|---|
| Base Technical Education (U/U)<br>Dir. Carol Weller 581-3189 | Assessment Co.<br>Software Co. |
| Biotechnology (USU)<br>Dir. Steven Aust 797-2730 | Intech 180 Corp. |
| Chemical Separations (BYU)<br>Dir. Reid Izatt 378-2315 | IBC Advanced Technologies |
| Coal Research (U/U)<br>Dir. Larry Anderson 581-7187 | FemtoScan Corp<br>International Resin Resources |
| Computer Based Education (BYU)<br>Dir. Jerry Larson 378-2349 | CALI, Inc. |
| Computer Integrated Manufacturing (BYU)<br>Dir. Dell Allen 378-3895 | Edge Foundation<br>Edge Inc.<br>Ozone Saver Industries<br>CAM Software<br>CIM Training Ctr.<br>Smartware<br>Utah Pods Mfg. Co-op |
| Information Technology (Handicapped) (USU)<br>Dir. Allen Hofmeister 797-3718 | Effective Instructional Tech. |
| Quality & Integrity Design (U/U)<br>Dir. David Hoeppner 581-3851 | Technology Mgt. Associates<br>FASIDE International, Inc. |
| Signal Processing (BYU)<br>Dir. Richard Christiansen 378-6587 | ASTECH, Inc.<br>Deseret Digital Systems<br>Vector Technologies |
| Solid Waste (USU)<br>Dir. Reed Nielsen 797-1795 | Recycling Tech. Corporation |
| Tomography (U/U)<br>Dir. Steven Johnson 581-7399 | Monolithic Technologies<br>TechniScan, Inc. |
| VLSI Design (U/U)<br>Dir. Kent Smith 581-8653 | Bonneville Microelectronics |
| X-Ray Imaging (BYU)<br>Dir. Larry Knight 378-2186 | MOXTEK |

# ACTIVE CENTERS

# Center for Advanced Composites Manufacturing and Engineering

*Dr. A. Brent Strong/Brigham Young University/Provo, Utah*

*Established July 1990 as the focal point and coordinator of resources within the state for technical knowledge and capability in the areas of composite materials, plastics, and other advanced materials. ACME assists existing local industry and start-up companies who are working with plastics and advanced materials. ACME also conceives, invents, develops, and spins off into commercial enterprises new or enhanced products in the field of composites, plastics, and advanced materials.*

## Overview

| | |
|---|---|
| 1994-95 State Contract | $150,000 |
| Matching Funds | $802,482 |
| Cumulative | 4,482,150 |
| Center Related Jobs | 27 |
| Industry Jobs Created | 3 |
| Benefiting Utah Companies: | |
| 1994 Center Spin-offs | 7 |
| Cumulative Spin-offs | 44 |
| Patents Applied | 3 |
| Patents Issued | 3 |
| License Agreements | 2 |

## Technologies

- **Cure and contamination** sensing devices which allow low cost detection of the physical or chemical changes in many non-conducting fluids such as resins, oils, transformer fluids, etc.
- **Damping of composites** through unique orientation of fibers results in as much as 10 times the normal damping capabilities.
- **Improvement of fiber binding** on thermoplastic companies.
- **A forming technique** for large thermoplastic composites.

## Status

- **129 companies assisted** in 4 years (9 new in last 6 mo).
- **44 companies launched** (2 in last 6 mo).
- **7 companies spun off** with center technologies.
- **5 US patent applications** (3 granted).
- **2 licensed products**
- **4 patent cases** successfully defended for local companies.

## Economic Impact

- **The Center** has assisted in the launch of 44 companies. These are new companies that are based on technology developed outside the center but where the center's assistance has been critical to the start of the company.
- **Two of these launched** companies have agreed to give the center some share of profits in recognition of the assistance which has been rendered.

# Center for Advanced Construction Materials

*Dr.Hosin Lee/University of Utah/Salt Lake City, Utah*

*Established in April 1994 to produce marketable products while advancing the science of construction materials. The emphasis will be on both increased performance and use of waste materials, and to provide expertise and assistance to private and public sector partners.*

## Overview

| | |
|---|---|
| 1994-95 State Contract | $0 |
| Matching Funds | $96,000 |
| Cumulative | $96,000 |
| Center Related Jobs | 7 |
| Industry Jobs Created | 0 |
| Benefiting Utah Companies: | |
| 1994 Spin-off Companies | 0 |
| Cum. Spin-off Companies | 0 |
| Patents Applied | 1 |
| Patents Issued | 0 |
| License Agreements | 0 |

## Technologies

•**The Center has developed** a proprietary process for mixing high levels of recycled tire rubber, up to 30% of aggregates by volume, with magnesium oxychloride to produce a superior grade of paving material, and to meet federal regulatory requirements on the use of recycled materials. A patent disclosure has been filed on this process.

• **The Center has also developed** a proprietary system to cryogenically process the tires down to 100 mesh size. A patent disclosure has been filed.

• **Also investigating the use** of other recycled materials in concrete, as well as other advanced construction materials with applications in both highway and building construction.

## Status

•**The Center has recruited** additional team members and purchased necessary equipment.

•**The Center secured** the matching funds from both private sector industrial partners and public sector partners.

•**A spin-off company** which is in the process of being created, "Green Hill Recycling" will produce crumb rubber in various sizes adopting our technology.

•**The center has set up** an operation to produce a new deicing material called "Ammonium Carbamate" for Mr. Charles Hansen who plans to build a plant to produce deicing materials if field tests show positive results this winter.

•**Center is in the process** of receiving funds from a major Korean construction company called "Kumho" to use the center's tire concrete technology in constructing apartments in Korea.

•**Another company called "Meandr Enterprises"** is also interested in applying the center's Magstone/polystyrene technology in building 15,000 low-income houses in Philippines.

## Economic Impact

•**The center hired** three half-time research associates and a part-time administrative assistant. The center hired two graduate students and four undergraduate students in Civil Engineering department.

•**A spin-off company "Green Hill Recycling"** is being created to process the recycled tires.

# Center for Aerospace Science Technology

*Dr. Kermit Reister/Weber State University/Ogden, Utah*

*Established as a center in 1988. Center focus is on development of small low earth orbiting satellites and other related aerospace technologies.*

## Overview

| | |
|---|---|
| 1994-95 State Contract | $91,000 |
| Matching Funds | $246,088 |
| Cumulative | $3,136,248 |
| Center Related Jobs | 9 |
| Industry Jobs Created | 2 |
| Benefiting Utah Companies: | |
| 1994 Spin-off Companies | 0 |
| Cum. Spinoff companies | 1 |
| Moved to Utah | 1 |
| Patents Applied | 1 |
| Patents Issued | 0 |
| License Agreements | 0 |

## Technologies

- **Has developed and flown** two satellites, NUSAT I and WEBERSAT, receiving world-wide recognition as a leader in the field of small and inexpensive low earth satellite development.
- **Mechanical spaceframe and equipment bus**; position and attitude control with 3 axis stabilization; communication links from space to ground control; power systems with articulating solar panels; central processing unit for data storage and processing.
- **Instrumental in** the establishment of Intraspace Corporation.
- **Successful spin-off** of Wasatch Aerospace Corporation.

## Status

- **CAST is continuing** with the development of more sophisticated small satellite technology through JAWSAT.
- **Phase I** - WSU and CAST are in the first phase of the development of an entity to commercialize CAST's technologies and expertise in producing and managing the launch of small, standardized commercial satellites at a price that will open the market to additional clients.
- **Phase II** - initial commercial development.
- ***Phase III*** - *full* commercialization.
- **Working with SBDC** consultant to establish commercialization plan.

## Economic Impact

**The new company:**

- **will be housed** in northern Utah
- **will develop** key partnerships with Thiokol Corp, Lockheed Corp. and Hill Air Force Base.
- **will contract** with CAST for continuing development of technology, thereby ensuring that CAST has a steady stream of revenue to support its applied research.
- **The potential for economic impact for the state is significant.**

# Center for Cancer Genetic Epidemiology

*Dr. Mark H. Skolnick/University of Utah/SLC, Utah*

*Established as a center in 1991 to utilize multiple approaches to study the genetic etiology of common cancers and their precursor lesions, currently breast cancer, melanoma, and prostate cancer and develop DNA diagnostics. Focus is on developing approaches to gene mapping and gene isolation and applying them in particular to the common cancers.*

## Overview

| | |
|---|---|
| 1994-95 State Contract | $20,000 |
| Matching Funds | $4,952,618 |
| Cumulative | $17,711,601 |
| Center Related Jobs | 35 |
| Industry Jobs Created | 50 |
| Benefiting Utah Companies: | |
| 1994 Spin-off Companies | 0 |
| Cum. Spin-off Companies | 1 |
| Patents Applied | 2 |
| Patents Issued | 1 |
| License Agreements | 1 |

## Technologies

- Genetic Analysis
- Gene Localization
- Gene Discovery
- Gene Diagnostics
- Gene Therapies

## Status

- Center has cloned the 17q linked breast cancer gene and the 9:- linked melanoma gene.
- Pursuing gene isolation of a second beast cancer suscept gene.
- Gathering more cancer families and preparing for linkage studies of breast, colon and prostate cancers.
- Status of Center towards becoming self-sustaining is nearly complete.

## Economic Impact

- Commercial partner, Myriad Genetics, Inc.'s economic impact on the State of Utah is the expenditure of approximately $4,000,000 this year. They have 50 employees including 9 Ph.D's.

- Myriad Genetics announced the identification of a tumor suppressing gene known as p16 that is suspected to be involved in a wide variety of cancers. Significant research will still be required to determine the causative involvement of the gene but the discovery is of potentially great importance in the understanding of cancerous tumor growth.

# Center for Chemical Technology

*Edward B. Walker/Weber State University/Ogden, Utah*

*Established as a center in 1990. The Center functions as an innovative resource to the community by conducting applied research in a variety of chemically-related areas leading directly to new and/or enhanced products. The Center facilitates the collaboration of Utah companies with diversified chemical interests to form alliances that benefit both them and the State of Utah.*

## Overview

| | |
|---|---|
| 1994-95 State Contract | $115,500 |
| Matching Funds | $256,325 |
| Cumulative | $1,590,050 |
| Center Related Jobs | 10 |
| Industry Jobs Created | 22 |
| Benefiting Utah Companies: | |
| 1994 Spinoff Companies | 2 |
| Cum. Spin-off companies | 2 |
| Patents Applied | 3 |
| Patents Issued | 4 |
| License Agreements | 3 |

## Technologies

- **Natural product chemistries**
- **Heavy oil separation and recovery**
- **Bioremediation and chemical characterization of various remediation technologies**

## Status

- **Four approved** patents and three patents pending
- **Working closely** with SBDC in the establishment of business plan that will enable Center to become self-sufficient in time. Broad diversity among industrial partners insures a more flexible financial support base. This fact, coupled with continued success in research and development helps provide a service-oriented source of income from the business community.
- **New partnerships** have been formed with Great Basin Lab, Linco Inc., Surgical Technologies, and Asbury Fluxmaster.
- **Working with SBDC** consultant to establish commercialization plan.

## Economic Impact

- **A pilot-scale facility** was constructed near Vernal, Utah this summer utilizing technologies patented through Center research efforts.
- **Eastman Chemical** sent two full-time engineers to Ogden to work with us in developing a pilot-scale B-carotene harvesting facility on the Lake.
- **ZymeQuest**-sponsored research involving the conversion of type-B blood to "universal donor" type-O blood has received notoriety in our local newspaper and spawned interest of local medical facility at HAFB.
- **Swapco** and its Texas partners conducted a full-scale extraction test at Asphalt Ridge (near Vernal) using the equipment that will eventually be used in the full-scale plant. These tests were successful in validating the economic feasibility of the extraction process and Swapco has committed to build a 3,000 barrel-a-day plant at Asphalt Ridge.

# Center for Computer Graphics and Scientific Visualization

*Richard Riesenfeld/Elaine Cohen/University of Utah/Salt Lake City, Utah*

*Established in 1991 to effect commercialization of Center technology that has been created under other research funding by 1) Evaluating which subsets of Center technology are sufficiently mature to consider for commercialization, 2) Creating product prototypes in order to have sufficient product to develop strategic partners and seek further investment, 3) Seek strategic partners for full commercial development.*

## Overview

| | |
|---|---|
| 1994-95 State Contract | $100,000 |
| Matching Funds | $1,826,000 |
| Cumulative | $5,649,256 |
| Center Related Jobs | 22 |
| Industry Jobs Created | 6 |
| Benefiting Utah Companies: | |
| 1994 Spin-off companies | 0 |
| Cum. Spin-off companies | 1 |
| Patents Applied | 0 |
| Patents Issued | 0 |
| License Agreements | 1 |

## Technologies

•**Computer Design, Modeling, Graphics, and Manufacturing** technology for automating the whole "art-to-part" process; scalable from a small job shop to a large advanced industrial shop, national televideo infrastruction and learning via national information highway.

## Status

•**Briefed Gov.Leavitt** on various leading edge interactive televideo education methods.
•**Briefed a committee of legislative** candidates on the same technology.
•**Further refined** product specifications and development milestones.
•**Created special software** experiment for potential strategic partner.
•**Attended trade shows** to assess competition for further update on relative status.
•**Met with potential strategic partners** at trade show and made product presentation.
•**Hosted potential strategic partner visit** here in Salt Lake and demonstrated prototype.
•**Met product development milestones** for this period.
•**Working with SBDC** consultant to establish commercialization plan.

## Economic Impact

•**The associated spinoff** company, Engineering Geometry Systems, created and delivered a custom product to Hill Air Force Base to increase their manufacturing productivity. The product is being used on the shop floor currently. Center technology served as base for this customized product.
•**Working with consultants,** our design for mfg. technology is being applied to develop a new drill bit. Success will help keep company in Utah and enhance business by 5-10 M/year.

# Center for Dairy Foods Technology

*Paul A. Savello/Utah State University/Logan, Utah*

*Established in 1990. Supports continued research and development in the newest technologies of the dairy product/process arena.*

## Overview

| | |
|---|---|
| 1994-95 State Contract | $59,227 |
| Matching Funds | $555,000 |
| Cumulative | $2,313,000 |
| Center Related Jobs | 7 |
| Industry Jobs Created | 4 |
| Benefiting Utah Companies: | |
| 1994 Spin-off companies | 0 |
| Cum. Spinoff companies | 2 |
| Patents Applied | 0 |
| Patents Issued | 1 |
| License Agreements | 0 |

## Technologies

•**The Center investigates** methods to fractionate/concentrate milk components in non-degradative ways. The best technology to do this is the use of specialized membranes such that proteins, carbohydrates, and salts of milk can be separated to find unique properties and applications.

•**Aseptic processing** of milk and dairy foods results in shelf stable, non-refrigerated foodstuffs that have minimum flavor change, retain nutrient makeup, and permit transportation/distribution/storage without refrigeration.

## Status

•**Center has** had numerous and significant contacts with food companies. These companies have used equipment and expertise in the CDFT. This extension role of the CDFT is important because food companies that conduct research at the Center's pilot plant have successfully transferred technology to a Utah firm that contract-packs milk products for export to Mexico, Puerto Rico, Europe.

•**During this present year**, a patent of "Creamier skim milk" has been issued.

•**The Center continues discussion** with Millard County officials and investors to begin small scale production of concentrated, sterile milk using the reverse osmosis membrane and ultra-high temperature processing technologies. This linkage of technologies was researched and perfected at the CDFT.

## Economic Impact

•**Gossner Foods, Inc.** has benefited from the work at the CDFT through the Center's working with national food companies, which use the Center's facilities to research and develop formulations that are contract-packed by Gossner Foods, Inc.

•**Heart-to-Heart Foods,** Inc. has used much of the membrane equipment at the CDFT in order to research and develop new cream cheese products. These cream cheese products are now produced in the Richmond plant and sold throughout Utah.

# Center for the Design of Molecular Function

## Biocatalysis

*Linda Powers/Utah State University/Logan, Utah*

*Established in 1988. With funding of approximately $1.8 M from the NIH Biomedical Research Technology Program, the Center for Biocatalysis Science and Technology has expanded to become the National Center for the Design of Molecular Function. The goals are to 1) establish the underlying bases for the design of molecular function which includes the development of real-time time-resolved spectroscopic technology; 2) apply this basic knowledge and technology to biomedical and environmental applications and monitoring; and 3) provide this information and specialized tools of its utilization to the scientific and engineering community.*

### Overview

| | |
|---|---|
| 1994-95 State Contract | 0 |
| Matching Funds | $688,745 |
| Cumulative | $3,505,530 |
| Center Related Jobs | 22 |
| Industry Jobs Created | 6 |
| Benefiting Utah Companies: | |
| 1994 Spin-off Companies | 0 |
| Cum. Spin-off Companies | 2 |
| Patents Applied | 8 |
| Patents Issued | 0 |
| License Agreements | 1 |

### Technologies

•**Market analysis** has shown that although new analytical instrumentation technology has appeared, the recent market growth has been largely due to developments in automation, data analysis and handling, and combination of existing techniques.

•**Instrumentation also offers** new technology in automation and data analysis and handling. This not only increases our possible new products but renders our spectroscopic instrumentation novel in these market aspects. No such capabilities currently exist.

### Status

•**Center currently** has prototypes of three new spectroscopic systems, two flow apparatuses, and parallel processing data collection and analysis device.

•**A project** sponsored by two Utah businessmen has yielded a new environmental test and treatment technology which is currently in patent application.

•**A new start-up** company, Envirol, Inc. has been formed and EPA and DOE have indicated they will fund the development for contaminated soils and groundwater.

### Economic Impact

•**The development of new techniques** and significantly enhanced instrumentation for general analytical use has a large established market and these are designed not only to attract larger instrumentation companies to Utah, but to enhance growth of Utah-based companies.

•**The development of "niche" products** offers a unique opportunity with little competition for start-up and smaller established Utah companies. Furthermore, these "niche" products are integral parts of the general use instrumentation and will render the start-up and smaller Utah companies as sole suppliers. The new company, Envirol, Inc., is such an example.

# Center for Design of Molecular Function

## Environmental Technology

*Linda Powers/Ron Sims/Utah State University/Logan, Utah*

*Established in July 1993 to improve economic opportunity and productivity for the state through the immediate application of environmental technologies. The work involves the application of chemistry and instrumentation to contaminated soils and ground water for characterization, monitoring and treatment.*

### Overview

| | |
|---|---|
| 1994-95 State Contract | 0 |
| Matching Funds | $570,000 |
| Cumulative | $1,157,745 |
| Center Related Jobs | 11 |
| Industry Jobs Created | 1 |
| Benefiting Utah Companies: | |
| 1994 Spin-off Companies | 0 |
| Cum. Spin-off Companies | 0 |
| Patents Applied | 1 |
| Patents Issued | 0 |
| License Agreements | 1 |

### Technologies

•**A test kit** has been developed that is rapid, inexpensive and portable - for hazardous waste site characterization and monitoring. The test kit can be used to detect chlorinated hydrocarbons such as pentachlorophenol, trichloroethylene, and PCBs. The test kit utilizes a novel analytical method and innovative instrumentation.

### Status

•**The Center** is presently in the process of developing a field test kit for pentachlorophenol (PCP) in soil. As part of this development, the test kit is being evaluated by the U.S. EPA. In May 1994 a report was submitted to the EPA that will be used in the evaluation process.

### Economic Impact

•**The impact** to the Utah economy would come from the success of the small business that will market this technology, as well as from an influx of funds for additional research. The state of Utah would also benefit from the reduced costs required to characterize contaminated sites within the state. Additional money for other research would come from increased EPA involvement in the area.

# Center for Developmental and Molecular Biology (CDMB)

*Kenneth White/Utah State University/Logan, Utah*

*Established in 1993 to facilitate product development, supplement near-term research, stimulate additional patent development and increase the commercialization process of current near-term products.*

## Overview

| | |
|---|---|
| 1994-95 State Contract | $107,480 |
| Matching Funds | $244,162 |
| Cumulative | $366,240 |
| Center Related Jobs | 13 |
| Industry Jobs Created | 0 |
| Benefiting Utah Companies: | |
| 1994 Spin-off companies | 0 |
| Cum. Spin-off companies | 0 |
| Patents Applied | 1 |
| Patents Issued | 0 |
| License Agreements | 0 |

## Technologies

•**Primary cell culture medium development.** Researchers at HyClone Lab, Inc. working in conjunction with scientists at USU have developed a lymphocyte culture fluid that out-performs all other culture media in the culture of lymphocytes and embryos. It is anticipated research by CDMB that result in development of additional formulations to enable culture of other cells which are currently difficult to culture. Marketable products: Tumor infiltrating lymphocyte medium cells transfected with the lytic peptide gene for treatment of several types of tumors; in vitro embryos and embryonic stem cells; medium to support the establishment and maintenance of embryonic and hemopioetic stem cells in vitro.

•**Lytic peptide expression and expression vector design.** Researchers at USU have evaluated, developed, synthesized and characterized several synthetic chemotherapeutic peptides referred to as lytic peptides. These peptides have been shown to be effective against a number of disease states that currently are either very difficult or impossible to treat with conventional therapy. Research focuses on the enhanced disease resistance of animals, plants and fish by the transfer and expression of lytic peptide genes as well as immunomodulation of lymphocytes by lytic peptide gene therapy for treatment of certain tumors. Two additional related patents are being developed and prepared for application.

## Status

•**Lytic peptide.** Studies are underway attempting to transfect bovine, ovine and murine lymphocytes with a lytic peptide construct. Several transgenic mice carrying the lytic peptide construct have been produced and are currently being evaluated for expression. A B-casein regulatory construct has been developed which can be induced to product CAT in mamary culture cells.

•**Embryo culture.** Dr. Polejaeva has been hired with COEP funds and has extensive background in embryonic stem cell isolation and culture.

•**Lymphocyte culture.** Research is continuing to evaluate additional modifications in lymphocyte culture medium.

•**Working with SBDC** consultant to establish commercialization plan.

## Economic Impact

•It is anticipated that HyClone Laboratories will begin marketing LCF/ECF in 1994.

•Center is also discussing research agreements with several companies relating to lytic peptide construct which may lead to licensing agreements.

# *Center for Environmental Technologies*

*Russell J. Price/University of Utah/Salt Lake City, Utah*

*Established in 1993 to support Utah's growing Environmental Technologies Industry through focused research and development in monitoring and sensing technologies, waste stream reduction, pollutant destruction and remediation, and through technology transfer and advanced technical training.*

## Overview

| | |
|---|---|
| 1994-95 State Contract | $100,000 |
| Matching Funds | $633,486 |
| Cumulative | $633,486 |
| Center Related Jobs | 8.5 |
| Industry Jobs Created | 6 |
| Benefiting Utah Companies: | |
| 1994 Spin-off companies | 0 |
| Cum. Spin-off companies | 0 |
| Patents Applied | 0 |
| Patents Issued | 0 |
| License Agreements | 2 |

## Technologies

- **Knowledge-based** Expert System for Waste-Fired Cement Kilns
- **Environmental Applications** of Time-of-Flight Mass Spectrometry
- **Environmental** Applications of the Air-Sparged Hydrocyclone (Radionuclide Separations, VOC stripping)
- **HydroPur** industrial wastewater recycling system

## Status

- **Performance of ongoing work** is being completed with key Utah companies in conjunction with CET's focused research programs.
- **Materials and process testing** contracts completed or underway for two Utah-based entrepreneurs. A series of contracts have been performed for Utah sewer treatment systems, introducing new techniques in that industry.
- **Contract pending** CET expertise is being applied to environmental problems associated with defense activities in Utah. Contracts are pending with Tooele County Health Department, and with various contracting offices of the US army for assessments of demilitarization activities at Utah defense installations.

## Economic Impact

- **Strategic partnerships** with 12 companies and installations have been formed by cooperative efforts.

# Center for Genetic Improvement of Livestock

*Von Mendenhall/Noelle Cockett/Utah State University/Logan, Utah*

*Established in 1991 to outline methods of genetically improving livestock using the rapidly evolving technologies of genetic markers and embryo cloning.*

## Overview

| | |
|---|---|
| 1994-95 State Contract | $98,500 |
| Matching Funds | $149,500 |
| Cumulative | $347,500 |
| Center Related Jobs | 9 |
| Industry Jobs Created | 0 |
| Benefiting Utah Companies: | |
| 1994 Spinoff companies | 0 |
| Cum. Spinoff companies | 0 |
| Patents Applied | 1 |
| Patents Issued | 0 |
| License Agreements | 1 |

## Technologies

The two technologies being developed within this Center include:

- **the identification** of genetic markers that are associated with reduced fat and increased muscle in sheep and
- **the improvement** of embryo cloning efficiency.

## Status

- **A genetic marker** associated with heavy muscling and reduced fat in sheep has been developed.
- **A flock of sheep** carrying the callipyge gene responsible for heavy muscling has been established at USU.
- **Characterization** of the heavy muscling trait is ongoing.
- **Ovine oocyte activation** rate has been improved using a new procedure developed by the Center.
- **Working with SBDC** consultant to establish commercialization plan.

## Economic Impact

- **The Center has determined** that the callipyge gene provides an additional $16.06 to the value of each marketed sheep. If just 25% of the sheep in Utah carried the callipyge gene, the total added value impact to Utah would be $1.405 million.
- **Center has initiated** negotiations with the USU Biotechnology Center concerning the commercialization of the callipyge genetic marker. Additional markers will be isolated and incorporated into the genetic test.
- **Animals carrying** the callipyge gene are being distributed to Utah sheep producers.

# Center for Meat Processing Technology

*Dr. Von T. Mendenhall/Utah State University/Logan, Utah*

*Established as a center in 1991. Development of new meat products and processing technology.*

## Overview

| | |
|---|---|
| 1994-95 State Contract | $203,220 |
| Matching Funds | $103,000 |
| Cumulative | $432,840 |
| Center Related Jobs | 12 |
| Industry Jobs Created | 25 |
| Benefiting Utah Companies: | |
| 1994 Spin-off companies | 0 |
| Cum. Spin-off companies | 3 |
| Patents Applied | 1 |
| Patents Issued | 2 |
| License Agreements | 3 |

## Technologies

- **Ultra-High Temperature** (UHT) pasteurization of meat surfaces.
- **Low fat lamb chops**, beef steaks, pork chops and bacon.
- **Processing technology** to reduce fat content of raw meat.
- **Processing technology** to bond meat to bone.
- **Combining UHT** with electron beam radiation technology to produce sterile meat products.
- **UHT pasteurization** combined with High-Temperature Aging to produce tender steaks and roasts from the cheaper less-tender primal cuts from beef carcasses.

## Status

- **Two patents have been issued** to USU and the Meat Processing Center during the last 6 months.
- **Three licensing agreements** are pending.
- **Commercial production** of UHT beef for the Food Service Market continues in Springville, Utah by ConAgra.
- **Products were displayed** at the Paris, France Food Show.
- **Eight major processors** in the European Common Market have indicated an interest in purchasing a license.
- **Products were displayed** at the Ut Farm Bureau Convention in SLC in Nov. As a result, the National Farm Bureau invited the Center to display and serve samples of the low-fat products to 8,000 delegates at the National Convention in St. Louis, Missouri in January of 1995.

## Economic Impact

- **ConAgra has established** a Federally inspected production facility in Springville, Utah. They currently have 7-10 employees and are producing about 8,000 lb. per day at capacity. The profit margin on the low-fat beef steak is about 20% compared to a 1% profit margin on boxed beef. ConAgra is continuing to market the low-fat beef products on a limited basis at the present time.

# *Center for Multimedia Education and Technology (U/U)*

*Magdy F. Iskander/University of Utah/Salt Lake City, Utah*

*Established in 1993 for development, production and distribution of interactive multimedia software modules for science, math and engineering education.*

## Overview

| | |
|---|---|
| 1994-95 State Contract | $125,000 |
| Matching Funds | $420,750 |
| Cumulative | $420,750 |
| Center Related Jobs | 12 |
| Industry Jobs Created | 0 |
| Benefiting Utah Companies: | |
| 1994 Spin-off Companies | 0 |
| Cum. Spin-off Companies | 0 |
| Patents Applied | 1 |
| Patents Issued | 0 |
| License Agreements | 0 |

## Technologies

Multimedia software development and distribution on CD-ROM

## Status

•Two CD-ROM products have been developed and are ready for production and distribution (sale). This includes the "Calculus Castle" CD-ROM and the CD-ROM for engineering electromagnetics. The Center also publishes a peer-reviewed journal in collaboration with John Wiley & Sons. The Center is also managing the Conceptual Learning of Science (COLOS) USA project, which is a consortium of 11 universities and which is sponsored by Hewlett-Packard Company.

•The Center is presently working on establishing a new company, "CAEME Software Inc."

## Economic Impact

•Provided jobs for three full time staff, four graduate students in Electrical Engineering, a team of five MBA students, two undergraduate students, and three faculty members.

•Purchased and donated multimedia computers to test sites at high schools.

•With the proposed establishment of the spinoff company, and the establishment of the COLOS USA project, the Center promises to establish additional new jobs in the state.

# *Center for Multimedia Education and Technology (UVSC)*

*Gary L. Phelps/Utah Valley State College/Provo/Orem, Utah*

*Established in 1993 to research state-of-the-art, interactive multimedia technology and to author and produce with external partners, a wide range of commercial training and educational applications.*

## Overview

| | |
|---|---|
| 1994-95 State Contract | $100,000 |
| Matching Funds | $503,871 |
| Cumulative | $503,871 |
| Center Related Jobs | 2 |
| Industry Jobs Created | 8 |
| Benefiting Utah Companies: | |
| 1994 Spin-off Companies | 3 |
| Cum. Spin-off Companies | 3 |
| Patents Applied | 0 |
| Patents Issued | 0 |
| License Agreements | 6 |

## Technologies

•**Interactive multimedia** computer-based authoring systems. Some authoring technologies will be copyrighted, held and owned by UVSC and the Center while others will be developed with external corporate partners.

•**Center will also license** other copyrighted technologies/authoring tools for use in producing multimedia programs at the Center.

## Status

•**While the production** of modules continues to be CMET's primary mission, two other developments have transpired since 1 July 1994.

•**The first is** multimedia training partnerships with two superlative companies - Williams Knowledge and Paragon Technologies. Combined value of software they bring to the partnership is over $10 million.

•**The second** development is to provide market and financial direction and consultation to Utah companies which have or are developing multimedia products.

## Economic Impact

Three new companies have been launched during 1994 using modules licensed from the center. These include Cela Solutions Inc. in Provo, $MC^2$ in South Jordan and Memory Lane Productions (a division of Harding & Harris) in Orem. A total of 8 industry jobs have also been created.

# *Center for Rapid Product Realization*

*David K. Sorensen/Brigham Young University/Salt Lake City, Utah*

*Established in July 1994 to provide manufacturing technology assistance services to Utah companies in improving Rapid Product Realization and manufacturing processes in general.*

## Overview

| | |
|---|---|
| 1994-95 State Contract | $200,000 |
| Matching Funds | $403,000 |
| Cumulative | $403,000 |
| Center Related Jobs | 12 |
| Industry Jobs Created | 8 |
| Benefiting Utah Companies: | |
| 1994 Spin-off Companies | 2 |
| Cum. Spin-off Companies | 2 |
| Patents Applied | 4 |
| Patents Issued | 0 |
| License Agreements | 3 |

## Technologies

- **Prominent technologies and capabilities** include advanced CAD systems, conventional and rapid prototyping, state-of-the art process definition and simulation.
- **The Center** also has access to advanced materials technologies from the ACME Center of Excellence.
- **Center is also coordinating** other institutions within the state as they apply to new product opportunities.

## Status

During the first five months of operation, the RPR Center has:

- **Contacted** 1500 manufacturers by mail
- **Received 130 inquiries** for new product assistance from inventors and companies
- **Reviewed 60 written applications** for new product assistance.
- **Initiated work** on 10 new products
- **Launched** 2 new companies
- **Been invited** by NIST to participate at a national conference on manufacturing startups.
- **Submitted** a major ($600,000) proposal to TRP
- **Secured** $278,000 of in-kind matching funds
- **Established** 3 royalty agreements
- **Negotiated** $110,000 in contracts

## Economic Impact

- **Assisting** 10 companies. These projects are still in process and a more accurate definition of economic impact will be available in the next report; however, projections on one of the more innovative products with only 20% market penetration in the US would result in over $60M in annual sales and over 500 new jobs in Utah.

# Center for Self-Organizing and Intelligent Systems

*Robert W. Gunderson/Utah State University/Logan, Utah*

*Established in 1993 to assist Utah companies in developing marketable products which use the technology of intelligent systems.*

## Overview

| | |
|---|---|
| 1994-95 State Contract | $150,000 |
| Matching Funds | $544,904 |
| Cumulative | $823,904 |
| Center Related Jobs | 14 |
| Industry Jobs Created | 0 |
| Benefiting Utah Companies: | |
| 1994 Spin-off Companies | 1 |
| Cum. Spin-off Companies | 1 |
| Patents Applied | 2 |
| Patents Issued | 0 |
| License Agreements | 2 |

## Technologies

•**Intelligent Systems** Technology generally includes any device and/or software concept which, in one way or the other, attempts to artificially replicate unique cognizance and control abilities of the human mind.

•**Artificial neural networks** are designed to mimic the ability of the brain and central nervous system to learn and generalize from past experience.

•**Fuzzy logic** was introduced as a way of emulating the reasoning processes fundamental to human intelligence.

•**Virtual controllers** attempt to place a remote human operator or controller in a virtual environment identical to that encountered by the control process.

## Status

In the first year and 3 months of its existence, CSOIS has focused upon

•**Two irrigation projects.**

•**Two applications to exercise machines.**

•**An autonomous vehicle control**

•**Plus, CSOIS is under contract** to develop a new pattern recognition product for a regional startup company, Monetary Systems Inc., and is developing a unique wheel chair virtual steering system for CPD. Both irrigation projects are currently being field tested, the two exercise machines will soon be on the market, and the vehicle control project is expected to lead to the establishment of a new Utah startup company within a year, or at most two.

## Economic Impact

•**Campbell Scientific Inc.** projects sales of $5 million/year over a seven year period.

•**ProForm Fitness Products Inc.** projects first year sales of approximately $40 million.

•**Monetary Services Inc.** is a startup company with an idea for a product which has significant sales potential. CSOIS has the needed software and hardware experience to develop the product for them.

# Center for Software Science

*Robert R. Kessler/University of Utah/Salt Lake City, Utah*

*Established as a center in 1990 to establish and operate an environment for the research and development of a wide range of software systems.*

## Overview

| | |
|---|---|
| 1994-95 State Contract | extension |
| Matching Funds | $10,500 |
| Cumulative | $6,345,393 |
| Center Related Jobs | 20 |
| Industry Jobs Created | 0 |
| Benefiting Utah Companies: | |
| 1994 Spin-off Companies | 0 |
| Cum. Spin-off Companies | 1 |
| Patents Applied | 0 |
| Patents Issued | 0 |
| License Agreements | 1 |

## Technologies

- **Operating systems**
- **Parallel programming languages**
- **Distributed computing**
- **System tools**
- **Object-oriented programming**

## Status

- **Work is directed** toward defining and implementing the next generation software systems for loosely coupled multi-computers.

Continue to support customers for Macintosh Backup program, and have released a new version. Tech transfer office is negotiating a license. Have currently sold 101 site licenses. Continue to work on technology to help with Unix/PC integration. Center will be advancing to Graduated Center status as of June 30, 1994.

## Economic Impact

- **Economic advantage** continues to come in the form of jobs for the researchers working in the Center. Center has grown from a salary budget of about $200K per year prior to becoming a Center to one of about $800K this year, which will grow ever greater with the new ARPA grant.

# Center for Value Added Seed Technology

*Dr. Grant Vest/Utah State University/Logan, Utah*

*Established center in 1991. The main focus of CVAST is to produce value-added crops using forefront plant biotechnologies and conventional plant breeding.*

## Overview

| | |
|---|---|
| 1994-95 State Contract | $70,000 |
| Matching Funds | $329,788 |
| Cumulative | $613,454 |
| Center Related Jobs | 13.3 |
| Industry Jobs Created | 0 |
| Benefiting Utah Companies: | |
| 1994 Spin-off Companies | 0 |
| Cum. Spin-off Companies | 0 |
| Patents Applied | 1 |
| Patents Issued | 0 |
| License Agreements | 0 |

## Technologies

- **Conventional plant breeding** of exotic wheatgrass forage and turf plants collected worldwide.
- **Molecular genetic marker** technology to move genes of interest from weedy wild grass species into commercial forage and cereal crops.
- **Plant tissue culture** to mass produce unique agricultural, horticultural and forestry plants.
- **Microbiology and plant physiology** to develop improved methods for plant genetic engineering.

## Status

- **Conventional plant breeding:** In addition to turf cultivars now under development, four forage grass cultivars are being prepared for release within the next year. Market surveys are underway.
- **Molecular genetic marker** technology: produced through plant breeding an interspecific population of wild Australian wheatgrasses.
- **Plant tissue culture:** New tissue culture media were developed.
- **Microbiology and plant physiology:** Wheat plants obtained using our genetic engineering procedures were evaluated by an outside lab and found not to contain transgenes. Withdrew patent. Further research being conducted.
- **Working with SBDC** consultant to establish commercialization plan.

## Economic Impact

- **Turf and forage** grass cultivars released by CVAST will be protected under provisions of the Plant Variety Protection Act. Several companies have expressed interest.
- **Collaborating with INEL** to
  1) develop bioreactors
  2) improve genetic engineering procedures for wheat and cotton.

# Center for 3D Computer Graphics

*Eric Pedersen/Dixie College/St. George, Utah*

*Established in 1991 to study practical applications of computer graphics, specifically networking and 3D graphics. Consortia is formed between Art, Graphics Arts, and Computer Science departments at Dixie College. Main focus is to conduct market research on computer graphics and networking tools and then cooperate with private industry to evaluate and create products and support services that will meet market demands.*

## Overview

| | |
|---|---|
| 1994-95 State Contract | $50,000 |
| Matching Funds | $125,000 |
| Cumulative | $471,431 |
| Center Related Jobs | 8 |
| Industry Jobs Created | 4 |
| Benefiting Utah Companies: | |
| 1994 Spin-off Companies | 1 |
| Cum. Spin-off Companies | 2 |
| Patents Applied | 0 |
| Patents Issued | 0 |
| License Agreements | 5 |

## Technologies

•**The focus** of our technology development is producing computer graphics products and technical support services. This is accomplished by writing software code and licensing the source code to a company, creating computer graphics products and licensing the product to a company and developing seminars and product research and support in partnership with industry.

•**The Center delivered** new products during fiscal year 93-94 to five companies.

## Status

•**The Center plans** to deliver new products to five additional companies from December 1994 through the first quarter of 1995.

## Economic Impact

Some of the statistical examples:

•**Center has hired** 5 research assistants to work on projects with industry.

•**In March of 1993** the Center signed a final licensing agreement with Mira Imaging for $140,000 for our source code in HyperSPACE Windows.

•**The Spirit of Utah Game** is being sold through the Heritage Foundation.

•**The first product developed** by the Center during our first funding year is still generating about $120 per month and represents a 15% royalty from Strata Inc.

•**The Center has 2 spinoff** companies, Illustrative Impression and InfoWest.

•**Center is well known** for its international seminar series.

# DISTINGUISHED CENTERS

# Center for Advanced Combustion Engineering Research

**Distinguished Center**

*Dr. L. Douglas Smoot/Brigham Young University/Provo, Utah*
*Dr. David Pershing/University of Utah/Salt Lake City, Utah*

*Established as a center in 1986 as a joint project between BYU and the U of U. This center is working towards the clean and efficient use of low-grade fossil fuels. The development of advanced combustion technology that will take advantage of alternative low-cost fuel resources such as coal, heavy oil, oil shale and tar sands. All of these fuel sources are abundant in Utah. Received "Distinguished Center" status in 1991.*

## Overview

| | |
|---|---|
| 1994-95 State Contract | $100,000 |
| Matching Funds | $9,975,821 |
| Cumulative | $60,200,867 |
| Center Related Jobs | 163 |
| Industry Jobs Created | 12 |
| Benefiting Utah Companies: | |
| 1994 Spin-off Companies | 0 |
| Cum. Spin-off Companies | 3 |
| Patents Applied | 0 |
| Patents Issued | 2 |
| License Agreements | 55 |

## Technologies

- **Understand mechanisms** of fossil-fuel combustion and pollutant and soot formation.
- **Understand the relationship** between fuel properties and conversion.
- **Develop** robust, reliable computer models to control and record the performance of particular combustion chambers.
- **Apply non-intrusive** diagnostics for complex combustion systems.
- **Fuel structure** and reaction mechanisms.
- **Pollutant formation/control** and waste incineration.
- **Fuel minerals**, fouling, and slagging.
- **Turbulent reacting** fluid mechanisms and heat transfer.
- **Comprehensive combustion** model development.
- **Model evaluation** data and process strategies.

## Status

- **The Center** research program consists of 43 active research projects among 163 participants focused in six thrust areas. Nineteen projects have been completed thus far, while 32 were initiated in years three through eight.
- **New projects** have been initiated in each year. Working groups for all six thrust areas, involving 44 respected combustion professionals from companies (26), universities (11) and government labs (7) are functioning effectively. Most of the projects are fundamental and most are focused toward ACERC deliverables.

## Economic Impact

- **An eight-year** cumulative budget and supported research effort of over $50,364,403.
- **New software licenses.**
- **New technology** for center members within the state, including REI, Inc., and Geneva Steel Co.
- **Consulting and technical** services to state companies.
- **A source** of highly skilled graduates with expertise in fossil energy for employment in key professional jobs within the State.
- **New technology** and new software products on which four new businesses have developed in Utah.
- **The indirect benefit** of having one of only 21 such highly sought after national engineering centers in the state, and the only one in fossil energy, which relates so directly to the state's natural fossil resources.

# Center for Biopolymers at Interfaces

## Distinguished Center

*Dr. Karin D. Caldwell/University of Utah/S.L.C. Utah*

*Established as a center in 1986 to increase knowledge and understanding of the interaction of proteins, nucleic acids, and cells with synthetic surfaces. This mission is important to the development of artificial organs and implants, production of contact lenses and diagnostic devices, and for biotechnological process development. Received Distinguished Center status in 1991.*

### Overview

| | |
|---|---|
| 1994-95 State Contract | 0 |
| 1994 Matching Funds | $1,750,588 |
| Cumulative | $8,536,731 |
| Center Related Jobs | 40 |
| Industry Jobs Created | 10 |
| Benefiting Utah Companies: | |
| 1994 Spin-off Companies | 0 |
| Cum. Spin-off Companies | 2 |
| Patents Applied | 2 |
| Patents Issued | 11 |
| License Agreements | 8 |

### Technologies

- **A large effort** is devoted to the development of methods for monitoring the status (concentration/activity) of proteins absorbed or bound to surfaces.
- **In addition** to providing general insight into the surface composition and biocompatibility of implant materials, these methods are developed for such special tasks as the construction of biosensors and the evaluation of wear regimes for contact lenses of different composition.
- **A separate line** of technology involves the analysis of particle sizes and size distributions in the colloidal range. This capability is extended to the analysis and quality control of emulsions and similar pharmaceutical products.

### Status

- **As a Distinguished Center** of Excellence, the CBI received funding for the development and marketing of specific technologies which resulted in last year's formation of a spin-off company, HCP Diagnostics. Their product line is immunosensors targeting the point-of-care testing market.
- **Efforts to commercialize** this technology have been intense.
- **The search** for a strategic partner has led to the identification of five well-established corporation with an expressed interest in a partnership with HCP Diagnostics.
- **Center faculty** will be actively involved in the running of next summer's 69th ACS Colloid and Surface Science Symposium.
- **The Center made** 10 new patent disclosures during the period.

### Economic Impact

- **Contracts with** CIBA Vision, industrial fellowships, industrial membership dues, industrial service fees, NIH Biotech Training Grant, NIH grants to CBI faculty, NSF grants to CBI faculty, including instrumentation support, significant fraction of the $19.8 million allocated from Federal sources for the Biomedical Polymers Building.

# Center for Supercritical Fluid Separations

*Milton L. Lee/Brigham Young University/Provo, Utah*

*Established as a center in 1986. Received "Distinguished Center" status in November 1991. The Center provides a focal point for research and development, education, and training in the area of chemical analysis where high resolution separations and high sensitivity detection are emphasized.*

## Overview

| | |
|---|---|
| 1994-95 State Contract | $100,000 |
| Matching Funds | $112,432 |
| Cumulative | $3,441,526 |
| Center Related Jobs | 17 |
| Industry Jobs Created | 21 |
| Benefiting Utah Companies: | |
| 1994 Spin-off Companies | 0 |
| Cum. Spinoff companies | 2 |
| Patents Applied | 0 |
| Patents Issued | 9 |
| License Agreements | 3 |

## Technologies

- **Supercritical fluid chromatography**
- **Supercritical fluid extraction**
- **Radiofrequency plasma** detection
- **Time-of-flight** mass spectrometry
- **Column technology** for capillary chromatography and electrophoresis

**Note: Milton Lee received an R&D 100 Award in behalf of Sensar Corporation and the inventors at BYU for the TOF 1000 time-of-flight mass spectrometer. This award is given each year nationally for the 100 technologically most significant products developed.**

## Status

- **Supercritical fluid** chromatography: Developed a new method for the group-type analysis of petroleum hydrocarbons that is based on the use of packed capillary supercritical fluid chromatography. Have transferred the technology to Dionex and are currently working out the final technical details.
- **Continuing evaluation** of a modifier addition module for supercritical fluid chromatography.
- **Detection**: Continuing the construction of the new vacuum system for the plasma time-of-flight mass spectrometer. Components are being machined and will be assembled and evaluated.

## Economic Impact

- **Dionex Corporation,** $1 million estimated dollar value to the state of Utah.
- **Sensar Corporation,** $694 thousand estimated dollar value to the state of Utah. The current annual payroll for the eleven employees at Sensar is over $540,000. Job creation is expected to be 30-50 jobs over the next three years.

# PLANNING GRANTS

# Utah Centers of Excellence Program
# Planning Grants Summary
Since 1986

| PLANNING GRANT | AMOUNT/RESULT |
|---|---|
| Biotechnology | $10,000/Center created |
| Water Information Science | 10,000/no further funding |
| Advanced Fossil Fuel | 15,000/Center created |
| Advanced X-Ray | 7,500/Center created |
| Communications | 10,000/Center created |
| Microelectronics | 10,000/Center created |
| Non-Intrusive X-Ray | 10,000/Center created |
| Dev. Heavy Oils to Asphalt | 10,000/Comb. Center created |
| Tar Sand Binders | 15,000/Comb. Center created |
| Quality and Integrity Design | 10,000/Center created |
| Rural Manufacturing | 10,000/Center created |
| Cancer Genetic Epidemiology | 10,000/Center created |
| Artificial Heart | 20,000/Center created |
| Drug Discovery | 10,240/no further funding |
| Biomedical Separations | 10,000/no further funding |
| Control Systems Tech | 10,000/Center created |
| Integrated Science Education | 10,000/Center created |
| Silicon Development | 10,000/no further funding |
| Fuel Engineering | 10,000/no further funding |
| Infrastructure Design | 10,000/no further funding |

| PLANNING GRANT | AMOUNT/RESULT |
|---|---|
| Information Technology | 10,000/Center created |
| Theory & Application of Geometry | 10,000/no further funding |
| Environmental Technology | 10,000/Center created |
| New Product Development | 9,700/no further funding |
| Emerging Information Systems (93) | 20,000/in process |
| Magnetism in Information Tech (93) | 5,000/in process |

Planning grants are given for exploratory research to prove the commercial viability of a technology before full center status and funding is awarded.

# LEGISLATION

## PART 6
## CENTERS OF EXCELLENCE

**9-2-601. Purpose.**

(1) The Legislature recognizes that the growth of new industry and expansion of existing industry requires a strong technology base, new ideas, concepts, innovations, and prototypes. These generally come from strong research colleges and universities. Technical research in Utah's colleges and universities should be enhanced and expanded, particularly in those areas targeted by the state for economic development. Most states are enhancing their research base by direct funding, usually on a matching basis. The purpose of this part is to catalyze and enhance the growth of these technologies by encouraging interdisciplinary research activities in targeted areas. The Legislature recognizes that one source of funding is in matching state funds with federal funds and industrial support to provide the needed new technologies.

(2) The Legislature recommends that the governor consider the allocation of economic development funds for Centers of Excellence to be matched by industry and federal grants on at least a two-for-one basis.

(3) The Legislature recommends that such funds be allocated on a competitive basis to the various colleges and universities in the state. The funds made available should be used to support interdisciplinary research in specialized Centers of Excellence in technologies that are considered to have potential for economic development in this state.

**History: C. 1953, 63-62-1, enacted by L. 1985, ch. 103, 1; 1986, ch. 109, 1; renumbered by L. 1992, ch. 241, 60.**

**Amendment Notes.** - The 1992 amendment, effective March 13, 1992, renumbered this section, which formerly appeared as 63-62-1, and substituted "part" for "chapter" in Subsection (1).

**9-2-602. Short title - Definitions.**

(1) This part is known as the "Centers of Excellence Act."

(2) As used in this part, "Centers of Excellence" means university-based, industry-supported, cooperative research and development programs.

**History: C. 1953, 63-62-2, enacted by L. 1985, ch. 103, 2; 1986, ch. 109, 2; renumbered by L. 1992, ch. 241, 61.**

**Amendment Notes.** - The 1992 amendment, effective March 13, 1992, renumbered this section, which formerly appeared as 63-62-2; inserted the subsection designations; and substituted "part" for "chapter" in two places.

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