STATE OF UTAH

DEPARTMENT OF
COMMUNITY AND
ECONOMIC
DEVELOPMENT

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CENTERS·OF
EXCELLENCE

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CENTERS OF EXCELLENCE PROGRAM

Report to the Legislature

1 October, 1989

CENTERS OF EXCELLENCE
Advisory Council

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Director of Research Development
Hyclone Laboratories
Logan, Utah

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Thomas A. Henrie, Ph.D., Consultant
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E. Cordell Lundahl, President
Lundahl Instruments
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Gerald Sharp, Ph.D., Senior Staff Engineer
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John M. Simonsen, Consultant
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Rex Spendlove, Ph.D., President
Hyclone Laboratories
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Jim Sorensen, Jr., President
Deseret Research, UBTL, DataChem (C.E.O.)
Salt Lake City, Utah

INTRODUCTION

The Centers of Excellence Program has made substantial progress during the last two quarters of 1988 and the first three quarters of 1989. During that time frame there has been a passing of the baton from Dr. Lynn Blake to G. Michael Alder as director of the program. Mr. Alder's background in high tech business development should be important in the progress of the centers at this point in their history.

It is apparent from the response to the Centers of Excellence Program that there was a "pent up" demand for the opportunity that this program has offered. It is also evident from the awards that have been made, after careful review by the Centers of Excellence Advisory Council, that there is a high degree of technical opportunity within the state. Further, as demonstrated from the amount of outside funding that has been attracted to match the state awards the opportunity and timing were good in beginning this program.

The challenge now is seeing the translation of what has been developed go into businesses and ultimately increase the amount of high paying job opportunities for Utahns. As you will see by the summary page, the centers are showing jobs created both in industry and in our universities.

During 1989 funding has been discontinued for the Center for Sensor Technology and the Center for Base Technical Education. The Center for Quality & Integrity Design has been reduced to a planning grant level. The Center for Advanced Materials and the Center for Microelectronics are in the process of being combined. All of these actions have taken place due to evaluations and discussions with the university research administrations. A supercomputer consortium between our three major univeristies has been newly created with supplemental funding provided by the Legislature this past year.

The opportunity at hand for Utah is very significant. There is the potential for as many as ten businesses to emerge from the centers that could be more than $100 million each in sales per year. Our challenge now is to:

- nurture these opportunities and provide an infrastructure for them to develop;
- plan for their growth, expansion and retention in Utah;
- transfer some of the centers technologies into existing companies within the state;
- use the Centers of Excellence to attract companies from outside the state to come to Utah.

Though many other states have programs that are funded at a higher level, a great deal has been accomplished with the resources that have been available. The state looks forward to continuing this successful venture.

CENTERS OF EXCELLENCE PROGRAM
Definition of Terms

Center of Excellence

Located at a Utah Institution of higher Learning, a Center is a designated location where specific research and development is conducted, and technology transfer takes place, leading to commercialization of the products of that research.

Principal Investigator

The Center Director who has instigated the research and is responsible for the direction of all affairs of that Center.

Associates

Agencies, companies, or individuals with whom a channel of communication has been established; potential contributors to the Center.

Contributors

Agencies, companies, or individuals who have contributed cash or in-kind donations to the Center, or who have purchased technology, goods or services from the Center.

Amount of Contribution

Dollar amount of donation, cash value of in-kind contribution, or income generated by the sale of technology, goods or services from the Center. This may be actually received, or committed at the time of this report. This is described as "Matching Funds."

State Contract

Dollar amount of commitment to the Center by the State Department of Community and Economic Development. State monies are not released until invoices are received for actual expenses and documentation of match funds.

New Companies

New Utah companies formed using the research and development of the specific technology at the institution since the centers program began.

Affiliated Companies

Utah companies started before the centers program began or begun separately from centers but now benefit substantially from centers research.

Benefitting Companies

All companies that have been associated with, affiliated with, created by, contributed to a center since the program began.

CENTERS OF EXCELLENCE PROGRAM SUMMARY (FY'86 - 9/31/89)

Center by Area of Technology	Page #	BENEFITTING COMPANIES Associates	Contributors	New & Affiliated Companies	Amount of Contribution	State Contract	Industry Created Jobs	Faculty Grad/Studnt/ Post Doc Employed
AEROSPACE & MANUFACTURING								
Space Engineering USU	2	27	23	1	$78,533,913	$950,000	173	18
Aerospace Technology WSC	2	59	33	2	1,412,381	490,000	59	11
Engineering Design U/U	3	112	18	4	6,890,748	573,000	53	59
URI USU	3	57	7	0	1,676,360	778,000	0	0
CAD/CAM USU	4	76	8	0	7,905,917	442,881	0	13
CIM BYU	4	23	21	3	525,595	222,119	12	7
BIOMEDICAL TECHNOLOGIES								
Artificial Heart U/U	5	61	19	1	15,595,167	325,000	1	64
Biopolymers U/U	5	40	27	1	6,304,918	500,000	3	41.5
Laser Institute U/U	6	22	18	1	7,302,000	100,000	21	6
Controlled Chemical Delivery U/U	6	13	11	2	6,689,618	346,000	38	34
Biocatalysis USU	6	17	7	0	1,376,756	500,000	0	17
Supercritical Fluid BYU	7	25	23	1	1,980,344	376,440	59	22
X-Ray BYU	7	51	4	1	648,524	360,000	6	23
INFORMATION TECHNOLOGIES								
Signal Processing BYU	8	23	15	5	1,962,660	646,334	40	29
Materials and Microelectronics U/U	8	146	95	4	10,764,967	649,780	2	36.5
Communications Res.U/U	9	8	6	1	1,556,371	210,120	0	49
Computer Networks USU	9	73	8	1	658,707	100,000	12	12
Computer Based Ed. BYU	9	13	6	1	1,261,584	410,000	13	30
Handicapped Education USU	10	16	5	1	2,451,824	286,325	16	32
Parallel Supercomputing BYU	10	6	6	0	17,950,000	300,000	0	0
Supercomputing U/U	11	2	2	0	13,061,000	350,000	12	0
NATURAL RESOURCES								
Combustion Eng. BYU	12	35	35	0	13,427,551	500,000	0	97
Coal & Oil U/U	12	13	13	1	1,208,024	490,000	0	44
Chemical Separation BYU	12	80	7	1	924,972	606,645	6	22
Pyrometallurgical U/U	13	3	2	0	168,000	113,680	0	7
Biotechnology USU	13	76	13	0	2,488,472	700,000	0	22
TOTALS:		**1077**	**432**	**32**	**$204,726,373**	**$11,326,324**	**526**	**696**

AEROSPACE AND MANUFACTURING

CENTER FOR AEROSPACE SCIENCE TECHNOLOGY

Professor Robert J. Twiggs
Weber State College

Overview

State Contract	$ 490,000
Matching Funds	$1,412,381
Benefitting companies	59
Industry jobs created	59
Fac/Staff/Grad Stud/Doc	11

Technologies

- Small satellite design including such features as
  - +particle detectors
  - +color cameras
  - +light detection for ozone mapping
  - +magnitometers
  - +microcomputers
  - +packet radio
- Developing sun angle detector

Status

- Webersat satellite scheduled for launch in Jan. '90
- 50% probability of AMSAT satellite contract for $1.5 MM
- High probability of designing and building first satellite for Korea
- Working with Intraspace on satellite to read power meters

Economic Impact

- Magnitometer developed by center has been licensed by Orchid Engineering of Huntsville, Utah
- Helped move new company here, Intraspace with 60 jobs and $6 million in contracts
- Designed sun sensor used on Navy satellite
- Direct funding of small satellites is growing
- Satellite to read power meters could be multi-million dollar royalty opportunity.

CENTER FOR SPACE ENGINEERING RESEARCH

Dr. Frank Redd
Utah State University

Overview

State Contract	$ 950,000
Matching Funds	$78,533,913
Benefitting companies	27
Industry jobs created	173
Fac/Staff/Grad Stud/Doc	18

Technologies

- Infrared instrumentation
- Sensor calibration
- Upper atmosphere measurements & modeling
- Plasma diagnostics
- Data analysis
- Image compression
- Cryogenics
- Program management

Status

- Increased annual operating budget to $20 MM
- Successfully competed to win $20 MM contract for critical SDI satellite (1992 launch)
- Now host annual small satellite conference (natl)
- Have flown 350 payloads 75 of which involved cryogenics
- Have become a space grant university with U of U & Denver U.

Economic Impact

- Image compression technology demonstration will facilitate new concept in video phones (Market size equal to VCR's)
- A total of 191 jobs now being directly supported by projects resulting from this Center
- Serving as a nucleus for developing further expansion in the space industry in Northern Utah

CENTER FOR ENGINEERING DESIGN

Dr. Stephen C. Jacobsen
University of Utah

Overview	
State Contract	$ 573,000
Matching Funds	$6,890,748
Benefitting companies	112
Industry jobs created	53
Fac/Staff/Grad Stud/Doc	59

Technologies

- Drug delivery systems
- Physiological signal monitor
- Robotics
- Microelectro systems
- Micromechanical systems

Status

- Robots with 54 degrees of freedom
- Artificial limbs now widely sold
- Working on development of miniature motor with rotor the diameter of human hair
- New contracts with Disney, Merck and Navy Dept.

Economic Impact

- Have created 3 companies with sales totalling $15 million annually and 15% pretax profit
- Have created 65 jobs including 35 professional engineers
- Two more new companies emerging with annual sales potential of $100 million each
- New robot contract will introduce technology to Europe

UTAH RESEARCH INSTITUTE

Dr. David Norton
Utah State University

Overview	
State Contract	$ 778,000
Matching Funds	$1,676,360
Benefitting Companies	57
Industry jobs created	0
Fac/Staff/Grad Stud/Doc	0

Technologies

- Computer Aided Logistics Systems (CALS)
- Parts on Demand Systems (PODS)
- Software for maintenance systems
- Concepts for business creation

Status

- Unsolicited proposal for $10 mill. submitted to Air Force
- Proposal to General Motors & foreign governments for $10 million submitted
- Expecting RFP for competitive bid in November 1989
- 26 Faculty participants
- Defining statement of work with Ogden Air Logistics Command for maintenance of Air Force weapons systems

Economic Impact

- Request for Proposal expected shortly to develop $20 million CALS/PODS program for Ogden Air Logistics Command
- Definition of statement of work on Air Force Weapons System Maintenance should yield $1 million contract

CENTER FOR COMPUTER AIDED DESIGN AND MANUFACTURING

Dr. Warren F. Phillips
Utah State University

Overview	
State Contract	$ 442,881
Matching Funds	$7,905,917
Benefitting companies	76
Industry jobs created	0
Fac/Staff/Grad Stud/Doc	13

Technologies

- Parts on Demand Systems
- Computer Aided Design
- Computer Aided Manufacturing

Status

- Breakthrough in last 6 months to make cheaper lightweight robots
- Algorithm controls position, velocity and deflection of robot arm
- Could reduce weight of robots by a factor of ten while retaining load capacity
- Involved with PODS with URI center as part of Utah university consortium

Economic Impact

- Lightweight robots are important for space applications. (NASA & IBM are funding)
- Large equipment donation from IBM facilitating research
- Results published; copyright to follow shortly on new robot weight reduction breakthrough

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CENTER FOR COMPUTER INTEGRATED MANUFACTURING

Dr. Dell K. Allen
Brigham Young University

Overview	
State Contract	$222,119
Matching Funds	$525,595
Benefitting companies	23
Industry jobs created	12
Fac/Staff/Grad Stud/Doc	7

Technologies

- Parts on Demand Systems
- Computer integrated system for all aspects of mfg.co.
- Design of cell concept for breaking up a factory into manufacturing components that could be located in remote locations

Status

- Software and hardware design advanced to demonstration stage
- Formed association with Utah Valley Community College

Economic Impact

- New company formed to undertake pilot demo
- IBM donating cash to assist in research applications

BIOMEDICAL TECHNOLOGIES

CENTER FOR TOTAL ARTIFICIAL HEARTS AND BIOMEDICAL DEVICES

Dr. Donald B. Olsen
University of Utah

Overview

State Contract	$ 325,000
Matching Funds	$15,595,167
Benefitting companies	61
Industry jobs created	1
Fac/Staff/Grad Stud/Doc	64

Technologies

- Animal experimentation-surgery, radiology, hematology, immunology, biochemistry, pathology, device retrival analysis
- Engineering-miniature hydraulics, device design, design analysis, CAD, computer machining capability, device fabrication, polymers, plastics, metallics and QA/QC
- Electrical design & fabrication
- Integrated circuits & VLSI
- Device testing

Status

- Have established leadership in electric artificial heart project
- Have only system with motor backup capabilities
- Received old St. Marks Hospital as a donation to the center
- Considered world leader in artifical organ research

Economic Impact

- $10 million backlog in research
- Looking for the right kind of industry linkage
- Developing incubator for new business start-ups

CENTER FOR BIOPOLYMERS AT INTERFACES

Dr. Karin D. Caldwell
University of Utah

Overview

State Contract	$ 500,000
Matching Funds	$6,304,918
Benefitting companies	40
Industry jobs created	3
Fac/Staff/Grad Stud/Doc	41.5

Technologies

- Researching surface interactions to assist the following industries:
  + Food processing
  + Medical devices
  + Scientific instruments
  + Pharmaceuticals
  + Cosmetics
- Biosensors
- Purification of materials
- Diagnostics

Status

- 21 member organizations representing the largest biomedical companies in the world
- Semi-annual meetings hosted in Salt Lake City bring attendees from around the country
- 12-15 projects funded annually after internal reviews are conducted
- Interdisciplinary approach; member scientists come from 4 different colleges representing eight academic departments

Economic Impact

- Service labs are offering specialized analysis services to outside companies and organizations on a fee basis
- Center is working vigorously to help move a member company here or to expand an existing Utah company using CBI technologies
- Start-up company formed with three companies

LASER INSTITUTE

Dr. Richard C. Straight
University of Utah

Overview	
State Contract	$ 100,000
Matching Funds	$7,302,000
Benefitting companies	22
Industry jobs created	21
Fac/Staff/Grad Stud/Doc	6

Technologies

- Fiber optic lasers
- Light activated drugs
- Metal vapor laser applications
- Laser angioplasty
- Cardiac surgical laser devices
- Fluorescence sensors

Status

- 6 patent applications for for laser angioplasty and and endscopic devices with HGM Corp

Economic Impact

- HGM Corp. Utah startup company using center technology
- Over $7 million in matching from outside sources

CENTER FOR CONTROLLED CHEMICAL DELIVERY

Dr. Sung Wan Kim
University of Utah

Overview	
State Contract	$ 346,000
Matching Funds	$6,689,618
Benefitting companies	13
Industry jobs created	3
Fac/Staff/Grad Stud/Doc	34

Technologies

- Membrane transport
- Novel hydrogels
- Polymeric surfactants
- Macromolecular drugs
- Heparin removal filters
- Insulin delivery systems

Status

- Secured eight US patents and and currently has five more pending
- CCCD is the world center in in medical polymers and drug delivery systems
- Sponsors internatl symposium on drug delivery systems every other year
- Eight patents licensed to two Utah companies

Economic Impact

- TheraTech Inc. spinoff has 38 employees with $2.2 million in sales expected in 1989
- New spin-off company, Insutech/ TTI formed to specialize in insulin delivery systems
- Ciba-Geigy funding large projects with patents filed (royalty bearing to U/U)
- Research Medical, another Utah company now funding centers research on heparin filter

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CENTER FOR BIOCATALYSIS

Dr. Linda Powers
Utah State University

Overview	
State Contract	$ 500,000
Matching Funds	$1,376,756
Benefitting companies	17
Industry jobs created	0
Fac/Staff/Grad Stud/Doc	17

Technologies

- Parallel processing electronics
- Biocatalysis
- High speed high pulse lasers
- Infrared imaging
- Molecular design
- Bioanalytical instrumentation

Status

- New breakthrough in infrared imaging
- $500K in equipment installed
- Patent applied for "TransAcq" parallel processing module powers up a PC to be equal to a VAX 8650

Economic Impact

- "TransAcq" module being licensed to CSA a Provo Co.
- Breakthrough in infrared imaging could make significant contribution in early detection of cancer

CENTER FOR ADVANCED SUPERCRITICAL FLUID SEPARATION TECHNOLOGIES

Dr. Milton L. Lee
Brigham Young University

Overview	
State Contract	$ 376,440
Matching Funds	$1,980,344
Benefitting companies	25
Industry jobs created	59
Fac/Staff/Grad Stud/Doc	22

Technologies

- Supercritical fluid chromatography
- Chromatigraphics stationary phases
- Radio frequency plasma detector

Status

- Five patents issued
- Two patents have been transferred & commercialized by Utah company
- New breakthrough technology for high sensitivity detector nearing patentability

Economic Impact

- Spinoff company Lee Scientific with 59 employees and sales of $6 million annually
- $2 million in matching funds from outside sources

CENTER FOR X RAY IMAGING

Dr. Larry Knight
Brigham Young University

Overview	
State Contract	$360,000
Matching Funds	$648,524
Benefitting companies	51
Industry jobs created	6
Fac/Staff/Grad Stud/Doc	23

Technologies

- Atomic Layer Epitaxy (ALE)
- MultiLayer X-ray Optics
- Leading edge technology in X-ray imaging
- X-ray laser technology

Status

- Spin-off company MOXTEK created with 6 jobs & sales of $150K in 1989
- 10 years of experience in a difficult research area. Have become leaders with little or no competition
- Can create multi layer reflectors with film thicknesses (between 3 and 20A)

Economic Impact

- MOXTEK has received three Phase I SBIR grants
- Near term market for large & small X-ray windows is $6 million annually
- $100 million markets possible in medical & non destructive testing areas
- MOXTEK applying for Phase II SBIR's

INFORMATION TECHNOLOGIES

CENTER FOR SIGNAL PROCESSING

Dr. Richard W. Christiansen
Brigham Young University

Overview	
State Contract	$ 646,334
Matching Funds	$1,962,660
Benefitting companies	23
Industry jobs created	40
Fac/Staff/Grad Stud/Doc	29

Technologies

- VLSI research
- Image compression
- Speech processing
- Robotics controls for manufacturing
- Optimal estimation theory research

Status

- Initial image compression products now being marketed through Eyring Research Institute
- One patent applied for and another issued during third quarter 1989
- ICON donated one of their largest computers and operating capital to CSP
- Rights to hearing aid technology are now licensed

Economic Impact

- New company ASTECH with 24 employees created from center technology
- Deseret Digital Designs another new startup from center technology is in formation
- Soft Solutions an Orem, Utah company has licensed center technology to expand their product base
- Vector Technologies, another new company was formed to market image processing products from the center

CENTER FOR ADVANCED MATERIALS AND MICROELECTRONICS

Dr. Gerald B Stringfellow
University of Utah

Overview	
State Contract	$ 649,780
Matching Funds	$10,764,967
Benefitting companies	146
Industry jobs created	2
Fac/Staff/Grad Stud/Doc	36.5

Technologies

- Multiple layer epitaxy
- Microprocessor design
- III/V compound chip design
- Ceramics as solid electrolytes
- Composite materials

Status

- Focus on III/V compounds, composites & cermamics estb.
- Advanced material for infrared detection in 8-12 micron range designed & disclosed to patent office
- Advanced material to facilitate yellow solid state laser designed
- Leading edge research in bismuth oxide fuel cells
- Close collaboration with local composites manufacturers

Economic Impact

- Option on infrared detection chip license taken by Space Eng. Inc., Logan, Utah
- Bonneville Microelectronics start-up to commercialize products from center research
- Center heavily involved helping move a branch of IBM, Philips or Hewlett Packard to Utah
- Ceramatec, Beta Power Inc. and Edo Western are successful small high tech ceramics firms spun-out from ceramics research at U of U

CENTER FOR COMMUNICATIONS RESEARCH

Dr. Craig Rushforth
University of Utah

Overview	
State Contract	$ 210,120
Matching Funds	$1,556,371
Benefitting companies	8
Industry jobs created	0
Fac/Staff/Grad Stud/Doc	49

Technologies

- Multiple access communications
- Coded modulation systems
- High performance medical imaging
- Vector quantization
- Adaptive digital filters
- Neural networks

Status

- Technology transferred as it is developed to Unisys
- 2 patents granted on decoding algorithms
- TechniScan startup to commercialize computer imagery

Economic Impact

- Unisys using products for expansion of its Utah operations
- TechniScan a spin off company has been awarded a Phase II SBIR for $500,000 with $200K subcontract to Center for Communications Research

CENTER FOR COMPUTER INFORMATION NETWORKS RESEARCH

Dr. Bruce R. Peterson
Utah State University

Overview	
State Contract	$100,000
Matching Funds	$658,707
Benefitting companies	73
Industry jobs created	12
Fac/Staff/Grad Stud/Doc	12

Technologies

- Computer assisted methods for design analysis
- Research for local area & large computer networks:
  - +network optimization software
  - +network traffic models
  - +verification software

Status

- Research complete and commercialization now feasible
- Software needs to be written & documented for engineering work station usage

Economic Impact

- Assisted in creating ICOMP a company in Logan, with 5 employees
- New company spin off planned with potential sales of greater than $35 million per year
- Developed strong relationship with Novell

CENTER FOR COMPUTER-BASED EDUCATION

Dr. Gordon Stokes
Brigham Young University

Overview	
State Contract	$ 410,000
Matching Funds	$1,261,584
Benefitting companies	13
Industry jobs created	13
Fac/Staff/Grad Stud/Doc	32

Technologies

- Video disc
- Digital video interactive systems
- Computer authoring systems
- Computer adaptive testing
- Computer based instruction

Status

- World leader in and have over 47 products for foreign & English as a Second Language (ESL) instruction
- Recognized as a world leader in language acquisition technologies
- Developed and supports a consortium of over 350 public, private & governmental agencies using sophisticated technologies for foreign language and ESL instruction

Economic Impact

- Have created a private company Cali, Inc. to distribute products
- Sales of products were $650K for 1989 (up 33% over 1988)
- Project growth in 1990 to $2 million sales
- Currently 10 employees anticipating growth to 21 in 1990

CENTER FOR HANDICAPPED EDUCATION

Dr. Alan Hofmeister
Utah State University

Overview	
State Contract	$ 286,325
Matching Funds	$5,231,809
Benefitting companies	16
Industry jobs created	16
Fac/Staff/Grad Stud/Doc	32

Technologies

- Video Disc
- Digital video interactive systems
- Expert systems

Status

- Produced over 15 special education products using expert systems
- Video disc products in science and mathematics
- Recognized nationally as leading technology center for sophisticated use of technology and quality of instructional design
- Leading educational group using artificial intelligence for special education administration

Economic Impact

- $1.8 million from outside sources incl. SC, WY, Wash, FL, VA, MD
- Helped create Systems Impact a Salt Lake City company annual sales of $5-7 million and 16 employees
- Have developed special education products for the State of Utah that dramatically increased the the effectiveness of educators

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CENTER FOR PARALLEL SUPERCOMPUTING (new center)

Dr. Douglas Chabries
Brigham Young University

Overview	
State Contract	$300,000
Matching Funds	$17,950,0000
Benefitting companies	6
Industry jobs created	0
Fac/Staff/Grad Stud/Doc	0

Technologies

Phase I Beta test

Status

- Large opportunities to expand scope of center to benefit Utah
- Waiting for delivery of Evans & Sutherland ESI/200 Supercomputer
- Beta test site will include:
  - +training
  - +software porting and performance
  - +software development
- Could become unique nationally to compare supercomputer architectures

Economic Impact

- IBM provided a 3090 ($11.7MM)
- Convex donated upgrading components for a C-120 and a C-220 to supercomputer status with a $100K donation
- CSA donated a 16 processor system systolic processor for supercomputer at smaller workstations
- N^3 talking about $2 - 3MM equipment donation
- Amdahl discussing equipment donation

CENTER FOR SUPERCOMPUTERS (new center)

Dr. David M. Grant
University of Utah

Overview	
State Contract	$350,000
Matching Funds	$13,061,000
Benefitting companies	2
Industry jobs created	12
Fac/Staff/Grad Stud/Doc	0

Technologies

- Fully operational site

Status

- IBM 3090 installed at University of Utah (operational)
- Agreement signed between 3 universities for cooperative use
- Newsletter published giving information on access and use
- UNIX operating system under Beta Test

Economic Impact

- IBM has contracted for $13MM in matching funds
- Negotiating on printer technology with IBM (potential $2MM)
- Also negotiating visualization package worth approximately $2 million

CENTER FOR ADVANCED COMBUSTION ENGINEERING

Dr. L. Douglas Smoot
Brigham Young University

Overview

State Contract	$ 500,000
Matching Funds	$13,427,551
Benefitting companies	35
Industry jobs created	0
Fac/Staff/Grad Stud/Doc	97

Technologies

- Fuel structure reaction mechanisms
- Fuel minerals
- Mechanisms for pollutant formation and control
- Reacting, turbulent flows
- Comprehensive model development

Status

- Focus on national status as consortium of excellence in the science
- Continue to host national meetings & guest speakers
- True collaboration between universities

Economic Impact

- $13.4 million in matching funds generated
- 97 university related jobs funded

CENTER FOR COAL AND OIL RESEARCH

Dr. Larry Anderson
University of Utah

Overview

State Contract	$ 490,000
Matching Funds	$1,208,024
Benefittng companies	13
Industry jobs created	0
Fac/Staff/Grad Stud/Doc	44

Technologies

- Coal slurry transport
- Resin extraction from Utah's unique high resin coal
- Differential liquefaction
- Low profile fluid catalytic cracker for oil

Status

- Patent applied for on new method of extracting resin from coal
- One of the top three centers for coal research in the nation
- Low profile fluid catalytic cracker has advanced to a "hot" model stage

Economic Impact

- New patent important to proposed joint venture that will produce 50,000 tons of resin per year (using 2.5 million tons of Utah coal)
- Research supports small ink business in Price, Utah
- New patent effecting the processing of 8MM BPD of petroleum
- Has potential for 1,000 jobs in 5 yrs

CENTER FOR CHEMICAL SEPARATIONS

Dr. Reed Izatt
Brigham Young University

Overview

State Contract	$606,645
Matching Funds	$924,972
Benefitting companies	80
Industry jobs created	6
Fac/Staff/Grad Stud/Doc	22

Technologies

- Pilot plant scale up for individual separations
- Individually designed macrocycles for molecule separations
- Patented technique for attaching macrocycles to solid substrate allows for reuse

Status

- Methodology for precious metals separations developed
- Selling product to industry
- One patent issued 13 applied for
- Need to develop capability in gas, high purity materials and biological separations
- Capability in environmental, analytical & precious metals markets

Economic Impact

- Created spin-off company IBC with 6 jobs & sales of $200K in 1989 ($40K in 1988)
- Company attracting many sources of growth capital
- Process for separating platinum rhodium represents a 40-60% cost reduction to the industry
- Plan calls for $10 MM in sales by 1993

CENTER FOR PYROMETALLURGICAL TECHNOLOGY

Dr. H. Y. Sohn
University of Utah

Overview

State Contract	$113,680
Matching Funds	$168,000
Benefitting companies	3
Industry jobs created	0
Fac/Staff/Grad Stud/Doc	7

Technologies

- Oxygen bottom blowing (QSL-K process)

Status

- Computations continuing prior decision to implement

Economic Impact

- Application of this technology will be aimed at making copper smelting operations more competitive

CENTER FOR BIOTECHNOLOGY

Dr. Steven Aust
Utah State University

Overview

State Contract	$ 700,000
Matching Funds	$2,488,472
Benefitting companies	76
Industry jobs created	0
Fac/Staff/Grad Stud/Doc	22

Technologies

- Fermentation biology
- Microbiology
- Molecular biology
- Monoclonal antibodies
- Data analysis

Status

- White rot fungus renders PCP's & PCB's harmless in the laboratory
- Field trials underway but first data irratic due to field conditions
- Replications under way in the field
- Treatment of creosote contaminated water has shown effective cleanup in in laboratory

Economic Impact

- Utah Power & Light funding research & have potential interest in helping research to be commercialized
- Blanket patent has issued for fungus used for environmental clean-up purposes
- Market for cleaning up contaminated sites is extremely large
- USU Biotechnology Building started after center was funded is now nearing completion

CENTERS OF EXCELLENCE PROGRAM
Planning Grants Summary
(Since 1986)

1.	Biotechnology	$10,000
2.	Water Information Science & Control	10,000
3.	Advanced Fossil Fuel	15,000
4.	Advanced X-Ray	7,500
5.	Communications	10,000
6.	Microelectronics	10,000
7.	Non-Intrusive X-Ray	7,500
8.	Developing Heavy Oils to Asphalt	10,000
9.	Tar Sand Binders	15,000
10.	Quality and Integrity Design	10,000
	Subtotal:	105,000
	Recovered:	(15,000)
	TOTAL:	$90,000

CENTERS OF EXCELLENCE PROGRAM

QUARTERLY REPORT

LYNN H. BLAKE, Ph.D.
DIRECTOR, CENTERS OF EXCELLENCE PROGRAM
1 JUNE 1989

UTAH CENTERS OF EXCELLENCE PROGRAM
QUARTERLY REPORT
1 JUNE 1989

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CENTERS OF EXCELLENCE PROGRAM
SUMMARY

Center by Area of Technology	# of Assoc.	#of Contrib.	$ Amt. of Contribution	State $ Contract	New Comp.	Viable New Comp.
BIOMEDICAL TECH.						
Artificial Heart	59	19	$ 15,595,167	$ 325,000	0	0
Biopolymers	40	27	6,304,918	350,000	1	0
Laser Institute	21	17	7,302,000	100,000	0	0
Sensor Tech.	7	8	1,206,075	75,000	0	0
MANUFACTURING TECH.						
CAD/CAM	76	8	8,905,917	383,000	0	0
CIM (sub-cont.)	17	16	525,595	244,000	3	0
Utah Research Inst.	57	7	676,360	778,000	0	0
Materials Mfg.	123	63	2,807,786	180,700	0	0
ENGINEERING TECH.						
Engineering Design	93	14	6,448,728	573,000	1	1
X-Ray	46	3	613,845	225,000	0	0
Supercritical Fluid	7	19	1,603,405	376,440	0	0
Quality & Integrity	39	9	707,000	200,000	0	0
NATURAL RESOURCES						
Combustion Eng.	15	38	13,427,551	500,000	0	0
Coal & Oil	10	13	1,208,024	315,000	0	0
Chemical Separation	62	7	528,917	399,209	1	1
Pyrometallurgical	1	2	168,000	73,680	0	0
COMMUNICATION & INFORMATION						
Signal Processing	16	29	1,962,660	396,334	5	0
Microelectronics	15	15	7,957,181	244,080	1	0
Communications Res.	4	5	807,920	210,120	0	0
Computer Networks	71	7	658,707	100,000	0	0
Computer-based Educ.	13	6	1,261,584	205,000	0	0
Base-technical Educ.	33	13	516,946	97,000	0	0
Handicapped Educ.	11	13	2,451,824	133,000	0	0
SPACE ENGINEERING & APPLICATIONS						
Space Engineering	27	22	78,533,913	850,000	1	1
Aerospace	32	49	1,412,381	430,000	1	0
BIOTECHNOLOGIES						
Biotechnology	63	10	2,488,472	500,000	0	0
Cont. Chem. Del.	5	9	6,689,618	346,000	2	0
Biocatalysis	10	4	830,156	500,000	0	0
TOTALS:	973	452	$173,600,650	$9,109,563	16	3
PLANNING GRANTS				80,000		
			TOTAL:	$ 9,189,563		

CENTERS OF EXCELLENCE ADVISORY COUNCIL
MEMBERSHIP

Mike Alder, Vice Chairman
NPI
417 Wakara Way
Salt Lake City, Utah 84108

David Bailey, Managing Partner
Eagle Place Partners
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Salt Lake City, Utah 84101

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Deseret Research
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Salt Lake City, Utah 84108

CENTERS OF EXCELLENCE PROGRAM
DEFINITION OF TERMS

Center of Excellence

Located at a Utah Institution of Higher Learning, a Center is a designated location where specific research and development is conducted, and technology transfer takes place, leading to commercialization of the products of that research.

Principal Investigator

The Center Director who has instigated the research and is responsible for the direction of all affairs of that Center.

Associations

Agencies, companies, or individuals with whom a channel of communication has been established; potential contributors to the Center.

Contributors

Agencies, companies, or individuals who have contributed cash or in-kind donations to the Center, or who have purchased technology, goods or services from the Center.

Amount of Contribution

Dollar amount of donation, cash value of in-kind contribution, or income generated by the sale of technology, goods or services from the Center. This may be actually received, or committed at the time of this report. This is described as "Matching Funds."

State Contract

Dollar amount of commitment to the Center by the State Department of Community and Economic Development. State monies are not released until documentation of match dollars from the institution is received.

New Companies

Utah companies formed since the effective date of the Contract between the Department of Community and Economic Development and the institution of higher learning.

Companies from Center Technology

New companies formed from the research and development of the specific technology at the institution.

CENTERS OF EXCELLENCE PROGRAM
SUMMARY
PLANNING GRANTS

1986 Planning Grants:

1.	Biotechnology	$ 10,000
2.	Water Information Science & Control	10,000
3.	Advanced Fossil Fuel	15,000
4.	Advanced X-Ray	7,500
5.	Communications	10,000
6.	Microelectronics	10,000
7.	Non-Intrusive X-Ray	7,500
8.	Developing Heavy Oils to Asphalt	10,000
9.	Tar Sand Binders	15,000
	Subtotal:	95,000
	Recovered	(15,000)
	TOTAL:	$ 80,000

CENTERS OF EXCELLENCE PROGRAM
SUMMARY
RATIOS AND AVERAGES

Ratio of Committed Match to the State Commitment - 19.1

Average of 16 Contributors per Center

Average of 34 Associations per Center

CENTER FOR TOTAL ARTIFICIAL HEARTS
AND BIOMEDICAL DEVICES

Dr. Donald B. Olsen
University of Utah

Contract Amount: $325,000

The main focus is on the development of artificial organs such as the heart and monitoring and diagnostic devices, artificial fallopian tube, urinary bladder, urethra, sphincter and ureter.

A patent has been applied for on Non Invasive Measurement of Pressure in an Artificial Heart. Proposals have been submitted for Thrombogenesis in Blood pumping Devices, and 100ml Stroke Volume Eliptical TAH in 50kg Recipients, to the National Institute of Health.

An Individual National Research Service Award Application on Interfacing Cardiac Assist Devices to Animals has been submitted to the National Institute of Health.

Matching Funds Source	In-Kind	Cash
Source		
Symbion Surgical Training		328,378
Dr. Kwon (electromechanical heart)		70,000
NIH Immune Response		512,885
NIH Small Art. Heart with Minimum Thrombosis: Bridge for Transplant		1,281,060
NIH Studies of Atrial Naturietic Peptide		568,600
NIH Inhibitor of Platelet Adhesion		97,801
NImbus, Inc. Hemopump System		144,923
Deseret Medical:		
Catheter Studies 1987		7,221
Catheter Studies 1988		27,221
Murex Foundation:		
Vacuum Formed TAH Studies 1987		25,257
Vacuum Formed TAH Studies 1988		47,335
NIH Artificial Heart		5,592,112
Centers of Excellence Program		500,000
University of Utah Matching Funds		600,000
NIH 100ML Stroke Volume Elliptical TAH		2,410,249
Development Account:		
Private Gifts 1987		70,000
Private Gifts 1988		55,000
NIH Energetic Comparison of Ventricular Assist Techniques		509,924
The Ottawa-Utah EVAD Program		2,747,350
	TOTAL: $	15,595,167

Companies Associated Since Beginning of Contract

1. ADAHF/NBS (Branko Tomazic)
2. Alexander Hospital, Athen, Greece, (Anastasis Poyiadjis)
3. Anethole J. Sipped Co., Inc., NY
4. Automatic Detections (Veal Pure)
5. BBC, London, (John Palfryman)
6. Baron Technologies
7. Biomaterials International, SLC, UT
8. Braci, Argentina, (Daniel Bracco)
9. Bristol Myers, (Bob Ripps)
10. Buckhart University, (Ruth Aachen)
11. BYU Kenneth Solen, Ph.D.
12. Cardiac Systems, Philadelphia
13. Catheter Technology
14. Chirrng Klinik Charito, Berlin, GDR, (Bernar Schubel)
15. Cleveland Clinic, (Michiaki Matsushita, M.D.)
16. Clinico Shapio, Bogota, Columbia (Dr. Hernando Orjuela)
17. CSSR Academy of Science
18. Department Anesthesi, Rea Hos. Cardio, Lyon, France (Claude Girard)
19. Deseret Medical
20. Dr. S.W. Kim Group,(K. Mukae)
21. Eagle Place, Inc. (Glenn Stuart)
22. Eli Lilly Co., (David Lipson)
23. Evogelismos Los, Athens, Greece (Christos Charitos)
24. Falcon Technologies
25. Frankfort Institute, (Prof. Dr. Klaus Gersonale)
26. Funacion Faualoro Senatorrio Guemes, Argentina (Jorge Issac Menolez)
27. G.M Research Lab - Audrey Porpas
28. Hospital Cor., Jordan Valley, (Stu Brerson)
29. IDON Corp., Ottawa, Canada
30. Institute of Medicine, Genetics, Moscow, USSR, (Nikolai Bochkov)
31. Institute of Transplantology, Moscow, USSR
32. Johns Hopkins School of Medicine, (Jon Peters)
33. Kyoritu College of Pharmacy (Tohiko Oese)
34. Kyushu University, (A. Takahara)
35. LEXCO, Hyland, IL
36. L'Express, Paris, France, (Charles Gilbert)
37. McCliur of Condiotey Llensu Acoleui of Uedinmo, Poland, (Todeun Petelur)
38. Medical Council of the Latieur SSR Health Ministry (Igor Stephanov)
39. Moscow, All-Union Cardiology Research Center, (George Dzhibladze)
40. Mountain View Pediatrics, (Dr. David Folland)
    National Cardiovac. Research Center, Osaka, Japan
41. National Center of Surgery, USSR, (Sergei G. Dzemeslkevich)
42. Nelson & Associates, Inc. (Dan Nelson)

43. Nimbus, Inc. (Richard Warple)
44. Okayama University, (Hiroyuki Ire)
45. Ottowa Heart Institute, (E.M. Farrell)
46. Oxian Jiaotong, Xian, China, (Dazong Jiang)
47. PSR-Utah (Karen Glynn)
48. Physicians for Social Responsibility, (Nanacy Moorehead)
49. Research Technologies
50. Seoul National University Hospital, Korea (Dr. Hyuk Ahn)
51. Soviet C-TTEE of Physicians, Moscow, USSR, (Alexei Dmitriev)
52. St. Jude Medical, St. Paul MN
53. St. V. Hospital, LA, CA, (Dr. Frank Versteeg)
54. Time Magazine, (Jon D. Hall)
55. Tokyo Medical & Dental University (N. Yui)
56. Tokyo University (Nabuharu Takai)
57. Tokyo Women's Medical College, (K. Kataoka)
58. Tyobo, (K. Nakamisan)
59. U C of D Medical Center, (Tsuyosti Kawamura, M.D.)

CENTER FOR BIOPOLYMERS AT INTERFACES

Dr. Karin D. Caldwell — Contract Amount: $350,000
University of Utah

The main foucs is to develop a thorough understanding of interfacial interactions essential for the control of processes and the design of products in many areas of industry including food processing, medical devices, scientific instruments, pharmaceuticals, cosmetics, soaps and detergents, sensors and controls, coatings, and many areas of biotechnology.

The Center receives support from ten participating corporations, seven of which have been members since its inception. Representatives of these corporations meet in Utah twice a year to evaluate the Center's performance. The Center participated in the successful bid for $19.8 million in federal funding to construct a new Biomedical Polymers Building at the University of Utah. One patent application and one spin-off company)Protein Solutions, Inc.) have resulted from the Center's activities.

Matching Funds	In-Kind	Cash
Funds		
Allergan Optical		45,000
Bausch & Lomb		60,000
Bausch & Lomb Fellowship Support		30,000
Baxter Healthcare		60,000
Baxter Healthcare Fellowship Support		30,000
Becton-Dickinson		60,000
Becton-Dickinson Fellowship Support		30,000
Biosym Technologies	120,000	
Cardio Pulomics		5,000
Ciba-Geigy		60,000
Ciba-Geigy Fellowship Support		45,000
E.I. Dupont de Nemours		45,000
Eastman Kodak Co.		60,000
Eastman Kodak Co. Fellowship Support		10,000
Eli Lily		60,000
HyClone Laboratories		5,000
Johnson & Johnson		30,000
Proctor & Gamble		15,000
Silicon Graphics Corp.	120,000	
Sola/Barnes-Hind Ophthalmic		30,000
U.S. Army Award #DAAL 03-87-K-0134 (Andrade)		524,029
O.N.R. #NOO 14-88-K-0415 (Bascom)		23,743
NIH 1 RO1 GM38008-01AS1 (Caldwell)		609,221
NIH 1R 23A 122898-01 (Herron)		153,925
NSF Award #EET-8705355 (Herron, Caldwell, Andrade)		114,000

Biopolymers Building (1/5), (Federal)	3,960,000	
Subtotals:	4,200,000	2,104,918
TOTAL:		$ 6,304,918

Companies Associated Since Beginning of Contract

1. 3M
2. AKZO
3. Alcan International
4. Allergan Optical
5. BASF
6. Bausch & Lomb
7. Baxter Health Care Corp.
8. Becton-Dickinson
9. Berol Inc.
10. Biometric Systems, Inc.
11. BioPolymers Inc.
12. Biosym Technologies
13. CardioPulmonics, Inc.
14. Celanese
15. Ciba-Geigy Corp.
16. DSM Corporation
17. DuPont de Nemours & Co.
18. Eastman Kodak Co.
19. Eli Lilly & Co.
20. Exxon
21. Fugi
22. Genetech
23. Hercules
24. Hoechst
25. Hyclone Laboratories
26. Idemitsu
27. Johnson & Johnson
28. Kabi
29 Kimberly Clark
30. Miles Laboratories, Inc.
31. Nygene Corp
32. Pharmacia
33. Procter & Gamble
34. Protein Solutions, Inc.
35. Silicon Graphics Corp.
36. Sola-Barnes Hind Ophthalmic
37. TTI
38. Technical Research Associates
39. Terumo
40. W.L. Gore

LASER INSTITUTE

Dr. Richard C. Straight — Contract Amount: $100,000
University of Utah

The main focus is the development of cardiac surgical laser devices, drugs (photosensitizers), fluorescence sensors, laser fibers and laser power sources in the photodynamic therapy of cancer, and multiple wavelength treatment capabilities for Laser surgery.

Recent developments include the attraction of American Cyanamid who owns Lederle, who is interested in the photodynamic area, and other development. The Strategic Defense Inititative Technology Transfer Contractors Meeting was held at the Laser Institute, and invited the program to submit for housing and installation of a free electron laser.

The Center provided assistance to the Canadian Government in establishing a new network of centers for laser photodynamic technologies. Dr. Straight served as one of five international peer reviewers meeting in Ottawa, Canada to advise the Canadian Government's Intercouncil Program Directorate for Science and Technology, establishing a new science and technology link between the Canadian government and industry and the University of Utah Laser Institute.

Dr. Straight organized and contributed to the scientific program of an international conference on future applications of lasers in America. The meeting was held in Florida, 3-7 March 1989 and involved leaders in academia, government and industry.

New support was obtained from the Treadwell Foundation in the amount of $60,000, for laser angioplasty, with a future committment of $240,000 to begin 1 July 1989.

Matching Funds Source	In-Kind	Cash
Phaser-R Corp Flashlamp Pumped Dye		35,000
Cooper LaserSonics Copper Vapor Laser		70,000
Treadwell Foundation		35,000
Virginia Zambukas Estate		43,000
Cooper Gold Vapor Laser		39,000
Phase-R Medical Stone Fragmentation		20,000
Wolf Corp. Lithotriptor		70,000
HGM Engineering Support for Angioplasty & Endoscopy		8,000
Sharplan, Inc.		38.000
Naval Research SDIO 84-88-C-0029		4,500,000
Office of Naval Research - Lasers in Biomed.		1,200,000
Office of Naval Research - Lasers in High Energy		800,000
American Cyanamid - Lederle		78,000

Laser Photonics	128,000
Pfizer Laser Systems	28,000
American Cynamid	150,000
Treadwell Foundation	60,000
TOTAL:	$ 7,302,000

Companies Associated Since Beginning of Contract

1. American Cyanamid Corporation
2. 3M, St. Paul, MN
3. California Laboratories, Carlsbad, CA
4. Concepts, Inc., Clearwater, FA
5. Cooper Lasersonics
6. Eder Instruments
7. HGM Medical Lasers, SLC, UT
8. Lasers for Medicine
9. Laser Institute of America, Toledo, OH
10. Luxtron, Mountain View, CA
11. Metalasers, Inc., Santa Clara, CA
12. Olympus Corp. of America
13. Pfizer Hospital Products
14. Primed, SLC, UT
15. QLT, Inc. of Vancouver, Canada
16. R. Wolfe
17. SLT, San Carlos, CA
18. Smith Arthroscopic, Los Angeles, CA
19. Treadwell Foundation
20. Wolf Corporation, Rosement, IL
21. Xanar

CENTER FOR SENSOR TECHNOLOGY

Dr. Jiri Janata
University of Utah

Contract Amount: $75,000

The main focus is on integration of solid state electronics, chemistry, physics and biology and investigation and application of the physiological and biochemical principles of sensing.

Matching Funds Source	In-Kind	Cash
NIH - Remote monitoring of Proteins		281,016
Office of Naval Research		285,879
Whitaker Foundation		143,977
NIHR		195,203
Boeringer Mannheim		75,000
Ciba Corning		75,000
IC Sensors		75,000
Sorin Biomedica		75,000

TOTAL: $1,206,075

Companies Associated Since Beginning of Contract

1. Baxter Travenol
2. Boehringer Mannheim
3. Ciba-Corning
4. Eli Lily
5. I.C. Sensors
6. Sorin Biomedica (Italy)
7. Unilever

CENTER FOR COMPUTER AIDED DESIGN AND MANUFACTURING

Dr. Warren F. Phillips
Utah State University

Contract Amount: $515,000
($132,000 subcontracted to Brigham Young University)

The main focus is research in computerized drafting, 3-D design, solid modeling, finite element modeling, numerical controlled manufacturing, robotics, facilities management, plant monitoring and control, data base management and inventory planning.

Matching Funds Source	In-Kind	Cash
Structural Dynamics Co.		252,000
Dassault Systems Co.		219,000
Lockheed Co.		123,000
Mac-Neal Schwendler		48,000
Morton-Thiokol		25,000
NASA		168,310
Consulting by Consortium	42,717	
IBM		8,027,890
Subtotals:	42,717	8,863,200
	TOTAL:	$ 8,905,917

Companies Associated Since Beginning of Contract

1. ADEM Ingenieurs Consells (Belgium)
2. Alca Engineers
3. AMAAX Coal Company
4. Atascadero Mutual Water Co.
5. Aktiengesellschaft (Germany)
6. B & A Engineering, Inc.
7. Banner & Associates
8. Boeing Computer Services
9. Bohannan-Huston, Inc.
10. Bountiful Engineering Department
11. Casper Board of Public Utilities (Wyoming)
12. Center for Mgmt., Utilities, & Water Protection (Tennesse)
13. Central Utah Water Conservancy District
14. CE-DATE A/S Byggeteknish (Denmark)
15. CH2M-Hill (Oregon)
16. Coldwell Richards & Swensen
17. Costin Engineering Company
18. Department of Natural Resources, Div. of Water Resources
19. EI Dupont DeNemours & Co.
20. ELC Electron Consulting Spa (Italy)

21. EMC Engineering, Inc.
22. East Bay Municipal Utility District (California)
23. Eduardo Ribeiro (Portugal)
24. Emery Mining
25. Engineering Dept. of Bountiful, Utah
26. Fars Regional Authority
27. FEMA (Colorado)
28. FLOOD Engineers (Florida)
29. Ford Engineering, Inc.
30. Forsgren-Perkins Engineering
31. Getty Mining Co.
32. Gingery Engineering Co.
33. Goodyear Atomic Corporation
34. Hercules
35. Holmes & Marver, Inc.
36. Howard Godat & Assoc. Inc.
37. J-U-B Engineers, Inc. (Idaho)
38. Jacksonville Florida (City)
39. Jones & Associates
40. KBNA Engineers, Inc.
41. Katholieke Universiteit (Belgium)
42. Knighton Engineering
43. Lafayette City (Louisiana)
44. Malcom-Pirnie Consulting Engineers
45. Marbury Engineering Co.
46. Merrick & Company
47. Montgomery Engineers (California)
48. NASA
49. Office National de l'eau Potable (Morocco)
50. Oregon Institute of Technology
51. PRC Toups. Div. of PRC Engineering
52. Pacific Power & Light
53. Psomas & Associates (California)
54. Petro Canada Exploration, Inc.
55. Pyramid Engineers & Land Surveyors (Nevada)
56. Raymond Vail & Associates
57. Robert C. Bogart & Associates
58. Roen Design Associates, Inc.
59. SAINCO (Spain)
60. Sierra Pacific Power Co.
61. SYMCAS, Inc.
62. TUV (Germany)
63. TRACOR Applied Sciences, Inc.
64. TRACOR Hydronautics, Inc.
65. Troltz, King, Durall, Anderson & Associates
66. UMA-Engineering Unlimited
67. UN Proyector Conacyt (Mexico)
68. Universal Engineering Corp. (Switzerland)
69. USAID/EQUADOR
70. VTM Consolidated, Inc.
71. W.E. Quicksall & Assoc., Inc.
72. Weber Basin Water Conservancy

73. West National Technical Center Soil Conservation
74. Wiley & Wilson (Virginia)
75. Willdan Associates
76. Yampa Valley Coal Company

CENTER FOR COMPUTER INTEGRATED MANUFACTURING

Dr. Dell K. Allen — Contract amount: $112,000
Brigham Young University — Sub-Contract from USU: $132,000

The main focus is on development and application of software, hardware and courseware, required for manufacturing sustems integration; including CIM framework architecture, CIM information system, CIM strategy with applications for planning and manufacturing parts on demand.

Matching Funds Source	In-Kind	Cash
Hewlett Packard		15,000
DCLASS Software Royalties		9,600
Avco Lycoming		125,000
Avco Lycoming		40,000
Oracle, Inc.	35,500	
Novell	3,000	
MSC	70,000	
Texas Instruments		500
CAM Software		2,500
C.A.O.		5,000
Autodesk	23,000	
Textron Lycoming		164,200
Remex	15,000	
Interlan	5,800	
ProMOD	5,000	
VersCAD	1,495	
Subtotals:	163,795	361,800
	TOTAL:	$ 525,595

Companies Associated Since Beginning of Contract

1. Autodesk, Inc.
2. Berrett Consulting
3. CAM Software, Inc.
4. CIM Training Center
5. InfoQuest
6. Interlan
7. Northrup Corp.
8. Oracle Corp.
9. ProMOD
10. Remex
11. SmartWare, Inc.
12. Texas Instruments

13. Textron Lycoming
14. U.S. Army
15. Verscad
16. Visher Systems
17. Whirpool Corp.

UTAH RESEARCH INSTITUTE

Dr. David Norton
Utah State University
University of Utah
Brigham Young University
Weber State College

Contract Amount: $676,360

The main focus is to establish a policy objective of improving the technology base for economic development in Utah. This Center furthers that objective by: (a) encouraging interdisciplinary research in target areas; (b) strengthening the interaction and cooperation between university and industry; and (c) thereby accelerating the application and commercialization of university research.

URI has completed the high level architecture required for the major project, Parts on Demand System (PODS). Consortium team members are presently defining the individual module architecture. Ten of the twenty-three target industries have been visited and are in the review process at this time. Each is being asked to be a PODS sponsor for $1.25 million over a five year period.

The Request for Proposal (RFP) for a Spare Parts Production and Reprocurement Information System (SPARES) will be let by the Air Force in April 1989. Statements of Qualifications are under review within the Air Force in order to determine the appropriate proposal format and who is qualified to receive the RFP.

In addition to teaming with General Atomics and Systems Research and Applications Corporation, URI has teamed with General Electric. General Electric provides the applicable manufacturing expertise and the capability to demonstrate the prototype of SPARES.

Matching Funds Source	In-Kind	Cash
(Consortium of Companies)		45,000
Rust Engineering		60,000
Marine Dynamics Biometrics		54,000
IBM		500,000
SAH Mechanical Design	2,200	
Elkhart Products		160
Renex Controller	15,000	
Subtotals:	17,200	659,160
	TOTAL:	$778,000

Companies Associated Since Beginning of Contract

1. AFWAL
2. Air Italia
3. Army Tooele Depot
4. Arthur Anderson & Company
5. The BDM Corporation
6. Battell
7. Clyde Digital
8. Data Catcher
9. Dynamac
10. Dynamics Research, Inc.
11. ERC
12. Emerson Electric
13. First Productivity
14. GA Technologies
15. GTE Government Systems
16. General Dynamics
17. Geometric Computing
18. HQ AFLC
19. Hughes Aircraft
20. IBM
21. ISC Technologies
22. Iomega
23. Japan Air
24. Korean Air
25. Logetec
26. Marine Dynamics Biometrics
27. McDonnell-Douglas
28. Morton Thiokol
29. McDonnell Douglas - IMET
30. McDonnel Douglas - Longbeach
31. National Bureau of Standards
32. NESCO Telecommunications
33. Northrup
34. Ogden Air Logistic Center
35. Ogden Machine
36. Odgen ALC Material Management
37. Oklahoma ALC
38. Pratt Whitney
39. Reynolds Aluminum
40. Rockwell
41. Rolls-Royce
42. Rust Engineering
43. Sacramento ALC
44. Samsung
45. San Antonia ALC
46. Simulator Engineering Division
47. South Carolina Research Authority
48. Standard Electric Lorenz

59. Sunstrand
50. Sverdrup
51. VSE
52. Warner Robbins ALC
53. Westinghouse
54. Ogden ALC - Software Technology Support Center
55. Ogden ALC - Maintenance Division
56. AFIT
57. Transoft International

CENTER FOR MATERIALS AND MANUFACTURING

Dr. Ron Gordon
University of Utah

Contract Amount: $180,700

The Center has made significant accomplishments in strengthening the materials characterization facilities in thermal analysis, scanning electron microscopy and electron microprobe and quantitative micro x-ray analysis (EDAX). This was accomplished by the purchase of a sophisticated differential thermal analysis system.

Matching Funds Source	IN-Kind	Cash
DuPont		5,130
Arup		10,000
EG&G Idaho, Inc.		31,070
Finegan		12,000
Galtech Semiconductor		25,000
Geocenters		55,000
NASA		177,711
U.S. Department of Energy		75,000
U.S. Navy		30,000
Winding Technologies		148,000
DOE: Alumina-Tetragonal Zirconia Composites		125,728
ARO: Paritally Stabilized Zirconia		91,977
NASA: Structural Ceramics in Multiaxial Loading		59,753
GRI: Solid Electrolytes for Solid Oxide Fuel Cells		50,000
DARPA Toughening Ceramics		65,000
Dow: Toughening Ceramics		30,000
Ceramic Matrix Cojmposites		14,983
NASA: properties of Carbon Fibers		50,011
NASA: Fractography of Composite Delamination		22,344
NASA: Fraction and Wear of TPS Fibers		27,360
NASA: Carbon Fiber Composite Strength		56,000
Liquid Phase Chromatography	15,000	
Hercules		18,857
Morton Thiokol		12,000
Dupont		10,000
Quality Composites		600
Hercules: Impact Damage Modeling		40,000
Hercules Scaling		19,000
Hercules: Impace Apparatus		16,500
Hercules Fatigue Tests		9,900
Lawrence Livermore: Compressive Strength		75,678
Atlantic Research		10,000
National Science Foundation		70,000
DOD: Ion Trap Mass Spectrometry		58,000

NATO: particulate Matter Pyrolysis		5,000
Galtech		10,000
IBM: Carbonaceous Residue		202,771
Winding Technologies	12,000	
BYU Tech	14,000	
SAMPE	2,000	
BYU Chemistry	500	
Shell Oil	33,668	
Grumman Aircraft	6,850	
R Cubed Composites	1,500	
Mics.	1,982	
NSF: Crystalline Polymers		230,000
USA ROD: polar Polymeric Dielectrics		185,000
DuPont: Polymers		1,000
ACS/PRF: Fracture in Polymers		18,000
DuPont: Fracture of K Polymers Composites		15,000
DuPont: Surface Embrittlement of Polymers		5,139
DuPont: Test System for Composites	35,000	
Evans & Sutherland		5,000
National Science Foundation (R.H. Boyd)		76,500
National Science Foundation (T. Hsu)		62,000
E.I DuPont (LCRL82505)		20,000
NASA (#5-28320)		116,000
Department of Energy (#5-27152)		112,987
Allied Signal (#6-46459)		14,000
Sandia Labs (#5-25066)		21,000
GRI Ceramatec (#5-25027)		49,933
Navy/S. Guruswamy (#5-28218)		8,100
IBM (Equipment Gift)	25,000	
Subtotals:	147,500	2,660,286
	TOTAL:	$ 2,807,786

<u>Companies Associated Since Beginning of Contract</u>

1. ARI
2. Abbott Critical Care, Murray, UTah
3. Aberdeen Proving Ground, Aberdeen, MD
4. Advanced Research Corporation, Santa Barbara, CA
5. AEROCOR Corporation, Ogden, UT
6. Aerodyne, INc., Ballerica, MA
7. Air Force Aeronautical Systems Div., Wright Patterson AFB, OH
8. Air Force Systems Command, Washington DC
9. Ames Research Center, Moffett Field,, CA
10. American Chemical Society
11. American Cyanamid

12. Applied Health Physics, Albany, NY
13. Army Missle Command, Redstone Arsenal, AL
14. Army Armamant Research, Dover, NJ
15. Army Laboratory Command, Adelphi, MD
16. Arthur Young Int'l.
17. Avantek, Inc., Santa Clara, CA
18. Bausch & Lonb, Rochester, NY
19. Beta Power, Inc., SLC, UT
20. Boeing, Seattle, WA
21. Bourns Precisions/Controls, Ogden, UT
22. Breakthrough
23. Campbell Scientific, Inc., Logan, UT
24. Center for Research in MSE, Austin, TX
25. Ceramatec, SLC, UT
26. Chrysler Corporation, Highland Park, MI
27. City Development, Inc.
28. Contour Composites, Woods Cross, UT
29. Delmed, Inc., Ogden, UT
30. Deseret Medical Inc., Sandy, UT
31. Diversified Tech Inc., Sandy, UT
32. DOE Chicago Operations
33. Dow Chemical, Midland, MI
34. Dugway Proving Ground, Dugway, UT
35. Eastman Kodak Co., Rochester, NY
36. EDO Western, Salt Lake City, UT
37. E.I. DuPont de Nemours & Company, Philadelphia, PA
38. Employment & Staffing Specialist, Elgin AFB, FL
39. Engineering Research Center, Boulder, CO
40. ERM Southwest
41. Evans & Sutherland, SLC, UT
42. Ford Aerospace & Communications, NeEwport Beach, CA
43. Galtech Semiconductors, Mt. Pleasant, UT
44. Garrett Turbine Engine Company, Phoenix, AZ
45. General Dynamics, CoOnvair Dir.
46. General Motors Corp., Detroit, MI
47. GoeCenter
48. George C. Marshall Space Flight Center, AL
49. Grumman Aircraft Systems, Bethpage, NY
50. Hercules Aerospace Corporation, Magna, UT
51. Hercules, Inc., Magna, UT
52. Hercules, Ins., Wilmington, DE
53. Hewlett Packard Co., Palo Alto, CA
54. Hill Air Force Base, UT
55. Hiltech
56. Hodson Chemical Construction, North Salt Lake, UT
57. Hoechst Cleanese Corp.
58. Honeywell Systems & Research Center, Minneapolis, MN
59. Hughes Aircraft Co., Los Angeles, CA
60. Huntsman Chemical, Slat Lake City, UT
61. IBM, Inc., San Jose, CA
62. ICI, Inc., Wilmington, DA
63. ICSB/DPCS, Langley AFB

64. Institute for Reliability, AFIT, Dayton, OH
65. Institute for Study of Fatigue, Washington, DC
66. International Technology Corporation
67. Jet Propulsion Laboratory, Pasadena, CA
68. Kansas State University, Manhattan, KS
69. Korean Institute of Science & Technology, Cambridge, MA
70. Langly Research Center, Hampton, VA
71. Litton Industries, Salt Lake City, UT
72. Litton Industries, San Carlos, CA
73. Massachusettes Institute of Technology, Cambridge, MA
74. McDonnell Douglas Astronautics Co., Huntington Beach, CA
75. McDonnell Douglas Helicopter, Phoenix, AZ
76. Mercury LPE, Philadelphia, PA
77. Merrell Dow Research Institute
78. Morrison-Knudsen Engineering, Inc.
79. Morton Thiokol, Inc., Brigham City, UT
80. Mountain West Plastics Corporation, Logan, UT
81. National Security Agency, DOD, Ft. George G. Meade, MD
82. Naval Air Propulsion Center, Trenton, NJ
83. Naval Research Laboratory, Washington, DC
84. New Mexico State University, Los Cruces, NM
85. North American Weather Consultants, Salt Lake City, UT
86. Pacific Engineering, Reno, NV
87. Parker Hannifin Corporation, Salt Lake City, UT
88. Penwalt Corp., Pharmaceutical Div.
89. Phillips 66 Company, Bartlesville, OK
90. Proctor and Gamble Co.
91. Purdue University, West Lafayette, IN
92. Quality Composites, Inc., Riverton, UT
93. R Cubed Composites, Inc., Murray, UT
94. Rand Corporation, Santa Monica, CA
95. Raychem Corp., Menlo Park, CA
96. Raydex Inc., Salt Lake City, UT
97. Recruitment Manager, Edwards AFB, CA
98. Remediation Technologies, Inc.
99. Research Triangle Institute, Research Triangle Park, NC
100. Rockwell International, El Segunda, CA
101. Rutgerswerke
102. Shell Development Co., Houston, TX
103. Spectrum Sciences & Software, Inc.
104. TJ Products, Inc., West Jordan, UT
105. Technical Research Associates, Inc., Salt Laek City, UT
106. Teledyne, Inc., Albany, OR
107. TerraTek, Salt Lake City, UT
108. Texas A & M University, College Station, TX
109. UNISYS Corporation, Salt Lake City, UT
110. Uniroyal Chemical Co., Inc.
111. US Army Corp of Engineers, Washington, DC
112. University of Florida, Gainesville, FL
112. Utah Engineering Experimental Station, Salt Lake City, UT
113. Utah Innovation Center

115. Utah Ventures, SLC, UT
116. VaporFab, Inc., Salt Lake City, UT
117. Varian, Palo Alto, CA
118. Washington University, St. Louis, MO
119. Wayne State University, Detroit, MI
120. Westinghouse
121. Sinding Technologies Corporation, Springville, UT
122. Williams International, Inc., Ogden, UT
123. White Sands Missile Range, White Sands, NM

CENTER FOR ENGINEERING DESIGN

Dr. Stephen C. Jacobsen
University of Utah

Contract Amount: $573,000

The main focus is on projects including artificial limbs, drug delivery systems, physiological signal monitors, artificial kidneys, robots and microelectro-mechanical systems.

Matching Funds Source	In-Kind	Cash
DARPA		5,000,000
Sarcos		290,000
Sarcos		83,700
System Development Foundaiton		66,000
Sarcos		440,000
Sarcos (Dec. 1988 - Feb. 1989)		100,000
NCI		162,000
Veterans's Administration		64,250
WINCO		35,000
Walt Disney Imageering		43,364
BRSG		4,940
National Science Foundation		80,445
Iomed		74,029
Private Foundation		5,000
	TOTAL:	$ 6,448,728

Companies Associated Since Beginning of Contract

1. A.W. Fors
2. Advanced Manufacturing Technology
3. Affiliated Industrial Products
4. Affiliated Metals
5. Ansoft Corporation
6. Applied Hydraulics
7. Automatic Detection Devices
8. B and K Machine
9. Ballard Supply
10. Bell Industries
11. Bell Laboratories
12. Bimco Machine
13. Bolt and Nut Supply
14. Brown & Sharpe Mfg.
15. C and H Machine and Weld
16. Cabletron Systems
17. Camera Den
18. Central Utah Tool
19. Circuit Graphics

20. Computer Com Systems
21. Dee's Machine Shop
22. Digital Equipment
23. Diplomat Electronics
24. Facon Sheet Metal
25. Fetzer's, Inc.
26. Future Electronics
27. Gatan
28. Gilman's Screen Printing
29. W.W. Grainger
30. R.S. Hughes
31. Hallmark Electronics
32. High Techn Welding and Machine
33. Howell's Photo
34. Industrial Heat Treat
35. Industrial Supply
36. Inkley Photo
37. Interstate Hydraulics
38. Ironics
39. JMW Acquisitions
40. Jacob's Machine and Design
41. Kaman Bearing
42. Kierulff Electronics
43. Kimball Supply
44. Lance Machine
45. Lab Technologies
46. LaCie, Ltd.
47. MBI, Inc.
48. The Machine Shop
49. Machinery Consultants
50. Mac Products USA
51. Marshall Industries
52. Martin's Machine
53. Materials
54. Melles Griot
55. Metal Finishing
56. Missile Supply
57. Modyne Machine and Manufacturing
58. Merck
59. Motion Control
60. Multiplex Display Fixtures
61. NASA
62. New England Nuclear
63. New York University
64. ORIEL Corporation
65. Pat's Precision Machine
66. Paxton Production Tools
67. Peterson's Specialized Fabricator
68. Rains Company
69. Replicolor
70. Rockwell
71. Rocky Mountain Machine

72. Sarcos
73. Standard Supply
74. Stuart Electric
75. Sunn Micro Systems
76. Symbion, Inc.
77. System Development Foundation
78. T.V. Specialists
79. Technology Works
80. Time Electronics
81. Time Saver Industrial
82. Tneumetrek, Inc.
83. Trembly Associates
84. United Precision and Engineering
85. University Book Store
86. Utah Tool and Dye
87. Utah Bearing
88. Virginia Semiconductor
89. Walt Disney Inagineering
90. Western Precision
91. Winco
92. Wright Patterson Air Force Base
93. Yost Office Systems

CENTER FOR X-RAY IMAGING

Dr. Larry Knight
Brigham Young University

Contract Amount: $225,000

The main focus is to use X-Ray microlithography to achieve the small pattern dimensions necessary for the next generation of computer chips, as well as for improved medical imaging - both conventional and microscopic, for diagnostics for nuclear fusion and underground tests.

MOXTEK Corp. is negotiating sales contracts with several large companies for X-Ray vacuum windows that will significantly improve analysis of light elements. Phillips Corp. and Tracor have finished extensive evaluation of the products. Sales have been made to Phillips, and HNU-Ortec.

MOXTED Corp. has received two SBIR awards from the National Science Foundation. The first is for the design of a compact x-ray laser, and the second is for the development of Atomic Layer Epitaxy for the production of multilayers with small d-spacing. The successful development of these products will open major new markets.

Matching Funds Source	In-Kind	Cash
L. Livermore National Lab (L Division		98,321
L. Livermore National Lab (Y Division)		408,184
Department of Energy		107,340
	TOTAL:	$ 613,845

Companies Assoicated Since Beginning of Contract

1. ARL
2. Bede X-Ray
3. Brookhaven National Lab
4. Caneca
5. EG&G, NV
6. Darsbury Laboratory
7. Eimtek, CA
8. HNU-Ortec, TN
9. Galtech
10. JEOL
11. Jordan Valley
12. KeVex Corp.
13. LANL, NM
14. L. Livermore National Laboratory
15. Lee Scienfitic
16. Link (England)
17. Marconi Electronic

18. Maxwell Labs
19. Microspec
20. Moxtek
21. Nicolet
22. North American
23. Oakridge National Laboratory, TN
24. Osoma
25. Oxford Instrument
26. Peak
27. Perkin-Elmer Corporation
28. Phillips, NJ
29. Physicon Corporation, AL
30. Rigaku
31. Seiko, CA
32. SRS Technologies, CA
33. Seamans
34. Signetics
35. Stanford University, CA
36. Texas Instruments
37. Texas Nuclear
38. Tracor X-Ray, CA
39. Tracor Northern, WI
40. University of California, Berkeley
41. University of Mexico
42. University of Nevada
43. University of Paris, France
44. University of Rochester Laser Energetics, NY
45. Vanderbilt University, TN
46. Warwick University, United Kingdom

CENTER FOR ADVANCED SUPERCRITICAL FLUID SEPARATION TECHNOLOGIES

Dr. Milton L. Lee
Brigham Young University

Contract Amount: $ 376,440

The main focus is on research in three main areas: capillary column supercritical fluid chromatography, supercritical fluid extraction and fractionation for analytical purposes, and determination of the thermodynamic properties of supercritical fluids.

In May of 1988, Lee Scientific received one of seven awards given in Boston by the Innovation Development Institute for "SBIR Awardee of the Year." Research at BYU funded by the Centers of Excellence Program has provided results and information that has been used in preparing proposals for the SBIR (Small Business Innovative Research) programs. To date, Lee Scientific has been awarded over $1.5 million in SBIR grants.

Matching Funds Source	In-Kind	Cash
DOE - Identify Genotoxic Components		279,000
DOE - Supersonic Jet Spectroscopy		154,293
Gas Research Institute		149,897
National Science Foundation		90,000
Department of Energy		59,893
Coordinating Research Council		40,000
Dow Chemical		8,000
Exxon Educational Foundation		8,000
DOE		133,000
Gas Research Institute		150,000
National Science Foundation		80,000
Department of Energy		61,643
Shell Development Company		20,000
Monsanto		17,500
Harvard Medical School		10,000
Department of Energy		81,189
Gas Research Institute		148,990
National Science Foundation		12,000
Dionex		100,000
	TOTAL:	$1,603,405

Companies Associated Since Beginning of Contract

1. Dow Chemical
2. Exxon Research & Engineering
3. Finnigan Corporation
4. Harvard Medical School

5. Monsanto
6. Shell Development Company
7. Dionex

CENTER FOR QUALITY AND INTEGRITY DESIGN

Dr. David W. Hoeppner
University of Utah

Contract Amount: $200,000

The main focus is to deal with the significant expansion of a Quality and Integrity Design Engineering Center, established at the University of Utah. It specifically deals with developing additional knowledge and an improved engineering educational system to help prevent our loss of manufacturing capability and our increased liability problems related to failures.

Dr. Hoeppner has contracted with the Federal Aviation Adminsitration for two courses for 1989 on Aircraft Structural Fatigue. The FAA plans to focus more efforts on fatigue, fracture mechanics, and corrosion.

Matching Funds Source	In-Kind	Cash
Rolls Royce		300,000
Hercules Aerospace		70,000
MTS Systems Corp.		20,000
Cerametek		5,000
Air Force		100,000
FAA		60,000
National Science Foundation		100,000
Brown and Sharp, Inc.		20,000
Gates Tire and Rubber		32,000
	TOTAL:	$ 707,000

Companies Associated Since Beginning of Contract

1. Army Research Office
2. BioReview, Inc.
3. Boeing Aerospace Company
4. CEAT (France)
5. Center for Biomedical Engineering
6. Cerametek
7. Federal Aviation Association
8. Garrett Auxiliary Power
9. Garrett Turbine Engine Company
10. Gates Tire and Rubber
11. Halcrow Offshore, Inc. (England)
12. Hercules Aerospace
13. Hill Air Force Base
14. Langley Research Center
15. Ladish Company
16. Lewis Research Center
17. Lockheed Aeronautical Systems Company

18. Lockheed Electronics Company
19. MTS Systems Corp.
20. MTS Systems
21. MTU (Germany)
22. McDonnell Douglas Aircraft
23. NASA Headquarters (Washington D.C.)
24. NLR (Netherlands)
25. National Science Foundation
26. National Institute of Health
27. Naval Air Development Center
28. Naval Air Propulsion Center
29. Office of Naval Research
30. Office of Scientific Research
31. Pratt & Whitney Canada
32. Rockwell International, Inc.
33. Rocket Propulsion Laboratory
24. Rocky Mountain Helicopter
35. Rolls Royce Aeroengine
36. SNECMA (France)
37. Sarcos, Inc.
38. Teledyne Continental
39. Wright Aeronautical Laboratories

CENTER FOR ADVANCED COMBUSTION ENGINEERING

Dr. L. Douglas Smoot
Brigham Young University

Contract Amount: $500,000

The main focus is on development of new combustion technology that will improve the U.S. competitive position in the international market, with an emphasis toward the clean and efficient use of low-grade fossil fuels, particularly coal.

The Annual Technical Review meeting was held on 7 December 1988, and a written report on Center activities was prepared.

Requests for 87-PCGC-2 software were received from Texaco, Mobil Oil, Pyropower, and Shell Co. Work was initiated to distribute an update to the 87-PCGC-2 software and user's manual to all licensed users (there are currently 11).

Matching Funds Source	In-Kind	Cash
Advanced Fuel Research, Inc.		647,050
Air Force		75,000
Angus Chemical		12,727
Babcock and Wilcox		49,666
Chevron Research		15,000
Combustion Engineering, Inc.		65,001
Consolidated Coal		65,001
Convex Computer Corp.		45,000
Coordinating Research Council		40,000
Corning Glass Works		15,000
Department of the Navy		213,180
Dow Chemcial USA		35,000
Electric Power Research Institute		132,352
Empire State Electric Energy		279,124
EPA		185,437
Foster Wheeler Corporation		49,666
Gas Research Institute		45,000
Gas Research Institute (2nd Contract)		136,075
General Electric Corporation		15,000
General Motors Corporation		15,000
Idaho National Engineering Lab		15,000
International Fuel Cells		15,000
Los Alamos National Laboratory		5,000
Los Alamos National Laboratory		62,294
Morgantown Energy Technology Center		683,709
National Institute of Health		116,587
National Science Foundation		9,700,000
National Science Foundation (Grant #2)		138,570

Pittsburgh Energy Technology Center	165,441
Pratt & Whitney	18,802
Pyropower Corporation	15,000
Questar Corporation	15,000
Shell Development	15,000
Southern California Edison	15,000
Tennessee Valley Authority	72,822
TRW	15,000
Utah Power and Light	157,381
Utah State	66,666
TOTAL:	$ 13,427,551

<u>Companies Associated Since Beginning of Contract</u>

1. Chevron Research
2. Convex Computer Corporation
3. Corning Glass Works
4. Dow Chemical
5. Gas Research Institute
6. General Electric Corporation
7. General Motors Corporation
8. Idaho National Engineering Lab
9. International Fuel Cells
10. Los Alamos National Laboratory
11. Pyropower Corporation
12. Questar Corporation
13. Shell Development
14. Southern California Edison
15. TRW, Inc.

CENTER FOR COAL RESEARCH

Dr. Larry Anderson
University of Utah

Contract Amount: $315,000

The main focus is the development of new markets for Utah coals, to promote processing, upgrading and preparation of Utah coals, and to promote efforts between institutions of the state and local industry in student and technician training for coal research. Also, to implement new technologies in coal/water slurry transport, differential liquefaction and resin extraction, and to find new markets for coals and their products.

Activities include negotiations and contracts with CPS, Tosoh (Japan), Utah Power and Light Company, Amax, Penelec (Pennsylvania Electric Co.), Hydroprocessing, Mining Ltd., Consolidation Coal Co., and Geneva Steel. Licensing agreement negotiations are underway for technology to be used for resin recovery. Research is proceeding on production of high purity resin by flotation techniques.

A novel technique for monitoring combustion reaction zones and combustor flue gas composition was developed and installed on the Ion Trap Detector (ITD) mass spectrometry system. The new method consists of a fast "virtual" vapor sampling valve with switch times of less than 0.2 sec. A disclosure of this new invention has been submitted to the University of Utah Technology Transfer Office and preparation of a formal patent application is planned.

Matching Funds Source	In-Kind	Cash
DOE (Fossil Fuel Liquefaction)		170,000
BYU (NMR Studies: Solid Crystalline)		100,772
DOE- Consortium for Fossil (5-22175, 5-22179, 5-22177, 5-22161, 5-22160, 5-22162, 5-22166)		119,999
DOE (5-27138)		76,769
DOE (5-27118)		135,000
Utah Power and Light		90,000
EG & G Idaho, Inc.		42,140
NSF (5-2205)		189,820
University of Kentucky		12,194
Brigham Young University		75,160
CPS Corporation		15,000
Penelec (5-25282)		93,257
DOE (5-22083)		87,913

TOTAL: $ 1,208,024

Companies Associated Since Beginning of Contract

1. CPS/Fossil Resin, Price, UT
2. Consolidation Coal Co., Pittsburgh, PA
3. Finnigan - MAT, San Hose, CA
4. Geneva Steel, Orem, UT
5 Geokinetics, SLC, UT
6. Hydroprocessing, Mining Ltd., Calgary, Canada
7. Penelec, GPU, Johnstown, PA
8. Somatogen, Inc., CO
9. Tosoh Corp.
10. Utah Power and Light, SLC, UT

CENTER FOR CHEMICAL SEPARATIONS

Dr. Reed Izatt
Brigham Young University

Contract Amount: $339,209

The main focus is to design and construct pilot plants for three separation systems based on existing laboratory scale operations, reduction of the level of unwanted and toxic species from municipal and other water supplies, recovery of high value metals from waste solutions, and the design and construction of new disposable electrodes for the qualitative detection of selected elements.

An SBIR proposal to EPA was funded through IBC Advanced Technologies (IBCAT). This grant will be used to develop materials for the efficient and economical removal of toxic heavy metals at the ppb level from potable water. Patents will be filed for a number of new processes. A pilot plant has been built and is being tested.

A new spin-off company has been created; IBC Advanced Technologies. A Ph.D. chemist with metallurgical experience, and an electrical engineer have begun working for the company in selling the precious metal recovery, purification and concentration materials and technology. Sales of $40,000 have been achieved and other contracts are under negotiation. Venture capital is earnestly being sought, and an updated business plan for IBCAT has been prepared .

Phase I of a NSF SBIR Grant has begun and the research involves development of analytical separation and concentration columns. These new columns will be readily usable in the analytical instrument being developed jointly by IBCAT and Tronac, Inc.

Matching Funds Source	In-Kind	Cash
National Science Foundation		53,500
Department of Energy (2 grants)		135,210
Gas Processor Association		45,000
Electric Power Research Institute		138,099
American Chemical Society		17,500
Office of Naval Research		98,608
Serpentix		41,000
	TOTAL:	$ 528,917

Companies Associated Since Beginning of Contract

1. Ace Battery Corporation
2. Action Mining

3. Advanced Technology Ventures, Menlo Park, CA
4. AMAX
5. American Research Institute, Marcus Hook, PA
6. Amway
7. Arizona Technology Development Corp., Tuscon, AZ
8. Arkansas River Project
9. Battelle Northwest, Richland, Washington
10. Beyer Corporation
11. Bicron Corporation
12. Bourk, Robert F., Oklahoma City, OK
13. Cascade Refining
14. Columbin Ventures, Denver, CO
15. Continental Ventures, Chicago, IL
16. Cooper Refineries, Townsville, Australia
17. Dr. Richard bartsch-Texas University
18. Cotter Corporation
19. DSV Partners, Princton, NJ
20. Delaney, J., Chicago, IL
21. Dionex
22. Electrical Power Research Institute
23. El Dorado, Pasadena, CA
24. Environmental Protection Agency (SBIR Grant)
25. Family Resources Foundation, Inc.
26. Gateway Venture Partners, St. Louis, MO
27. Galtech
28. Garner & Leach Refining, Attleboro, MA
29. Gdansk Technical University (Poland)
30. Genexus
31. Gryphon Ventures, Boston, MA
32. H & B Mining
33. Idaho National Engineering Laboratory
34. Inco Ltd., Manitoba, Canada
35. Johnannesburg Consolidated Investment Co., Ltd.
36. Kerr McGee
37. LDS Foundation (Tom Henrie)
38. Dr. Jerry Lowry (EPA), University of Maine
39. Morgan, Holland Ventures, Boston, MA
40. NWT
41. Newtech Ventures, San Francisco, CA
42. Norddeutsche Affinerie (Germany)
43. Norwest Ventures, Minneapolis, MN
44. O.C. Tanner Co.
45. Oak Ridge National Laboratory
46. Oceanarium Products, Denver, CO
47. Phillips Petroleum Company
48. RST, Inc.
49. Rendezvous, Inc.
50. Saba Resources, Inc.
51. Serpentix
52. Shipley Co., Newton, MA
53. Signetics
54. Tronac

55. U.S. Bureau of Mines
56. University of Kiel
57. University of Idaho
58. Utah Ventures
59. Valley National Investors, Phoenix, AZ
60. ViraTek
61. Woodside Fund, Woodside, CA
62. Y-Tek

CENTER FOR PYROMETALLURGICAL TECHNOLOGY

Dr. H. Y. Sohn
University of Utah

Contract Amount: $ 73,680

The main focus is in making copper smelting operations more competitive. QSL-K oxygen pyrometallurgy, as exemplified in state-of-the-art leadmining and steelmaking, will be studied for possible use at Kennecott's Utah Smelter. The ultimate goal of this process is steady-state, automated production of high-quality blister copper, slag of very low copper content, and gas of very high sulfur dioxide content -- all in a single, closed, essentially autogeneous and fugitive emission-free, continuous reactor.

Matching Funds Source	In-Kind	Cash
Dr. Paul E. Queneau	48,000	
Kennecott	120,000	
Subtotal: $	168,000	
	TOTAL:	$ 168,000

Companies Associated Since Beginning of Contract

1. B.P. Minerals America

CENTER FOR SIGNAL PROCESSING

Dr. Douglas M. Chabries
Brigham Young University

Contract Amount: $396,334

The main foucs is on five closely related research efforts: (1) VLSI research into the design and miniaturization of integrated circuit devices; (2) image processing research focused on compression techniques to allow video teleconferencing; (3) speech processing with adaptive technology which has focused on the elimination of noise and compensation for the hearing impaired; (4) robotics research focused on both visual and automatic speech recognition to be used with robots in a manufacturing environment; and (5) optimal estimation theory research applied to the needs of local industry.

Eyring Research Institute has developed a product which they have named "Impression," using Center technologies. Hughes and Hewlett Packard are close to adopting this as a standard product. Two new local companies have been formed; Deseret Digital Designs and Vector Technologies. A fundamental breakthrough in image compression technology has been achieved, which will significantly impact nationally.

Matching Funds Source	In-Kind	Cash
Environmental Research		25,000
ESL		51,139
ESL		24,563
FBI 3/12/87		25,000
FBI 1/88		25,000
Hewlett Packard	680,000	
Hewlett Packard	124,770	
Hewlett Packard	356,258	
Hughes		54,000
Hughes		30,997
Hughes		50,000
ICON	62,315	
Netline		8,474
Office of Naval Research		39,942
Space Dynamics Lab		50,000
Tektronix	20,000	
Tektronix	19,400	
Tektronix	4,305	
UNISYS		40,000
Westinghouse		90,000
ESL 5/88		51,542
ESL 4/88		39,926
Mapstar		60,000
ESL 7/88		39,949

Mapstar		50,000
Space Dynamics Lab		17,000
ICON 2/89		53,053
Hewlett Packard 2/89		34,463
Adaptive Digital Systems		18,000
Subtotals:	$ 1,044,702	917,958
	TOTAL:	$ 1,962,660

<u>Companies Associated Since Beginning of Contract</u>

1. Antin
2. Digital Hearing
3. Excalibur
4. FBI
5. Federal Bureau of Investigation
6. Hewlett Packard
7. Hughes
8. ICON
9. Mapstar
10. Office of Naval Research
11. Space Dynamics Lab
12. Tektronix
13. UNISYS
14. Westinghouse
15. ESL
16. ERIM

CENTER FOR MICROELECTRONICS

Dr. Gerald B. Stringfellow — Contract Amount: $244,080
University of Utah

The main focus is to develop new material for semiconductor devices, new technology for processing of these new materials into useful devices and circuits, new integrated circuit design tools for existing silicon circuits and for the new devices.

The National Science Foundation has funded a joint Japan/US workshop on "Alloy Semiconductor Physics and Electronics." The workshop is co-sponsored by the Japanese Society for the Advancement of Science.

A new company has been formed; Bonneville Microelectronics. This company has two employees and has received research contracts for $500,000, and is anticipating venture capital.

Matching Funds Source	In-Kind	Cash
Department of Energy		735,552
DARPA		5,003,496
UNISYS		277,000
American Cyanamid		77,682
NASA		127,682
AFOSR		261,508
General Instrument	500,000	
General Instrument		92,110
National Science Foundation		214,531
ONR		162,992
ATM		19,177
ONR/NRL		451,008
National Science Foundation		11,280
Norton Company		4,750
American Cyanamid		18,413
Subtotals:	$ 500,000	7,457,181
TOTAL:		$ 7,957,181

Companies Associated Since Beginning of Contract

1. Advanced Technology Materials, New Milford, CN
2. American Cyanamid, Stamford, CN
3. Air Force Office of Scientific Research (AFOSR)
4. Bonneville Microelectronics, SLC, UT
5. Bonneville Scientific, SLC, UT

6. Caeco, SLC, UT
7. General Instrument
8. Mason Research, Worchester, MS
9. NSF
10. National Semiconductor, SLC, UT
11. Norton Co., SLC, UT
12. ONR/NRL
13. Triquint, Beaverton, OR
14. UNISYS, SLC, UT
15. Vitesse,Camarillo, CA

CENTER FOR COMMUNICATIONS

Dr. Craig Rushforth
University of Utah

Contract Amount: $210,120

The main focus is on research on computer/communications networks, data compression, application of signal processing algorithms, coding, modulatin and spread spectrum.

The major activities during the past quarter are in four main fields of imaging activity; (1) medical imaging; (2) nondestructive testing; (3) goephysical imaging; and (4) surveillance and other imaging areas such as radar, sonar, satellite, etc.

Matching Funds Source	In-Kind	Cash
UNISYS		230,780
National Science Foundation		200,000
NCI, NIH, PHS Research Grant		123,087
NHLBI, NIH, PHS Research Grant		134,053
Cray Research	120,000	
Subtotals:	$ 120,000	687,920
	TOTAL:	$ 807,920

Companies Associated Since Beginning of Contract

1. Morton Thiokol
2. R-CON International
3. Techniscan, Inc.
4. UNISYS

CENTER FOR COMPUTER INFORMATION NETWORKS

Dr. Bruce R. Peterson — Contract Amount: $100,000
Utah State University

The main focus is to develop computer assisted methods for the design analysis, and simulation of large computer information networks.

The sixth semiannual conference was held at Drexel University. Presentations were made to sponsors and to three potential sponsors concerning ongoing and completed projects. Contact has been made with 8 qualified potential sponsors.

Matching Funds Source	In-Kind	Cash
Apple Computer		50,000
Bell of Pennsylvania		50,000
Drexel University		114,030
Drexel University		119,677
Northern Telecom		100,000
Novell Systems		100,000
Pennsylvania ATC-BFP		125,000
	TOTAL:	$ 658,707

Companies Assoicated Since Beginning of Contract

1. AT&T
2. Apollo
3. Apple Computer
4. Bell of Pennsylvania
5. Boeing
6. Bourns
7. Campbell Scientific
8. Chung-Ang University
9. Computer Products
10. Data Communications Corp. of Korea
11. Design Analysis Associates
12. Dewell Industrial Co.
13. Digital Equipment Corporation
14. Digitran
15. EG&G Reticon
16. Evans and Sutherland
17. Ford Foundation
18. Foundation for Advanced Research
19. Globesat, Inc.
20. General Motors
21. Hewlett Packard
22. Hughes
23. Hyosung-Hitachi Data Systems, Ltd.

24. IBM
25. IDT
26. Icomp, Inc.
27. Iomega
28. Ines Co., Ltd.
29. Innovative Technologies
30. Institute of Space Science and Astronomy
31. Ines Co., Ltd.
32. Intel
33. Jyoni Corporation
34. Keizaikai Co., Ltd.
35. Korea Science Foundation
36. Lundahl AstroCircuits
37. Keizaikai Co., Ltd.
38. Korea Advanced Institute of Science & Technology
39. Korea Chamber of Commerce & Industry
40. M + R Forwarding Ltd.
41. Martin Marietta
42. Microsoft
43. Ministry of Science and Technology
44. Morton Thiokol
45. Mountain Bell
46. Northern Telecom
47. Novatech, Inc.
48. Novell
49. Nyosung-Nas
50. Omnidata
51. Oriental Telecommunications Company, Ltd.
52. Pacific Telesis
53. Pennsylvania ATC-BFP
54. QSI
55. Ricoh Company, Ltd.
56. SCADA Engineering Co., Ltd.
57. Shimizu Corporation
58. Signetics
59. Space Systems Engineering
60. Sun Microsystems
61. TRW
62. Teledyne
63. Televideo
64. Tokyo Ilectronic Industry Co., Ltd.
65. Ungerman Bass
66. UNISYS
67. US West
68. Westcor
69. Westinghouse
70. Yonsei University
71. Young Dong Machinery Co., Ltd.

CENTER FOR COMPUTER-BASED EDUCATION

Dr. Gordon Stokes
Brigham Young University

Contract Amount: $205,000

The main focus is on developing software for the delivery of instruction, development of authoring productivity tools that incorporate object-oriented design, data-base management, and graphics production facilities, and adaptive teaching systems.

Matching Funds Source	In-Kind	Cash
Calico		500,200
Digital Equipment Corporation		115,000
Department of Defense		366,601
IBM		100,000
National Security Agency		129,783
Sun Microsystems		50,000
	TOTAL:	$ 1,261,584

Companies Assoicated Since Beginning of Contract

1. 3M Corporation
2. Calico
3. Department of Defense
4. Defense Language Institute
5. Digital Equipment Corporation
6. IBM
7. National Security Agency
8. Pioneer Communications of America
9. Sony
10. Sun Microsystems
11. Tandberg Research
12. Waterford Institute
13. Wicat Systems

CENTER FOR BASE TECHNICAL EDUCATION

Dr. Carol Weller
University of Utah

Contract Amount: $97,000

The main focus is on commercialization of base technical curriculum and assessment products and human products in the form of base technically educated, skilled, and adaptable members of the Uath workforce. The goals of this project include consolidation of teaching technologies with advanced technologies required by industries, and development and commercialization of unique curriculum and assessment products for use in maintaining and enhancing research, development, and transference linkages with industry.

Matching Funds Source	In-Kind	Cash
Federal Grants:		
Teacher Preparation		30,157
Rural Transition Preparation		30,894
Transition Preparation		58.491
Research in Transition		41,263
Rural Collaboration		78,296
Rural Teacher Training		87,107
Transition Leadership Training		80,000
Preparation of Transition Teachers		77,012
United States Land & Cattle Co.	1,226	
Technical Devices	200	
Standard Supply Company	300	
National Institute of Disability Research		31,500
Donation		500
Subtotals:	1,726	515,220
	TOTAL: $	516,946

Companies Assoicated Since Beginning of Contract

1. Allyn & Bacon
2. Beehive International
3. Chaffin Educational Software, Co.
4. Colorado Interagency Vocational Services
5. College Hill Press
6. Council for Behavioral Disorders
7. Davis/Morgan Vocational Service
8. Developing Assessment Products
9. Division for Career Development
10. Granite Vocational Services
11. Highland Ridge Hospital

12. IBM
13. Jordan School District
14. Kessler, AFB
15. Megawest Systems
16. Microsoft
17. National Assessment Institute
18. OEC Diasonics
19. Questar
20. Salt Lake City College
21. Salt Lake Community College
22. Salt Lake Community High School
23. Sculpture Software
24. Teachers College Press
25. Utah Advanced Technology Council
26. US West
27. Utah Math Science Network
28. Utah School for the Blind
29. Utah School for the Deaf
30. Utah Valley Community College
31. Warshaw Foundation
32. Wicat Systems, Inc.
33. Work Opportunity Rehabilitation Consolidated

CENTER FOR HANDICAPPED EDUCATION

Dr. Alan Hofmiester
Utah State University

Contract Amount: $113,000

Matching Funds Source	In-Kind	Cash
U.S. Dept. of Educ., Grant #G008530204 Expert Systems & The Evaluation of LD Placements		354,918
U.S. Dept. of Educ., Grant #H023C80029 Determining Effectiveness of Coorperative Programming & Remediatio with Group-based Videodisc Math & Science Program in Mainstreamed Classrooms		310,000
U.S. Dept. of Educ., Grant #H180C8005 Development and Validation of a Special Education Intelligent Administrative Support Program		116,045
U.S. Dept. of Educ., Grant #G008430053-88 Study of Selected Microcomputer-based Artificial Intelligence Systems in Special Education		295,575
U.S. Dept. of Educ., Grant #H029K88072 Expert System for Preservice Training		254,928
U.S. Dept. of Educ. Grant #Ho23G80069 Expert System for Guiding Teachers in Referring Students for Special Education Placement		236,106
U.S. Dept. of Educ., Grant #G008730290-88 Intelligent Tutoring of Meta-Cognitive Stratagies		330,018
U.S. Dept. of Educ., Grant #G008730285 Assessing Social and Cross-Cultural Impact of Group-based Videodisc Technology		197,598
Western Oregon State College/Oregon State Higher Education, #RFP-83-035 Communication Skills Center for Deaf-Blind Children, Birth to 5 years		223,824
U.S. Dept. of Educ. Grant #61-53-8-8, Mainstreaming Effectiveness Evaluation		87,812
South Caroline State Dept. of Education Videotape Training		21,000
Washington State Educational Service District 114, project #331, Revision of CLASS.BD		7,000
Florida State School Board of Sarasota County, Control #87-177, Least Restrict Environment Prototype		17,000

TOTAL: $2,451,824

Companies Associated Since Beginning of Contract

1. Allyn & Bacon Publishing Co., Needham Heights, MA
2. American College of Emergency Physicians, Dallas TX
3. Boeing Commercial Aircraft, Seattle, WA
4. Communication Skill Builders, Tucson, AZ
5. DLM Teaching Resources, Allen, TX
6. Education Turnkey Systems, Inc., Falls Church, Va
7. Futuretech, North Ryde, NSW 2113, Autrailia
8. Harding & Harris, Orem, UT
9. Hyclone Laboratories, Inc., Logan, UT
10. IBM, Educational Product Division, Rockville, MD
11. Systems Impact, Inc., Gaithersburg, MC

CENTER FOR SPACE ENGINEERING RESEARCH

Dr. Frank Redd
Utah State University

Contract Amount: $ 1,230,000
($380,000 subcontracted to Weber State College)

The main focus is to bring University Space Engineering resources to bear on the support of locally based space enterprises, encourage innovative research leading to spinoffs of new industry, attract new space industry to Utah, and produce experienced graduates ready to join an expanding state employment base in space industries.

A new company, IMCOP, has been formed to market the data compression technology developed at the Center. This technology development has enormous market potential. Demonstrations of ICOMP, Inc. technology are now available on video, and are being shown to potential investors.

During the past year three image processing boards have been produced which may be marketed at products. Three patents have been disclosed and are being prepared to be filed in the U.S. Patent and Trademark office.

Matching Funds Source	In-Kind	Cash
Globesat		450,000
Morton-Thiokol		223,100
UNISYS		30,970
Learn, Inc.		14,060
Space Systems Eng.		12,705
McDonnell Douglas		75,172
Fibertek		7,200
USAF/SPIRIT II		18,600,000
USAF/AIRIT		16,108,739
USAF/AFGL (056)		3,396,168
USAF/CIRRIS		10,162,627
DID/SDI		24,742,166
DNA/SPEAR		3,650,209
NSF/ESPY		130,000
ONR/SDI		45,000
SRI/SETS		145,000
NASA/ SPACE EXPERIMENT STATION		300,000
NASA/CRYOGENIC VALVES		115,000
NASA/CHARGE III		68,000
NASA/IRLE		120,345
NASA/LANGLEY		70,000
NASA/SPACE SYSTEM DESIGN		67,452
	TOTAL:	$ 78,533,913

Companies Associated Since Beginning of Contract

1. Aerodyne Research
2. Aerojet Research
3. ASTRON Research and Engineering
4. Ball Aerospace Company
5. Boeing Aerospace Corp.
6. Fiberscience Corp.
7. FIbertek
8. Globesat, Inc.
9. Hercules Aerospace
10. Honeywell Space Systems
11. Hughes Aircraft Company
12. ICOMP
13. Intraspace, Inc.
14. Irvine Sensors, Inc.
15. Learn, Inc.
16. Lockheed Space & Milliles
17. Martin Marietta Space
18. McDonnell Douglas
19. Morton-Thiokol
20. Nichols Research, Co.
21. Orbital Sciences Corporation
22. Rockwell International
23. SAIC
24. Sensor Systems Group
25. Space Data Corporation
26. Space Systems Engineering
27. UNISYS

CENTER FOR AEROSPACE SCIENCE TECHNOLOGY

Professor Robert J. Twiggs
Weber State College

Contract Amount: $ 50,000
($380,000 subcontract from Weber State College)

The main focus is to design and manufacture useful aerospace experiments, devices or systems, and to support similar interprises in space industries and in other Utah schools and organizations.

Working with Intraspace, the program jointly is developing the NUSAT II and the T-Sat satellite, including support services, flight qualifications, operational performance test requirements, environmental performance testing, and facilities and equipment support. There are two project areas now being interfaced and a new type of ejectable GAS mechanism. The second is at the end of a tether experiment.

Matching Funds Source	In-Kind	Cash
Federal Aviation Administration		24,000
Federal Aviation Administration		14,000
Browning Manufacturing		125
Lundahl-Astro Circuits		3,500
Bonneville Scientific		4,700
Pensar, Inc.		1,240
Federal Aviation Administration		1,500
Iomega Corporation		4,700
Federal Aviation Administration		800
Federal Aviation Administration		1,000
Federal Aviation Administration		1,000
Richland Community College		3,000
Federal Aviation Administration		1,000
Technology Incubator Program		30,000
TRW		500
WSC Zoology Department		6,000
Orchid Engineering		519
Orchid Engineering		242
Option Technologies		712
Hill Air Force Vibration Facility	27,500	
Spectro Labs	3,600	
Affiliated Metals	1,091	
Microtech Research, Inc.	850	
Hexcel Corporation	500	
Peterson Specialized Fabracators	475	
TRW, Inc.	470	
Deutsch Fastener Corporation	170	
ADS, Inc.	100	
Narmco Materials	100	

American Cyanamid	100	
Stanley Tools	75	
Neulink, Inc.	68	
Affiliated Metals	5,000	
Intraspace, Inc.	26,000	
Intraspace, Inc.	17,000	
Volunteer Student & Engineering Labor	1,052,155	
Option Technologies		1,788
VaporFab, Inc.		500
Intraspace, Inc. (machine tooling)	26,000	
Intraspace, Inc.	17,000	
Interface Electronics		2,302
Federal Aviation Administration '89		980
AMSAT		2,231
AMEMCO, Inc.		392
AMSAT, Inc.		6,106
Intraspace Electronics		981
Orchid Engineering		309
Intraspace Corporation		
SALT Project		20,000
SATTRAC Project		100,000
Subtotals:	1,178,254	234,127
TOTAL:		$ 1,412,381

<u>Companies Associated Since Beginning of Contract</u>

1. AMSAT, Inc., Washington D.C.
2. AMEMCO, Inc., Kaysville UT
3. Arianespace, Inc., Washington, D.C.
1. Ballalis
2. Bonneville Scientific
3. Browning Arms
4. Computer Science Corporation
5. E.G.& E., Ogden, UT
6. Eagle Canyon Research Associates
7. Federal Aviation Assoicates
8. Globesat, Inc.
9. Intraspace, Inc.
10. Lundahl Astro Circuits
11. Morton Thiokol
    NASA Goddard, SFC, Greenbelt, MD
    NASA Marchall SFC, Huntsville, UT
12. Niagara Mohawk Power, Syracuse, NY
13. Ogden City Development
14. Orchid Engineering
15. Orion International Technical

16. Pensar, Ogden, UT
    QSI Systems, Logan, UT
    RMS Technologies, Lexington, MA
    Richland Comm. Col., Decatur, IL
    Space Service, Inc. Houston, TX
    TSA Technologies, Inc., Ogden, UT
17. Vaporfab, North Salt Lake City, UT
18. Interface Electronics, Salt Lake City, UT
    Opinion Technologies, Inc., Morgan, UT
    Everett & Winthrop, Inc., Salt Lake City, UT
    Sporting World Products, Ogden, UT
    Cal Pro, Inc., Ogden, UT
    EDO Corporation - Fiber Sciences Division, SLC, UT

CENTER FOR BIOTECHNOLOGY

Dr. Steven Aust — Contract Amount: $500,000
Utah State University

The main focus is development of recombinant DNA technology in plant breeding, use of microbiological in agriculture, use of monoclonal antibodies in disease control of livestock animals, and to enhance enzyme production for food processing and engineering control.

The Applied Biosystems Model 477 Peptide Sequencer with the dedicated Model 120 PTH Analyzer was installed at the beginning of May. Several proteins have been placed on the instrument for sequencing. The Monoclonal Laboratory receives requests for hybridoma from companies and outside researchers.

The most significant recent activity is the signing of a non-exclusive license agreement with Remediation Technologies, Inc., to market the use of white rot fungi for the biodegradation of environmental pollutants. This technology, for which two patent applications are pending, was developed in the Center and is being tested at the Utah Power and Light, Idaho Falls Pole Yard. Another contract was signed with Morrison Knudsen Engineers to test the technology non dieldren contaminated soils. Other contracts are being pursued. The marketing of this technology will require the development of an inoculum producing company. This is being done by the USU foundation.

Matching Funds Source	IN-Kind	Cash
Univesity of Louisville Res. Fdn.-Biological treatment of soils contaminated with pentachlorophenol		162,918
U.S. EPA - Biodegradation of environmental pollutants		140,000
NIH Varibility of Sod & Other Enzymes Health Sciences		24,405
DuPont DeNemours & Company		45,000
Utah Power & Light - Testing & Utilization of White Rot Fungus		468,366
Proctor & Gamble - Effects of Ethylenediominetetramenthylene Phosphonic Acid on Superoxide and Iron Dependent Lipid Peroxidation		25,215
ReTec - Biodegradation of Coal Tar		10,000
Morrison-Knudsen Engineers - Biological Treatment of Soils Contaminated Deldrin		100,000
National Institute of Health - Fungal Degradation of Environmental Pollutants		20,000
HHS/NIH National Institute of Environ-		

mental Health Sciences Biological
Hazardous Waste Management 1,492,568

TOTAL: $2,488,472

Companies Associated Since Beginning of Contract

1. 3C Company
2. ARI
3. Adria Laboratories, Columbus, OH
4. American Cyanamid
5. Arkansas Science and Technology Authority
6. Arthur Young International
7. Association of Biotechnology Co.
8. Austin Venture
9. BASF Corporation
10. Biotech Institute
11. BioTrol
12. Breakthrough
13. CDM Federal Program Corporation
14. California State University, Fresno, CA
15. Canonie
16. CH2M Hill
17. City Development, Inc.
18. Consolidated Biotech Inc.
19. Developmemt Center for Biotechnology
20. Diamond Research Products
21. ERM Southwest
22. Ebasco Services, Inc., Arlington, VA
23. Ecoline Development Eng., Ltd.
24. Ecova
25. Environmental Engineering and Science
26. Environmental Week
27. Fluor Daniel
28. General Dynamics, Convair Division
29. Groundwater Technology
30. Hiltech
31. Hoechst Celanese Corporation
32. ICI Research Group
33. International Technology Corporation
34. Institute for Environmental Medicine, NY Univ. Medical
35. Institute for Public Policy and Business Research
36. Kabanco
37. Krystone Environmental Research, Inc.
38. Landan Assoc., Inc.
39. Manville
40. Merrell Dow Research Institute
41. Morrison-Knudsen Engineering
42. Microlife Technics
43. Nitragin Co.

44. North Dakota State University
45. NUS Copr.
46. OCS Labs
47. Penwalt Corporation, Pharmaceutical Div.
48. Precor Corporation
49. Proctor and Gamble Co.
50. Remediation Technologies, Inc.
51. Reno Research Center, Reno, NV
52. Robbins & Laramie
53. Rutgerswerke
54. Sequoia Capital
55. Shell Development
56. Spectrum Sciences & Software, Inc.
57. Synbiotics Corp.
58. Uniroyal Chemical Co.
59. University of Utah
60. Utah Innovation Center
61. Utah Power and Light
62. W.L. Enterprises
63. Wilbur Ellis Company

CENTER FOR BIOCATALYSIS

Dr. Linda Powers
Utah State University

Contract Amount: $500,000

The main focus is to explore and elucidate the basic principle of bio-catalytic processes, especially those involving metals, and develop synthetic analogs of bio-catalysts; to develop time resolved spectroscopic technology necessary for these basic studies and; to apply this basic knowledge to the development of bio-catalysis technology and the new time resolved instrumentation to industrial and environmental monitoring and management.

Matching Funds Source	In-Kind	Cash
Ardent Computers, Inc.	54,000	
Savannah River Laboratory		100,000
AT&T Bell Loboratories & Northwestern University	300,000	
NIEHS Superfund Grant		376,156
Subtotals:	354,000	476,156
	TOTAL:	$ 830,156

Companies Associated Since Beginning of Contract

1. Alta Technology, Inc.
2. AT&T Bell Laboratories
3. Ardent Computers, Inc.
4. Hyclone Laboratories
5. INEL
6. NASA
7. NIEHS
8. Northwestern University
9. Otsuka Industries
10. Savannah River Laboratory

CENTER FOR CONTROLLED CHEMICAL DELIVERY

Dr. Sung Wan Kim
University of Utah

Contract Amount: $346,000

The main focus is to develop new and effective methods for the delivery of pharmaceutical and chemical agents. Research and development in controlled drug delivery systems is currently a major area for research pursued by most pharmaceutical industries. The goal is to design an effective drug delivary system which minimizes side effects with maximum efficacy.

Matching Funds Source	In-Kind	Cash
Theratech, Inc.		600,000
Theratech, Inc.		900,000
Ciba-Geigy		1,200,000
Hisamitsu		15,000
Sam Yang Company		10,000
NIH (S.W. Kim)		1,744,204
NIH (J. Kopecek)		424,830
NIH (W.I. Higuchi)		940,000
NIH (K. Knutson)		855,584
	TOTAL:	$ 6,689,618

Companies Assoicated Since Beginning of Contract

1. Baron Technologies
2. Ciba-Geigy
3. Research Medical, Inc.
4. Theratech, Inc.
5. Hisamitsu