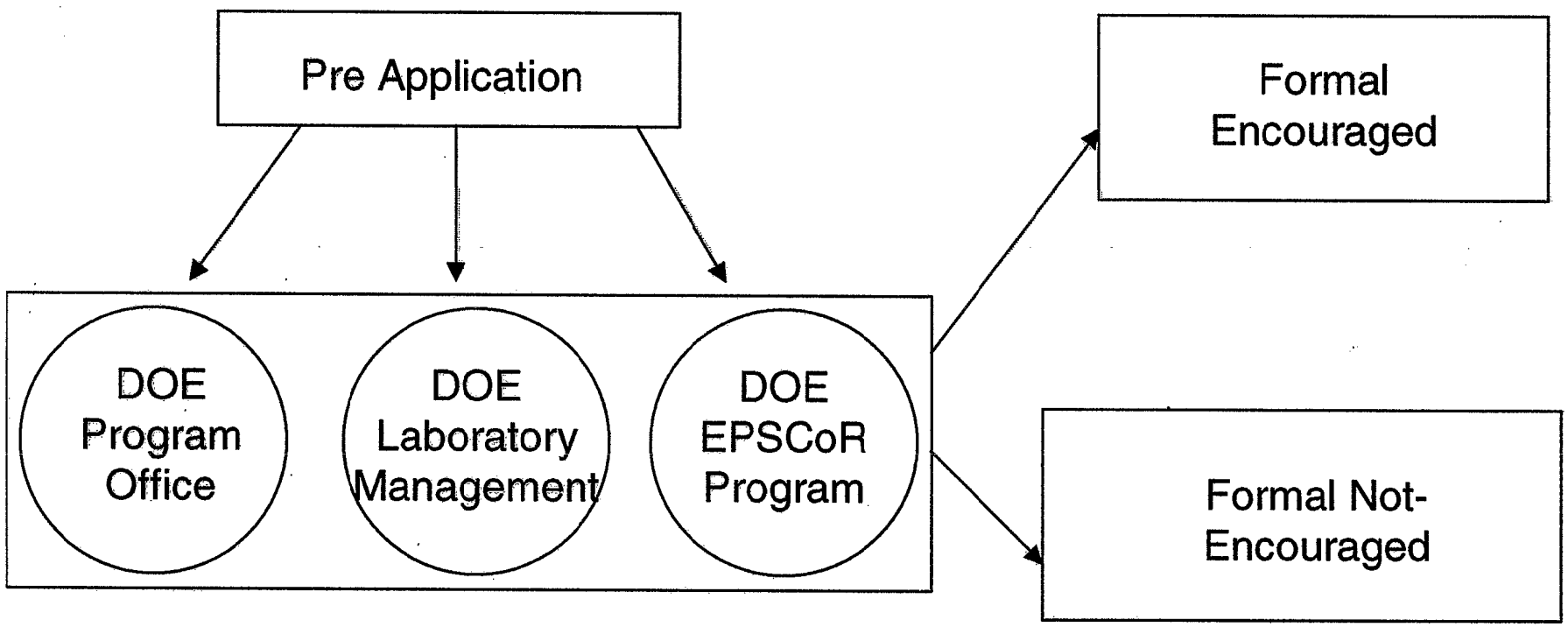
HEP AND NP ARE DISTINCT PROGRAMS

High Energy Physics seeks to discover the fundamental constituents of matter and the forces between any one constituent and another. Nuclear Physics, on the other hand, is fundamentally a many-body science aiming at an understanding of the properties and behavior of multi-particle systems, that is nuclei composed of neutrons and protons, or many quarks; in this respect it is much closer to atomic and molecular physics than to High Energy Physics.

EPSCoR

Experimental Program to Stimulate Competitive Research



Experimental Program to Stimulate Competitive Research

Condensed Matter Physics and Materials Chemistry Team
Materials Sciences and Engineering Division

Mat Varma

Program Manager

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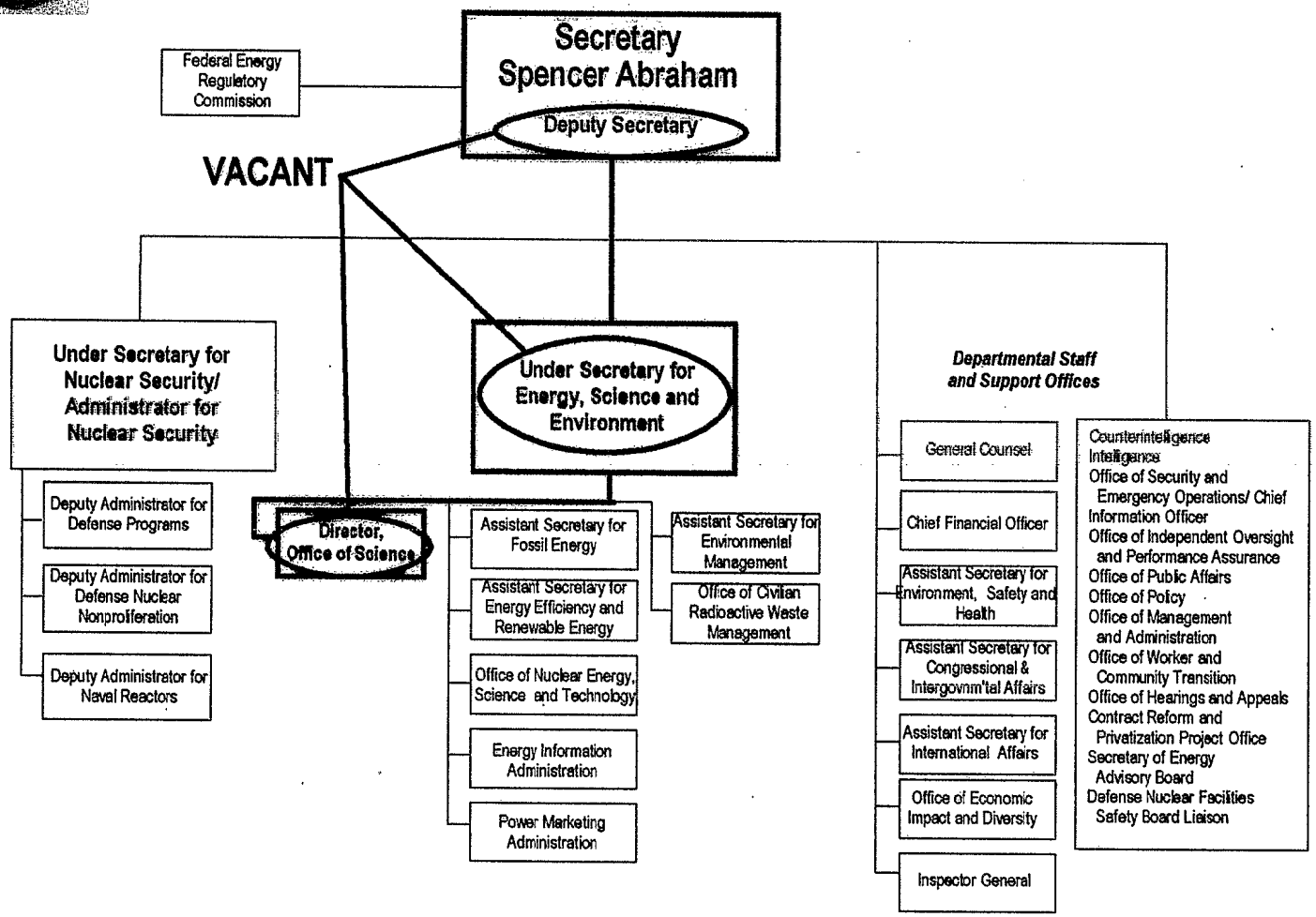
Department of Energy



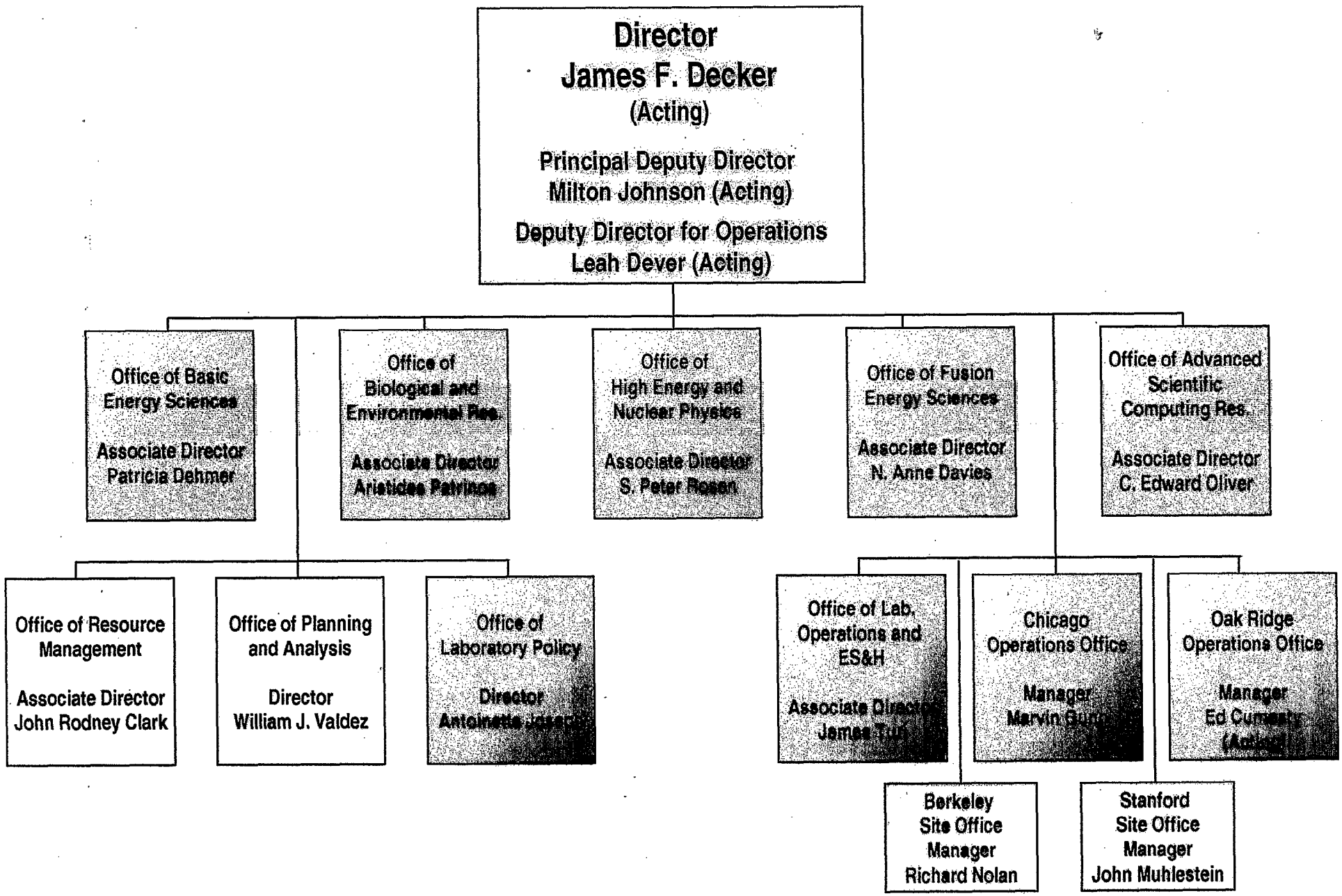
The Deputy Secretary also serves as the Chief Operating Officer

Department of Energy
Budget Profile*
(Dollars in Millions)

	FY2000	FY2001	FY2002 (Request)
Defense Programs	4,562.0	5,069.3	5,300.0
Defense Nuclear Nonproliferation	761.7	873.9	773.7
Naval Reactors	669.6	687.6	688.0
Energy Efficiency and Renewable Energy	1,055.4	1,188.6	1,032.5
Fossil Energy	409.0	735.7	745.4
Nuclear Energy Science & Technology	225.6	277.5	223.1
Environmental Management	5,948.7	6,266.9	5,912.8
Office of Civilian Radioactive Waste Management	340.5	390.4	445.0
Environment, Safety and Health	138.1	161.1	140.1
Office of Science	2,829.4	3,155.5	3,159.9

* From Page 10 Department of Energy FY2002 Presidents Budget

Office of Science Organization



Office of Basic Energy Sciences

Patricia Dehmer, Associate Director
⊗ Iran Thomas, Deputy Associate Director
Mary Jo Martin, Secretary

Associate Director's Office Staff Contacts
Robert Astheimer
F. Don Freeburn
Stanley Staten
Sharon Long

Materials Sciences and Engineering Division

⊗ Iran Thomas, Director
Christie Ashton, Program Analyst
Tarra Hardeman, Secretary

Metal, Ceramic, and Engineering Sciences
Robert Gottschall
Terry Jones, Proc. Tech.

Structure and Composition of Materials
Robert Gottschall
Vacant FTE
◆Robert Hwang, SNL

Mechanical Behavior of Materials and Radiation Effects
Yok Chen
◆Robert Hwang, SNL

Physical Behavior of Materials
◆Andrew Quong, LLNL
◆Wendy Cieslak, SNL
◆Robert Hwang, SNL
●Angus Rockett, U. of IL

Synthesis and Processing
Alan Dragoo
Vacant FTE
Timothy Fitzsimmons
●Angus Rockett, U. of IL

Engineering Sciences
Robert Price
●Bassem Armaly, U. of MO
Timothy Fitzsimmons
◆Wendy Cieslak

Condensed Matter Physics and Materials Chemistry
William Oosterhuis
Melanie Becker, Proc. Tech.

Experimental Condensed Matter Physics
Jerry Smith

Theoretical Condensed Matter Physics
Manfred Leiser
◆Dale Koelling, ANL

Neutron and X-ray Scattering
Helen Kerch

Neutron and X-ray Scattering Facilities
Vacant FTE

Materials Chemistry
Dick Kelley

EPSCoR
Matesh Varma

Spallation Neutron Source
Jeffrey Hoy

Chemical Sciences, Geosciences, and Biosciences Division

William Millman, Acting Director
Karen Talamini, Program Analyst
Carolyn Dorsey, Secretary

Molecular Processes and Geosciences
Paul Smith (Acting)
Diane Matthews, Proc. Tech.

Catalysis and Chemical Transformations
Vacant FTE
◆Daniel Melamed, BNL

Chemical Energy and Chemical Engineering
Paul Maupin

Separations and Analysis
Vacant FTE
●Dick Gordon, Wash. State U
◆Norman Edelstein

Heavy Element Chemistry
Paul Smith
◆Norman Edelstein, LBNL

Geosciences
Nickolas Woodward
◆Henry Shaw, LLNL

Fundamental Interactions
Allan Laufer
Sharon Bowser, Proc. Tech.

Atomic Molecular and Optical Physics
Eric Rohlfing

Chemical Physics
William Kirchhoff
Eric Rohlfing

Photochemical and Radiation Sciences
Mary Gress

Biophysical Chemistry
Vacant FTE

Energy Biosciences
Gregory Dilworth
Patricia Snyder, Proc. Tech.

Photosynthesis
Gregory Dilworth
James Tavares
●Sharlene Weatherwax, UCLA

Biological Synthesis
Gregory Dilworth
James Tavares
●Sharlene Weatherwax, UCLA

Metabolic Interconversion
Gregory Dilworth
James Tavares
●Sharlene Weatherwax, UCLA

Legend
⊗ Dual Capacity
● IPA
◆ Detallee

Facilities Supported by the Division of Materials Sciences

National Synchrotron Light Source

High Flux Isotope Reactor

Intense Pulse Neutron Source

Stanford Synchrotron Radiation Laboratory

Manuel Lujan, Jr. Neutron Scattering Center

Advanced Light Source

Advanced Photon Source

Spallation Neutron Source

Organization Chart

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Mathematical, Information, and Computational Sciences Division
Acting Dir. - C. Edward Oliver
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Mission: To foster and support fundamental research in advanced computing research -- applied mathematics, computer science, and networking -- and to operate supercomputer, networking, and related facilities to enable the analysis, modeling, simulation, and prediction of complex phenomena important to the Department of Energy.

Technology Research Division
Director - Walter Polansky
Phone: (301)903-5995
E-mail:
walt.polansky@science.doe.gov

Mission: To foster and support high-risk research in the natural sciences and engineering in partnership with the private sector leading to innovative applications relevant to the Nation's energy sector.

Office of Scientific and Technical Information
Director - Walter Warnick
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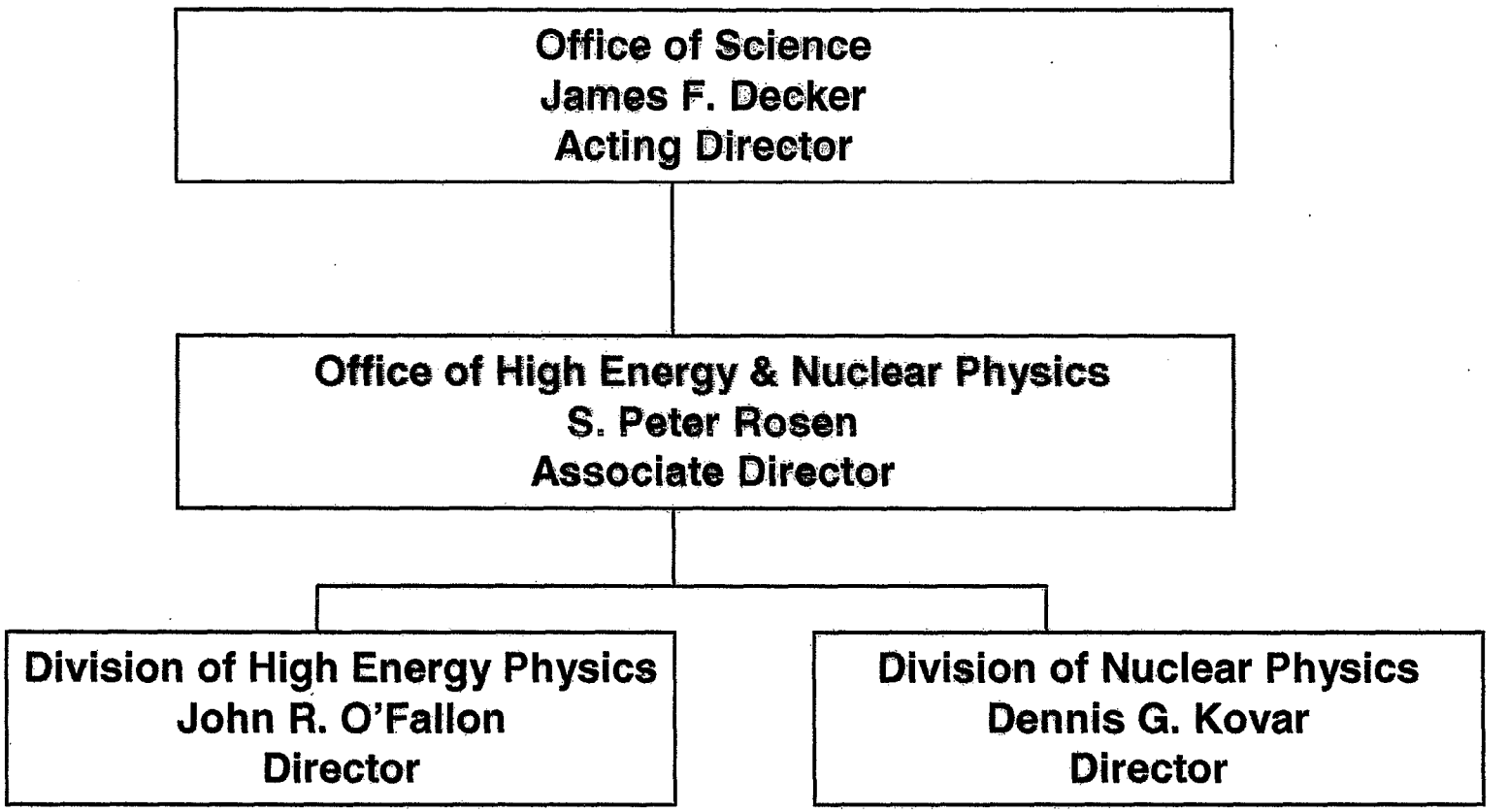
E-mail:
walt.warnick@science.doe.gov

Managed by ASCR office but not part of the ASCR program.

Office of High Energy & Nuclear Physics



Office of Fusion Energy Sciences

N. Anne Davies
Associate Director of Science for Fusion Energy Sciences

Al Opdenaker
Shahida Afzal ‡
Suellen Velthuis ‡

International Activities
Michael Roberts ,** Director

Sandy Newton **‡
Debra Frame

Research Division

John Willis , Director
Marty Carlin ‡
T. J. Moore ‡
John Sauter ‡

Ron McKnight ♦
Curt Bolton
Michael Crisp
Rostom Dagazian
William Dove
Steve Eckstrand
Chuck Finfgeld
Arnold Kritz *
Darlene Markevich
Erol Oktay
Don Priester
Walt Sadowski

Facilities & Enabling Technologies Division

Michael Roberts ,** Director
Sandy Newton ,**‡

Warren Marton ♦
Gene Nardella
Sam Berk
T.V. George
Ray Schwartz , On Call from SC-80

♦Principal Acting Director *On Assignment (Lehigh Univ.) **Dual Capacity ‡Support Staff

Fusion Energy Sciences Program

- FES is a multi-purpose scientific research effort producing
  - science knowledge and technological benefits in the short term
  - science base for a fusion energy option in the long term

- FES Scientific Program Goals
  - Advance fundamental understanding of plasma-theory/simulation/experiments
  - Resolve outstanding scientific issues by investigating a broad range of magnetic confinement configurations
  - Advance understanding and innovation in high-performance plasmas; participate in a burning plasma experiment
  - Develop technologies needed to advance fusion science; pursue innovative technologies and materials to improve the vision for fusion energy
  - Advance the understanding and predictability of high energy density plasmas
  - Develop science and technology of attractive Inertial Fusion Energy systems

Portfolio

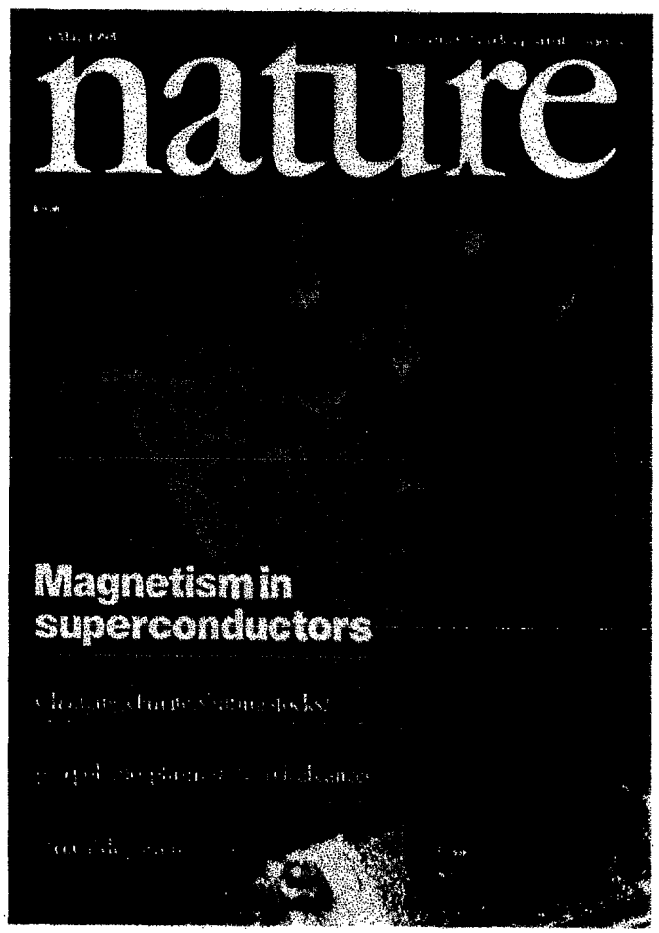
- Breadth of DOE programmatic research areas and participating DOE Laboratories supported by the EPSCoR Program
  - Research Areas Supported

    Materials Sciences
    Biological Sciences
    Fusion Energy Sciences
    Transportation Technologies
    Defense Sciences
    Chemical Sciences
    Environmental Sciences
    High Energy and Nuclear Physics
    Coal and Power Systems
    Advanced Scientific Computing
  - National Laboratories Participating

    Argonne National Lab. (ANL)
    National Energy Technology Lab. (NETL)
    Lawrence Berkeley National Lab. (LBNL)
    Los Alamos National Lab. (LANL)
    National Renewal Energy Lab. (NREL)
    Princeton Plasma National Lab. (PPNL)
    Sandia National Laboratories (SNL)
    Brookhaven National Lab. (BNL)
    Fermi National Accelerator Lab. (FNAL)
    Lawrence Livermore National Lab. (LLNL)
    Idaho National Eng. & Environ. Lab. (INEEL)
    Pacific Northwest National Lab. (PNNL)
    Oak Ridge National Lab. (ORNL)

Materials Sciences Division

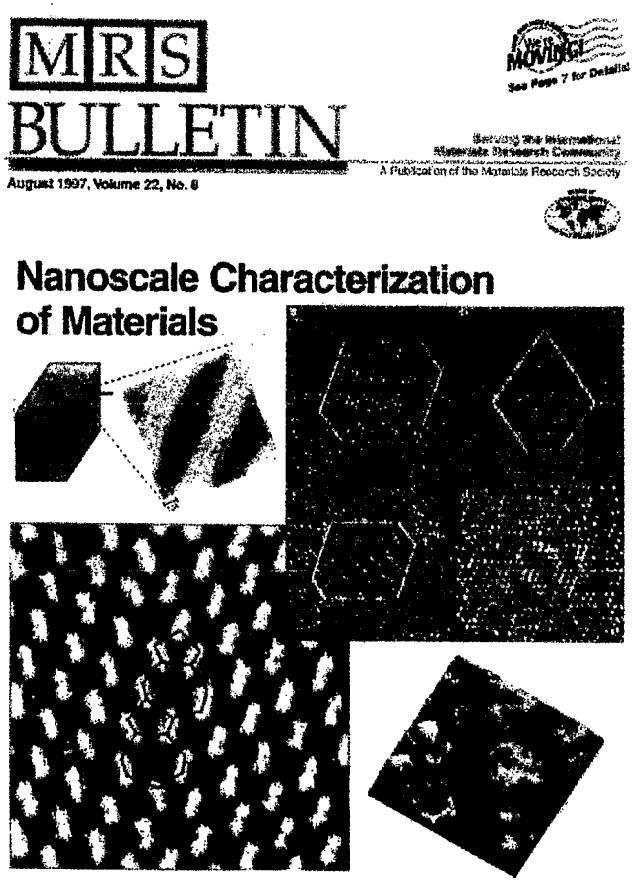
Condensed Matter Physics and Materials Chemistry Program



- **Structure and Dynamics of Solids, Liquids, and Surfaces**
  - Determination of atomic arrangements of atoms and the consequent physical properties of materials
  - Ordered and disordered solids/liquids by X-ray and neutron scattering
  - Surfaces probed by scanning tunneling microscopy, photoelectron diffraction, and holography
  - Theory, modeling, and computer simulation to provide understanding and predictive capability
- **Electronic Structure**
  - Determination of optical, transport, thermodynamic, and magnetic properties using a variety of spectroscopies such as NMR, infrared, photoemission
  - Correlation of electronic spectra and structure with materials properties such as photovolatic, superconducting, magnetic, and reactivity
- **New Materials Synthesis** for improved properties through new combinations of atoms and new degrees of complexity, e.g., competing interactions among spin, charge, lattice
  - Low-dimensional structures, e.g., thin films, multilayers, self-assembled monolayers, micelles
  - High-temperature superconductors and other complex structures
  - Organic conductors, superconductors, and magnets
  - Complex fluids, colloids, polymers, and biomolecular materials
- **Surfaces and Interfaces**
  - Electronic structure at surfaces and interfaces to determine catalytic activity, patterns of crystal growth for special structure (such as multilayered materials), and corrosive, adhesive, and electrochemical properties
- **Development of Experimental Techniques**
  - Spin polarized NMR
  - Z-contrast scanning transmission electron microscopy
  - X-ray microscopy, spectromicroscopy, photoelectron holography
  - 100 Tesla pulsed magnet

Materials Sciences Division

Metal and Ceramic Sciences Program



- **Synthesis and Processing Science**
  - High rate metal forming and superplastic forming of metals and ceramics
  - Welding and joining processes for metals, ceramics, and dissimilar materials
  - Assisted processes for controlled formation of thin films, modified surfaces, and interfaces
  - Effects of processing on molecular structure, network topology, pore formation, crystallite growth, and sintering
- **Predictive Theory, Simulation, and Modelling** for cost-effective experimental guidance, design of experiments, alloy compositions, and materials processing
- **Structural Characterization on Angstrom Scale** of localized geometry of atomic structure, lattice defects, elemental composition, bond character, charge distribution, magnetic domain configurations, interfaces and boundaries in solids
- **Mechanical and Physical Behavior**
  - Solid state diffusion and transport mechanisms
  - Irradiation damage mechanisms, modelling, and minimization
  - Surface reactivity including aqueous, galvanic, hot gaseous corrosion
  - Superconducting behavior with focus on role of structure, defects, grain boundaries
  - Magnetic energy loss mechanisms in hard and soft magnets
  - Photovoltaic behavior with focus on recombination centers and interfaces
  - Ordering, high temperature, and mechanical behavior of ordered intermetallic alloys
  - Characterization of internal stress, crack nucleation, crack growth, and crack tip shielding
  - Time-dependent high-temperature mechanical reliability, fracture toughness, interfacial adhesion, and grain boundary sliding in structural ceramic composites
  - Alloy theory, thermodynamics, diffusion, viscosity, elastic constant, and glass transition in bulk metallic glasses

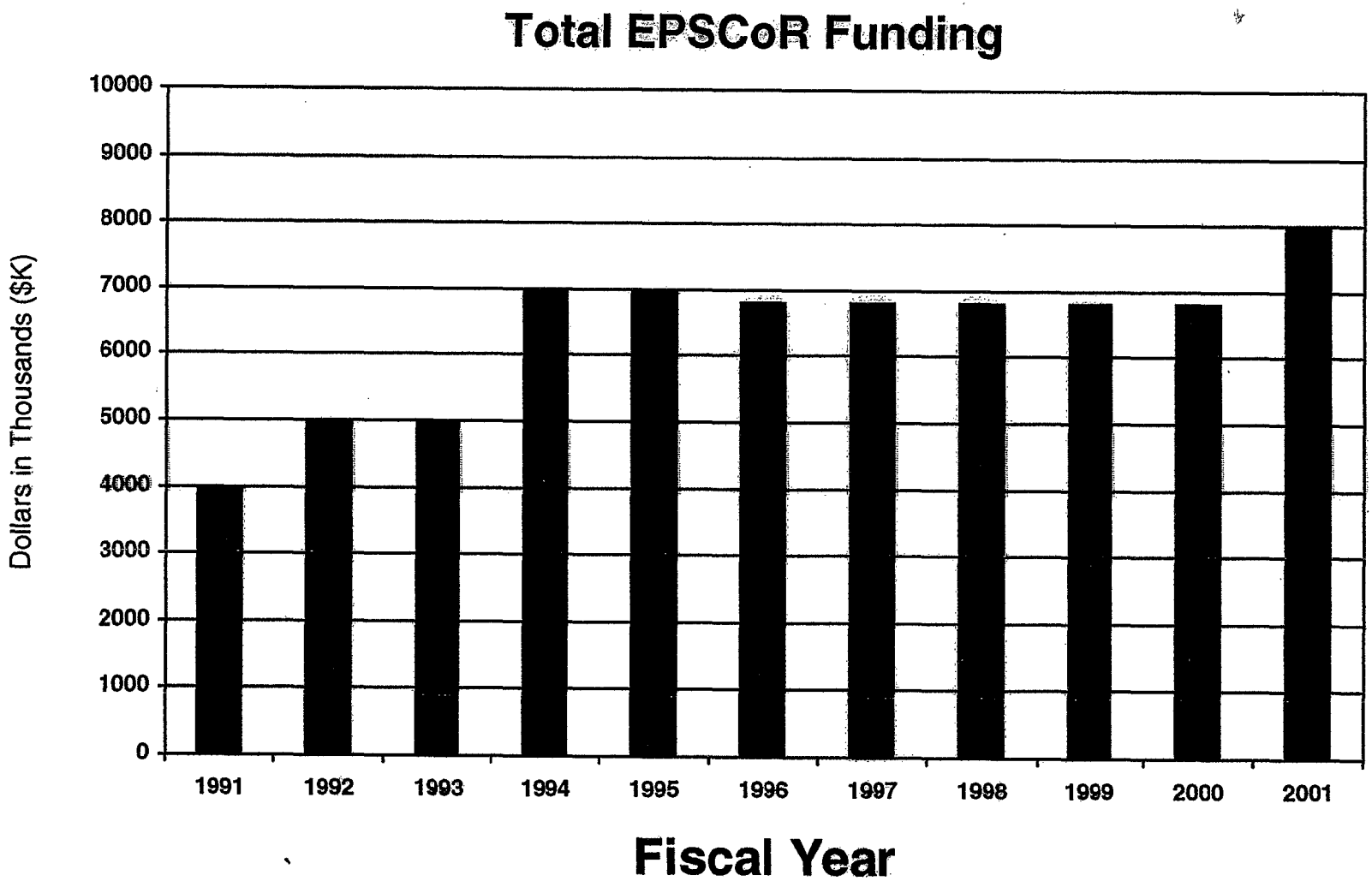
Relevance

- The DOE EPSCoR Program has three main objectives:
  - To enhance the research capabilities of designated states
  - To conduct competitive energy-related research
  - To develop science and engineering manpower to meet current and future needs in energy-related areas
- These objectives are attained through the award of Implementation Grants and Laboratory Partnership Grants.

Distinguishing Features - Continued

- **Laboratory Partnership Grants:**
  - Collaborative research with national laboratory required
  - Training of students and young faculty at the laboratory encouraged
  - Visit by Lab scientist to EPSCoR States also encouraged
  - Individual principal investigator originated
  - Research area of interest to DOE and states
  - Application endorsed by the state coordinator
  - DOE program office and DOE laboratory priority review
  - Exactly 10% cost share by the states required and nominal cofunding by program offices recommended
  - No EPSCoR program funds to the national laboratories
  - One to three year grants
  - Maximum funding has increased from $50,000 per year in FY 1999 to $75,000 per year in FY 2000 to $150,000 per year in FY 2001

Funding History



Distinguishing Features

- **The Experimental Program to Stimulate Competitive Research (EPSCoR) was started by the NSF in 1979 to broaden the geographical distribution of federal funding for academic research and development. In FY 1991, the program was started in DOE under Congressional direction.**
- **There are at present 21 states (AK, AL, AR, HI, ID, KS, KY, LA, ME, MS, MT, NE, NM, NV, ND, OK, SC, SD, VT, WV, WY) and Commonwealth of Puerto Rico (PR) eligible to participate.**
- **Program funds basic research in energy-related programmatic areas of interest to DOE by awarding Implementation Grants and Laboratory Partnership Grants.**
- **Implementation Grants**
  - Two applications per state (But only one award)
  - Coordinated research area of interest to state and DOE
  - At least 1-1 state matching funds
  - One research clusters per application (a cluster is a group of scientists working on a common theme)
  - Program Coordination and Human Resource Development will be incorporated and coupled closely with research cluster
  - Maximum funding of $750,000 per year for up to six years

National and International Standing

- National standing: This is one of the seven National programs addressing the research competitiveness of the designated states. It represents the Nation's only program in collaboration with EPSCoR states in energy-related research.
- Laboratory Partnership Grants are allowing EPSCoR State investigators to work closely with the DOE National Laboratories in conducting collaborative research and training students.

Funding Summary

	FY 2000	FY 2001	FY 2002 Pres. Req.
	$ 6,815K	$ 8,000K	$ 8,000K
◆ Implementation Grants	$4,586	$4,770	$4,095
◆ Laboratory Partnership Grants	$1,897	$2,915	$3,540
◆ Other	$332	$315	$365

❒ All grants are to EPSCoR States

Program Highlights

- 5 New States Awarded Implementation Awards:
  - Kansas, Mississippi, Nebraska, Vermont, and West Virginia
- 20 New State-Lab Partnership Awards (FY00/FY01)
- Almost 100% Participation from Program Offices in Cofunding, most national labs participating
- DOE/EPSCoR Workshop with NSF at ANL (1997) at ORNL (1999) planned at LBNL (2000) and at BNL (2001)
- Strengthened Implementation Awards by Coupling Human Resource Development with Research Clusters

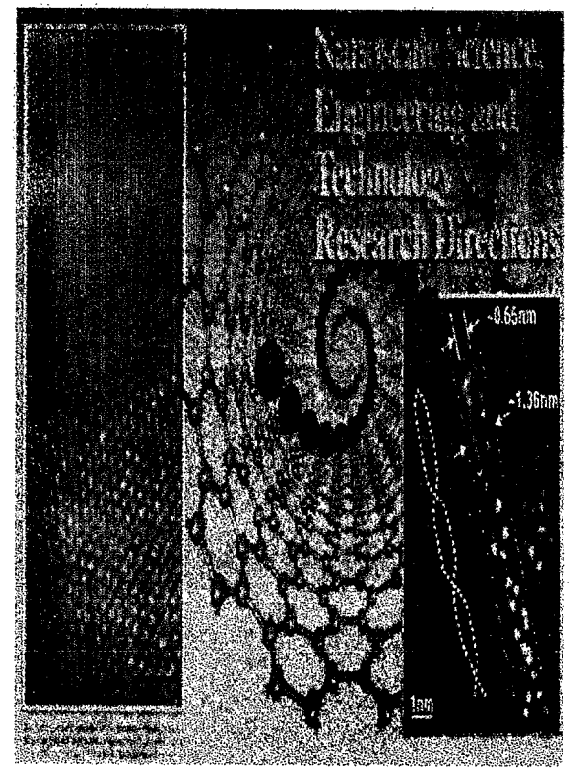


Figure shows a z-contrast transmission electron microscope image of iodine atoms intercalated inside a single wall carbon nanotube. *Research by Partnership grantee and ORNL (Cover of DOE workshop on Nanotechnology)*

FY 2000 Highlights

- **5 New States Awarded Implementation Grants:**
  Kansas, Mississippi, Nebraska, Vermont and West Virginia
- **20 New Laboratory Partnership Grants (FY00/FY01)**
- **Almost 100% Participation from Program Offices in cofunding, most National Laboratories participating**
- **DOE/EPSCoR Workshop with NSF at ANL (1997), at ORNL (1999), at LBNL (2000), and planned at BNL (2001).**
- **Strengthened Implementation Grants by Coupling Human Resource Development with Research Clusters.**

Recent Accomplishments

- Optical Diagnostics for Electron Beam Accelerators - Montana
- New Capability for High-Resolution Studies of Photon-Ion Interactions at the ALS - Nevada
- New Methods Determine Efficiency/Acceptance of a Large Time Projection Chamber - Arkansas
- New Stellarator Wave Heating Scheme Promising for Fusion - Alabama
- Idaho State University and INEEL Develop Bacterial Probes to Access Activity of Important Enzymes Involved in Chlorinated Solvent Degradation
- Kansas State University has Led to Understanding of the Microscopic Processes for the Manipulation of Atoms on Metal Surfaces
- Predicted the Local Current Density and water Distribution in Two Dimensions on the Surface of the Membrane Electrode Assembly (MEA) in a Proton Exchange Membrane Fuel Cell (PEMFC) - South Carolina
- 3 EPSCoR grantees have won prestigious university/state research awards; 2 grantees were made fellows of the scientific societies and 2 graduate students were recognized for their research at the scientific meetings

Challenges

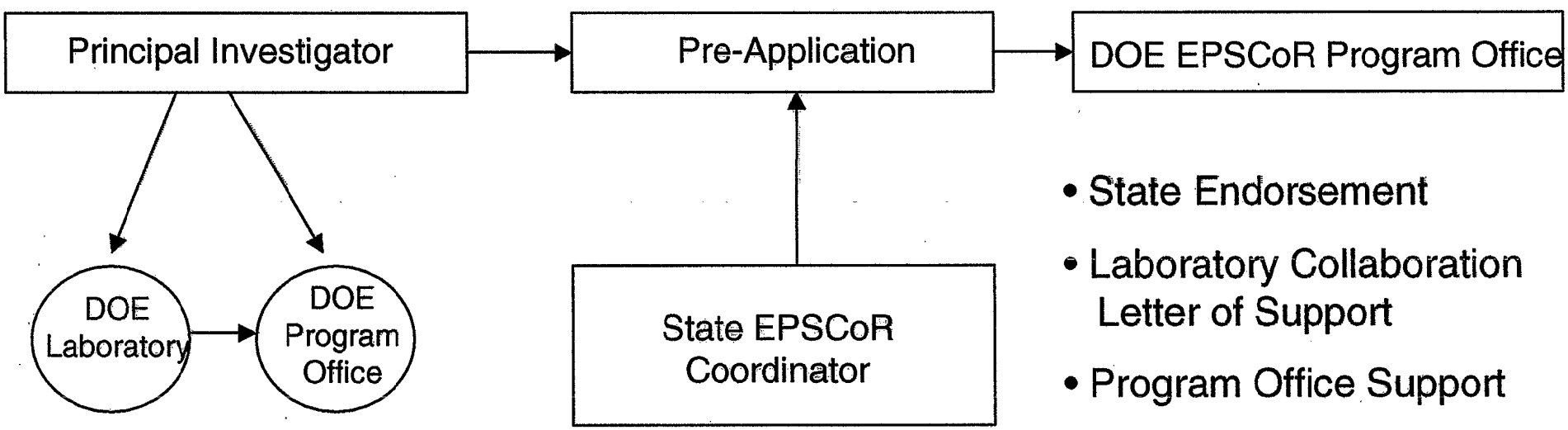
- Maintain balance between the Implementation Grants and Laboratory-Partnership Grants.
- Increase participation to 100% of eligible states.
- Adjust the program to include other states that may be added to the program such as Delaware, New Mexico, and Hawaii.

Major Historical Impacts

- The number of states participating in Implementation Grants has increased from six in FY 1997 to ten in FY 2000.
- Initiated Laboratory Partnership Grants in FY 1998 to increase the number of states participating in the program. Eighteen states are participating now.
- EPSCoR State investigators are conducting competitive research in collaboration with world class scientists at DOE National Laboratories, using state-of-the-art research facilities. Nearly all DOE National Laboratories are collaborating.

EPSCoR

Experimental Program to Stimulate Competitive Research

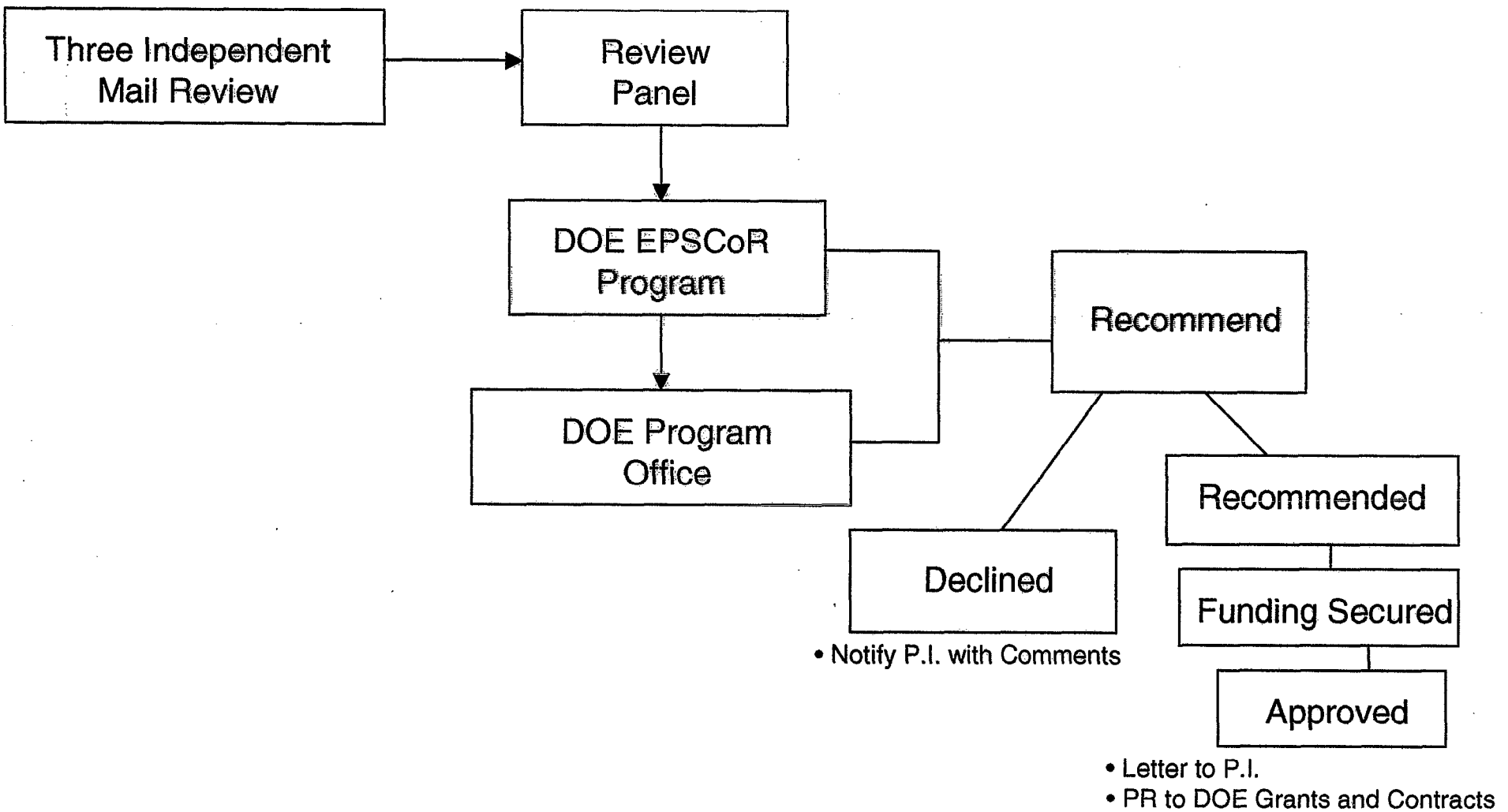


- State Endorsement
- Laboratory Collaboration Letter of Support
- Program Office Support
- Cost Share

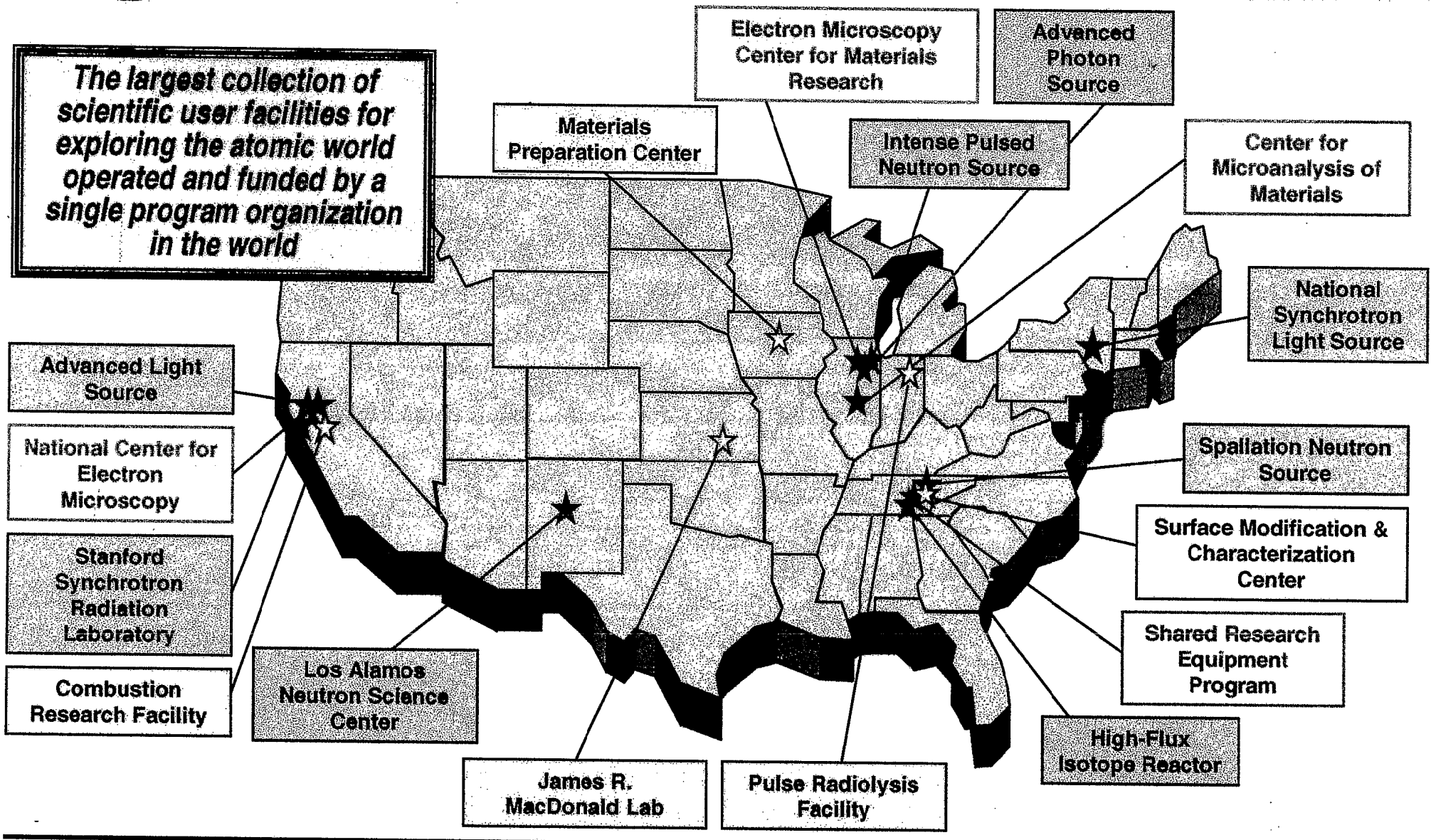
EPSCoR

Experimental Program to Stimulate Competitive Research

Formal Proposal



BES Facilities & Collaborative Research Centers



Major User Facilities:
- *4 Synchrotron Radiation Light Sources*
- *4 High-Flux Neutron Sources*

Collaborative Research Centers:
- *4 Electron Beam Microcharacterization Centers*
- *5 Special Purpose Centers*

Office of Science
Budget Profile*
(Dollars in Thousands)

	FY2000	FY2001	FY2002 (Request)
High Energy Physics	683,050	712,001	721,100
Nuclear Physics	340,869	360,508	360,510
Biological and Environmental Research	416,037	482,520	442,970
Advanced Scientific Computing Research	122,338	165,750	165,750
Fusion Energy Sciences	238,260	248,493	238,495
Basic Energy Sciences	752,031	991,679	1,004,705

* From Page 26 Department of Energy FY2002 Presidents Budget

Office of Biological and Environmental Research

Dr. Ari Patrinos, Associate Director
Mr. Michael Riches, Executive Assistant

Life Sciences Division
Dr. Marvin Frazier
Director

Molecular Biology
- Microbial Genome
- CCTI

Cellular Biology
- Low Dose Radiation Research
- Neutron Dosimetry

Genome
- Human

Biological Research
- Model Organisms
- Human Subjects
- Technology Development

Structural Biology
- Structural Biology Research
- Structural Biology Facilities Support
- Computational Biology

Medical Sciences Division
Dr. Michael Viola
Director

Medical Applications
- Radioisotope Development
- Radiopharmaceuticals
- Instrumentation
- Clinical Feasibility
- Boron Neutron Capture Therapy
- Molecular Nuclear Medicine

Measurement Science

Structural Biology Facilities

Computational Structural Biology

Genome Instrumentation

Environmental Sciences Division
Dr. Jerry Elwood
Acting Director

Climate and Hydrology
- Climate Modeling and CHAMMP
- ARM
- UAV

Atmospheric Chemistry and Carbon Cycle
- Atmospheric Science
- Carbon Cycle
- Ocean Sciences

Ecological Processes
- Ecosystem Function and Response
- Vegetation

Human Dimensions
- Information and Integration
- Education
- Integrated Assessment

NIGEC

Environmental Remediation
- Bioremediation
- Cleanup Research
- EMSL

Interactions

- BES
  - Jointly funding projects with Materials Sciences and Engineering Division and Chemical Sciences, Geosciences, and Biosciences Division.
- SC
  - Jointly funding projects with following offices:
    - ASCR, BER, FES, HENP
- DOE
  - EM - Office of Science and Technology
  - EE - Office of Transportation Technology
  - DP - Office of Defense Science
  - FE - Office of Natural Gas and Petroleum Technology, Office of Coal and Power Systems
- Interagency
  - Program coordinated through EPSCoR Interagency Coordinating Committee (EICC)
  - Agencies represented: DOD, EPA, NASA, NIH, NSF, USDA