U.S. DEPARTMENT OF ENERGY

OFFICE OF SCIENCE

Research Opportunities in the DOE Office of Science

ASME International Mechanical Engineering Education Conference
Hilton Head Island, South Carolina

Linda G. Blevins, Ph.D.
Office of the Deputy Director for Science Programs
Office of Science
March 30, 2009
www.science.doe.gov

Download this talk at
http://www.science.doe.gov/SC-2/Deputy_Director-speeches-presentations.htm

The Office of Science supports basic research in support of the DOE mission.

- The DOE is a mission agency with responsibilities in energy, environment, and national security.
- The Office of Science supports research within the DOE mission at universities and national laboratories.
- The Office of Science also plans, builds, and operates user facilities for the scientific community.

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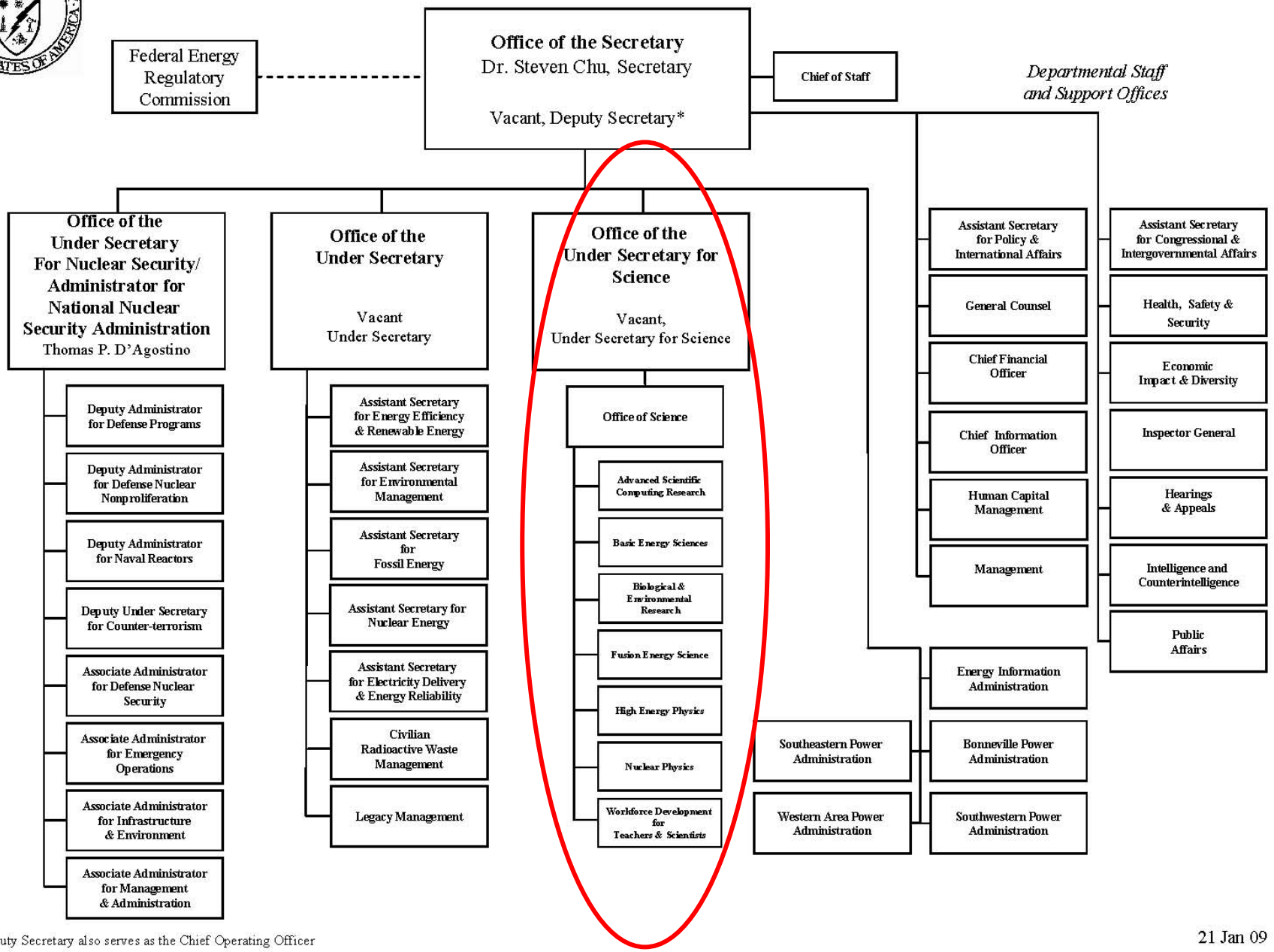
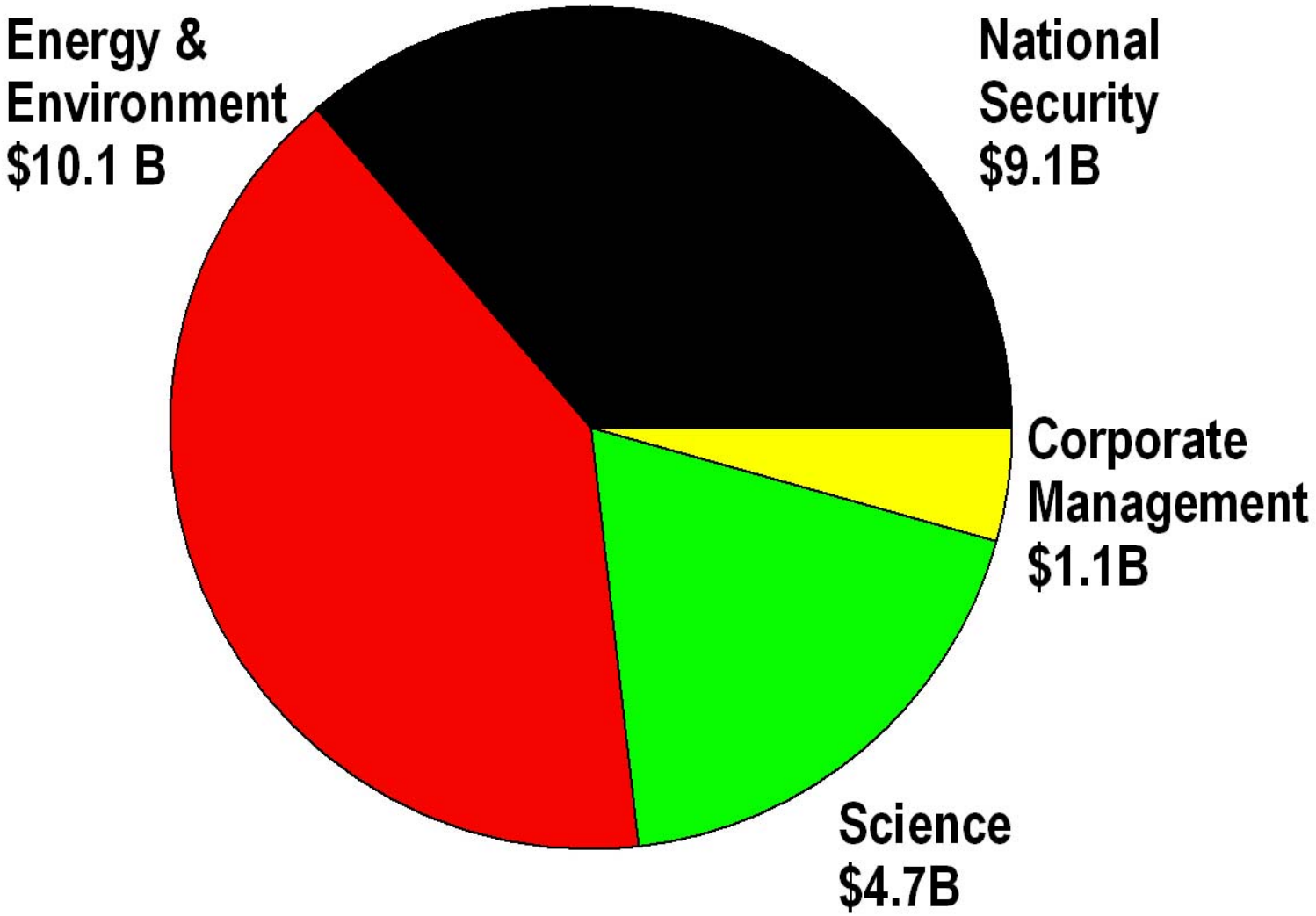


*The Deputy Secretary also serves as the Chief Operating Officer

21 Jan 09

Fiscal Year 2009 DOE Budget Request to Congress



Administration's Energy Plan

Within 10 years save more oil than we currently import from the Middle East and Venezuela combined.

Put 1 million plug-in hybrid cars – cars that can get up to 150 miles per gallon – on the road by 2015.

Generate 10 percent of our electricity from renewable sources by 2012, and 25 percent by 2025.

Implement an economy-wide, cap-and-trade program to reduce greenhouse gas emissions 80% by 2050.

http://www.whitehouse.gov/agenda/energy_and_environment/

DOE's Priorities and Goals

Priority: Science and Discovery: Invest in science to achieve transformational discoveries

- Organize and focus on breakthrough science
- Develop and nurture science and engineering talent
- Coordinate DOE work across the department, across the government, and globally

Priority: Change the landscape of energy demand and supply

- Drive energy efficiency to decrease energy use in homes, industry and transportation
- Develop and deploy clean, safe, low carbon energy supplies
- Enhance DOE's application areas through collaboration with its strengths in Science

Priority: Economic Prosperity: Create millions of green jobs and increase competitiveness

- Reduce energy demand
- Deploy cost-effective low-carbon clean energy technologies at scale
- Promote the development of an efficient, "smart" electricity transmission and distribution network
- Enable responsible domestic production of oil and natural gas
- Create a green workforce

Priority: National Security and Legacy: Maintain nuclear deterrent and prevent proliferation

- Strengthen non-proliferation and arms control activities
- Ensure that the U.S. weapons stockpile remains safe, secure, and reliable without nuclear testing
- Complete legacy environmental clean-up

Priority: Climate Change: Position U.S. to lead on climate change policy, technology, and science

- Provide science and technology inputs needed for global climate negotiations
- Develop and deploy technology solutions domestically and globally
- Advance climate science to better understand the human impact on the global environment

Priority: Science and Discovery

Invest in Science to Achieve Transformational Discoveries

- Focus on transformational science
  - Connect basic and applied sciences
  - Re-energize the national labs as centers of great science and innovation
  - Double the Office of Science budget
  - Embrace a degree of risk-taking in research
  - Create an effective mechanism to integrate national laboratory, university, and industry activities
- Develop science and engineering talent
  - Train the next generation of scientists and engineers
  - Attract and retain the most talented researchers
- Collaborate universally
  - Partner globally
  - Support the developing world
  - Build research networks across departments, government, nation and the globe

The Office of Science supports research and facilities within defined scientific programs.

Advanced Scientific Computing Research

Discover, develop, and deploy the computational and networking tools that enable researchers in the scientific disciplines to analyze, model, simulate, and predict complex phenomena important to the DOE.

Biological and Environmental Research

Understand complex biological, climatic, and environmental systems across spatial and temporal scales ranging from sub-micron to the global, from individual molecules to ecosystems, and from nanoseconds to millennia.

Basic Energy Sciences

Understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels in order to provide the foundations for new energy technologies and to support other aspects of DOE missions in energy, environment, and national security.

Fusion Energy Sciences

Expand the fundamental understanding of matter at very high temperatures and densities and the scientific foundations needed to develop a fusion energy source.

High Energy Physics

Understand how our universe works at its most fundamental level.

Nuclear Physics

Discover, explore, and understand all possible forms of nuclear matter.

Workforce Development for Teachers and Scientists

Help ensure that DOE and the Nation have a sustained pipeline of highly trained STEM workers.

Office of Science FY 2009 Appropriations

(dollars in thousands)

	FY 2008		FY 2009	
	Enacted Approp	Current Approp	Enacted Approp.	Recovery Act
Basic Energy Sciences	1,283,402	1,252,756	1,571,972	
Advanced Scientific Computing Research	351,173	341,774	368,820	
Biological & Environmental Research	544,397	531,063	601,540	
High Energy Physics	720,317	702,845	795,726	
Nuclear Physics	434,226	423,671	512,080	
Fusion Energy Sciences	302,048	294,933	402,550	
Science Laboratories Infrastructure	64,861	66,861	145,380	
Science Program Direction	177,779	177,779	186,695	
Workforce Development for Teachers & Scientists	8,044	8,044	13,583	
Safeguards and Security (gross)	75,946	75,946	80,603	
Small Business Innovation Research/Tech. Transfer	——	92,997	——	
Subtotal, Science	3,962,193	3,968,669	4,678,949	
ARPA-E.*	——	——	15,000	
Congressionally-directed projects	123,623	120,161	93,687	
SBIR/STTR (transfer from other DOE offices)	——	47,241	——	
Subtotal, Science	4,085,816	4,136,071	4,787,636	
Safeguards & Security (charge to reimbursables)	-5,605	-5,605	——	
Rescission of prior year Congressionally-directed projects	-44,569	-44,569	——	
Use of prior year balances	——	-3,014	-15,000	
Total, Science Appropriation	4,035,642	4,082,883	4,772,636	
Less: ARPA-E	——	——	-15,000	
Total, Office of Science	4,035,642	4,082,883	4,757,636	+1,600,000

*** ARPA-E is a separate entity reporting to the Secretary of Energy.**

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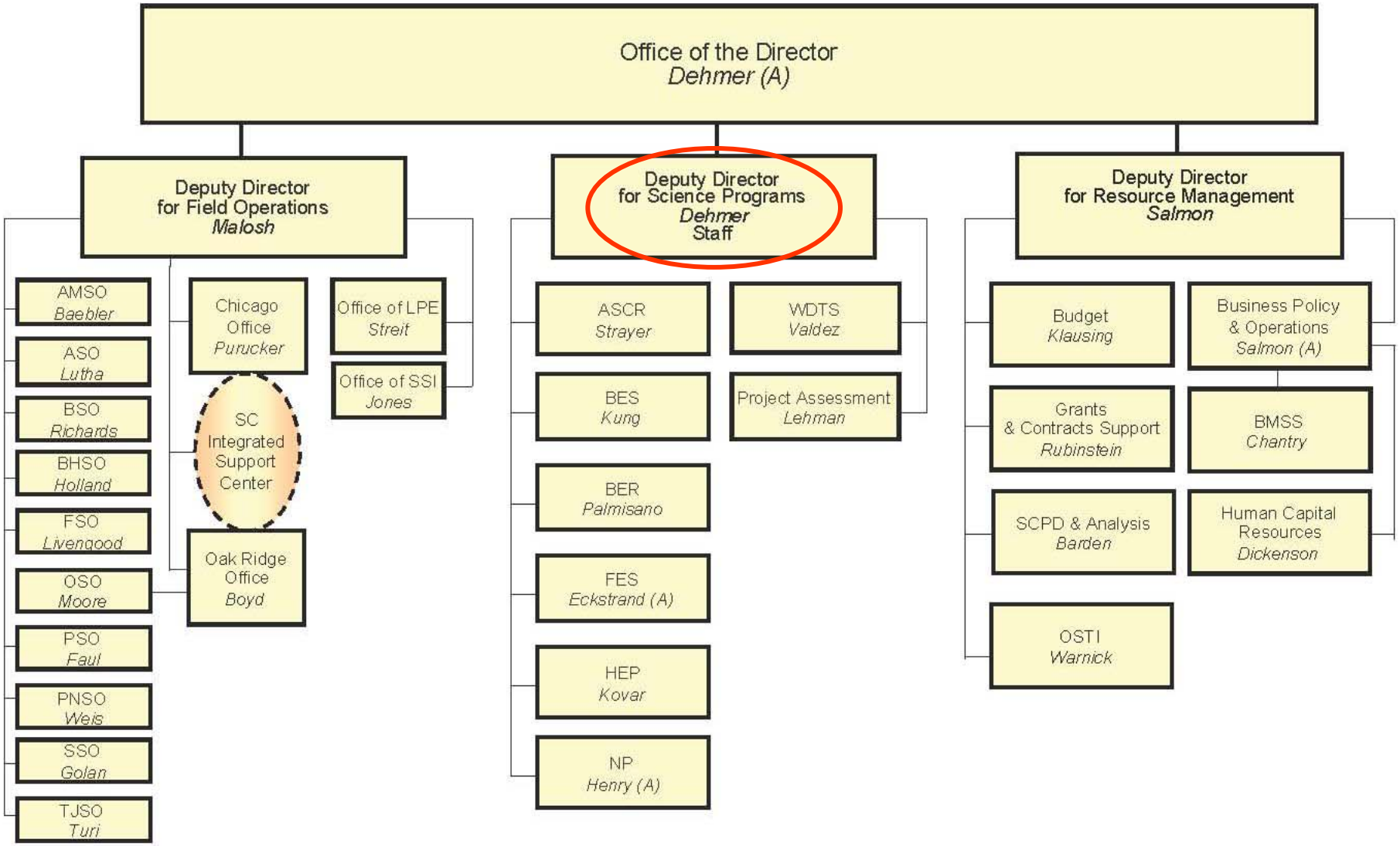

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Deputy Director
for Science Programs

- Provides scientific and management oversight of, and direction to, the Office of Science Program Offices.
- Sets Office-of-Science-specific policy related to the management of Office of Science programs.
- Ensures the Office of Science research portfolio is integrated across its Program Offices, with other DOE Program Offices, and with other Federal agencies.

http://www.science.doe.gov/SC-2/index.htm

Office of Science Numbers

The Office of Science is a steward for 10 of 17 DOE national labs and operates more than 30 major scientific user facilities.

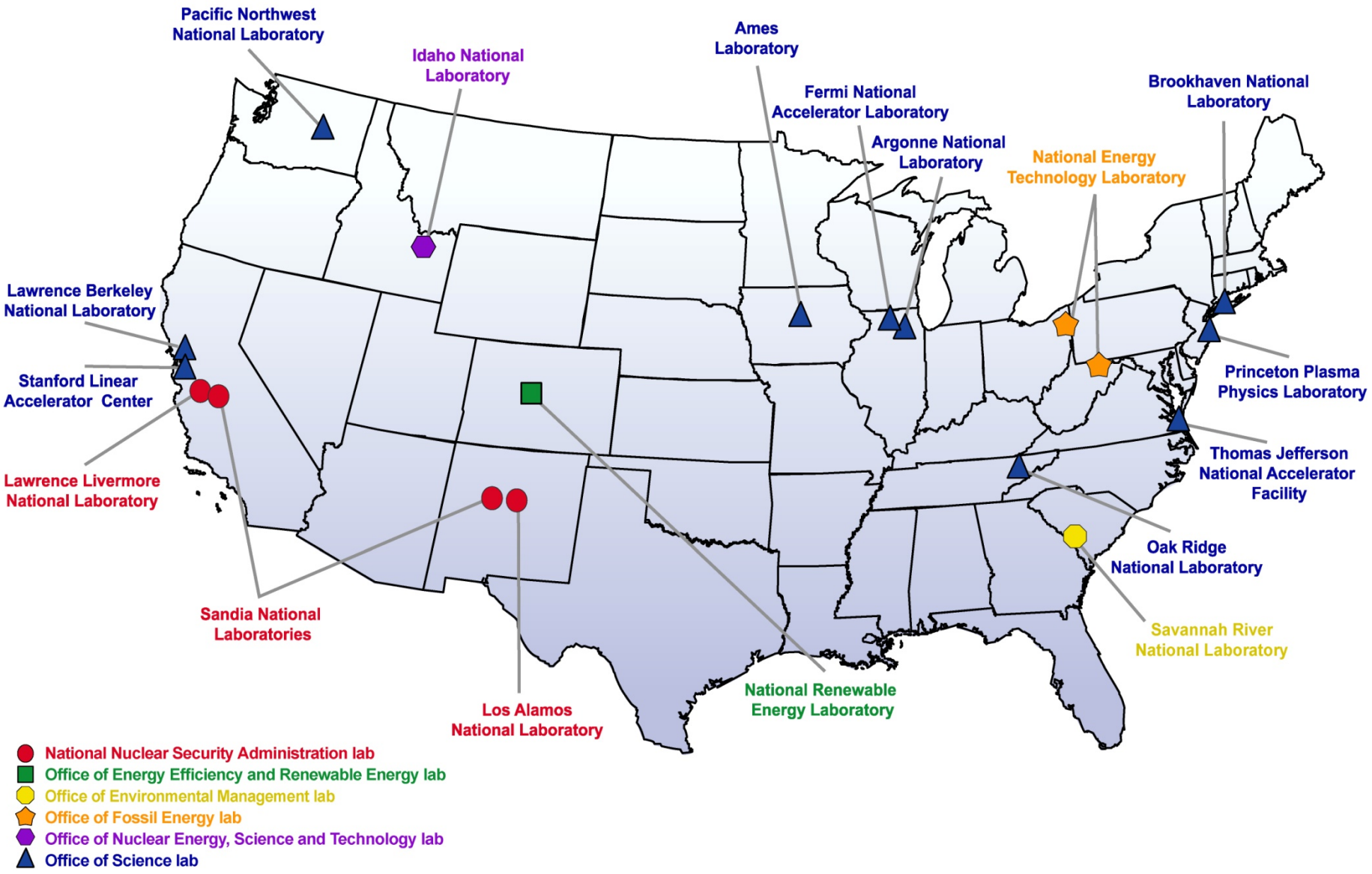
Approximately 1/2 of the budget supports operations of the scientific user facilities and construction of new facilities; the other 1/2 supports research at the national laboratories and universities.

About 1/3 of Office of Science research funding goes to support grants at more than 300 colleges and universities nationwide.

In FY 2009 SC plans to support the research of ~24,000 faculty, postdoctoral researchers, graduate students, and undergraduates.

~20,000 users of scientific facilities a year
~1/2 of the annual 20,000 facility users come from universities;
~1/3 of the users come from DOE national laboratories;
the remaining come from industry, other agencies, and international entities.

Department of Energy National Laboratories



Office of Science User Facilities

- Four operating **synchrotron light sources**, and two next-generation light sources
- Three **neutron sources**
- **Particle accelerators/colliders** for high energy and nuclear physics
- **Fusion/plasma facilities**, including **ITER** which aims to demonstrate the feasibility of fusion energy
- **Joint Genome Institute** – for rapid whole genome sequencing
- **Three Bioenergy Research Centers**
- Five **Nanoscale Science Research Centers** – assembly of capabilities unmatched in the world
- **Environmental Molecular Science Laboratory** – integrated experimental resources for discovery and innovation in the environmental molecular sciences
- Advanced **computational resources** – terascale to petascale computing and networks for open science

All research funded at laboratories and universities, including facilities construction and operations, is awarded through a peer-reviewed, merit-based process.

Merit Review Criteria*:

Scientific and/or technical merit of the project

Appropriateness of the proposed method or approach

Competency of the personnel and adequacy of proposed resources

Reasonableness and appropriateness of the proposed budget

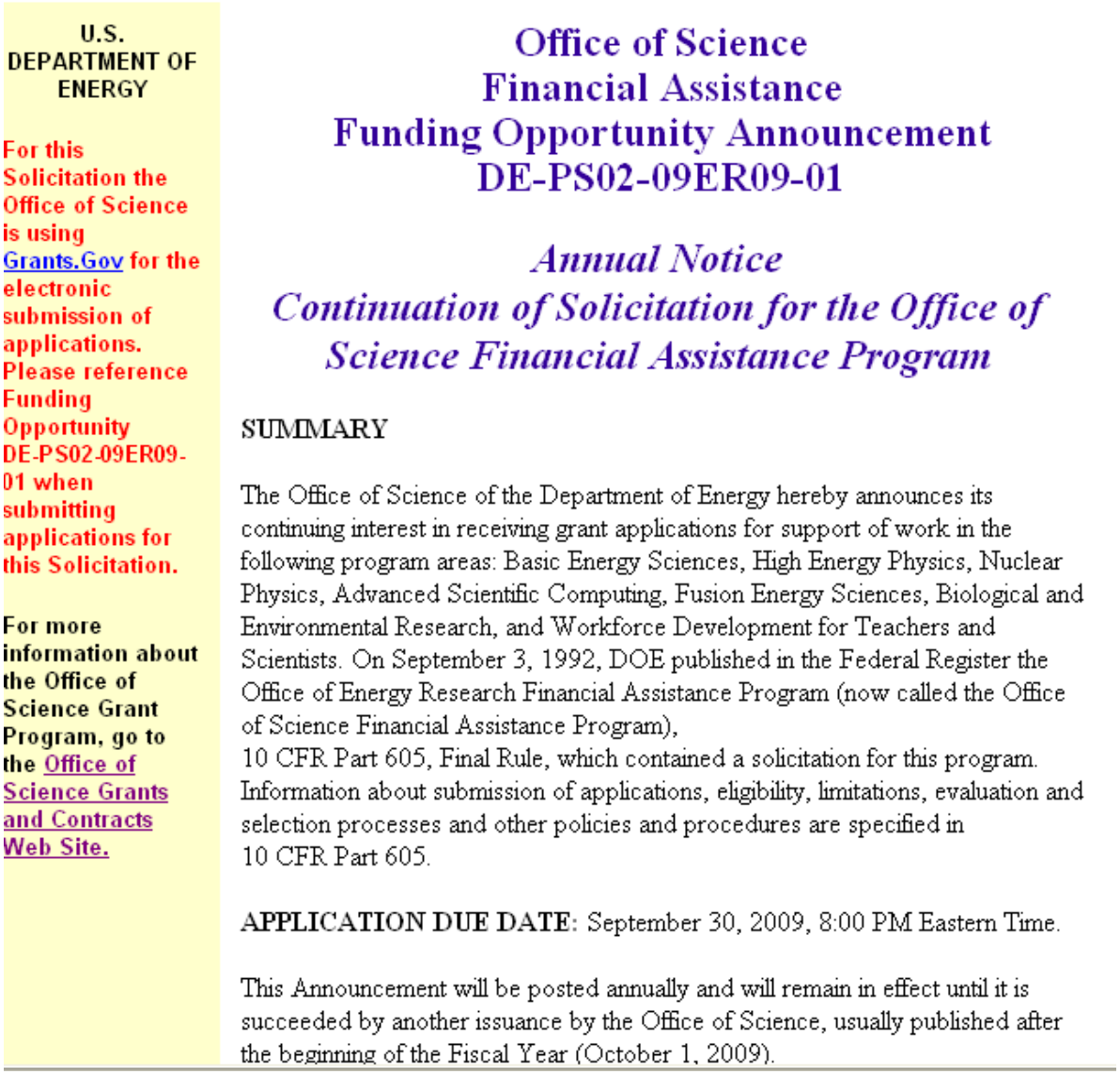
* From 10 C.F.R. 605

The Office of Science has ~3000 active grants and cooperative agreements, entertaining ~2000 new and renewal applications per year.

How to Find Office of Science Research Opportunities

Grants and Contracts Website
http://www.sc.doe.gov/grants/grants.html

Annual Open Solicitation
http://www.sc.doe.gov/grants/grants.html



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For this Solicitation the Office of Science is using Grants.Gov for the electronic submission of applications. Please reference Funding Opportunity DE-PS02-09ER09-01 when submitting applications for this Solicitation.

For more information about the Office of Science Grant Program, go to the Office of Science Grants and Contracts Web Site.

Office of Science
Financial Assistance
Funding Opportunity Announcement
DE-PS02-09ER09-01

Annual Notice
Continuation of Solicitation for the Office of Science Financial Assistance Program

SUMMARY

The Office of Science of the Department of Energy hereby announces its continuing interest in receiving grant applications for support of work in the following program areas: Basic Energy Sciences, High Energy Physics, Nuclear Physics, Advanced Scientific Computing, Fusion Energy Sciences, Biological and Environmental Research, and Workforce Development for Teachers and Scientists. On September 3, 1992, DOE published in the Federal Register the Office of Energy Research Financial Assistance Program (now called the Office of Science Financial Assistance Program), 10 CFR Part 605, Final Rule, which contained a solicitation for this program. Information about submission of applications, eligibility, limitations, evaluation and selection processes and other policies and procedures are specified in 10 CFR Part 605.

APPLICATION DUE DATE: September 30, 2009, 8:00 PM Eastern Time.

This Announcement will be posted annually and will remain in effect until it is succeeded by another issuance by the Office of Science, usually published after the beginning of the Fiscal Year (October 1, 2009).

Open throughout the year.

Funding Opportunity Announcements can be more specific, too.

Contact a program manager before submitting.

More information on funding opportunities can be found on the program websites.

Advanced Scientific Computing Research

http://www.sc.doe.gov/ascr/index.html

Basic Energy Sciences

http://www.sc.doe.gov/bes/bes.html

Biological and Environmental Research

http://www.sc.doe.gov/ober/ober_top.html

Fusion Energy Sciences

http://www.science.doe.gov/ofes/

High Energy Physics

http://www.science.doe.gov/hep/index.shtm

Nuclear Physics

http://www.sc.doe.gov/np/

Workforce Development for Teachers and Scientists

http://www.scied.science.doe.gov/scied/sci_ed.htm

Recent Examples of Topical Solicitations: Watch http://www.sc.doe.gov/grants for future opportunities

Fundamental Research in Superconducting RF Cavity Design **Notice DE-PS02-09ER09-05 -- Posted October 15, 2008. Letters of Intent encouraged by December 15, 2008. Formal applications due by January 15, 2009.**

Plasma Science Centers **Notice DE-PS02-08ER08-25 --Posted June 26, 2008. Letters of Intent requested by August 11, 2008. Preapplications required by September 1, 2008. Formal applications due February 18, 2009.**

Plant Feedstock Genomics for Bioenergy: A Joint Research Funding Opportunity Announcement USDA, DOE **Notice DE-PS02-09ER09-03 --Posted November 12, 2008. Preapplications are required and should be submitted by December 9, 2008. Formal applications due February 18, 2009.**

Environmental Remediation Science Program **Notice DE-PS02-09ER09-07 --Posted December 24, 2008. Preapplications encouraged and due by January 30, 2009. Formal applications due by April 9, 2009.**

Integrated Radiochemistry Research Projects of Excellence **Notice DE-PS02-09ER09-08 --Posted January 12, 2009. Preapplications required and due February 16, 2009. Formal applications due April 2, 2009.**

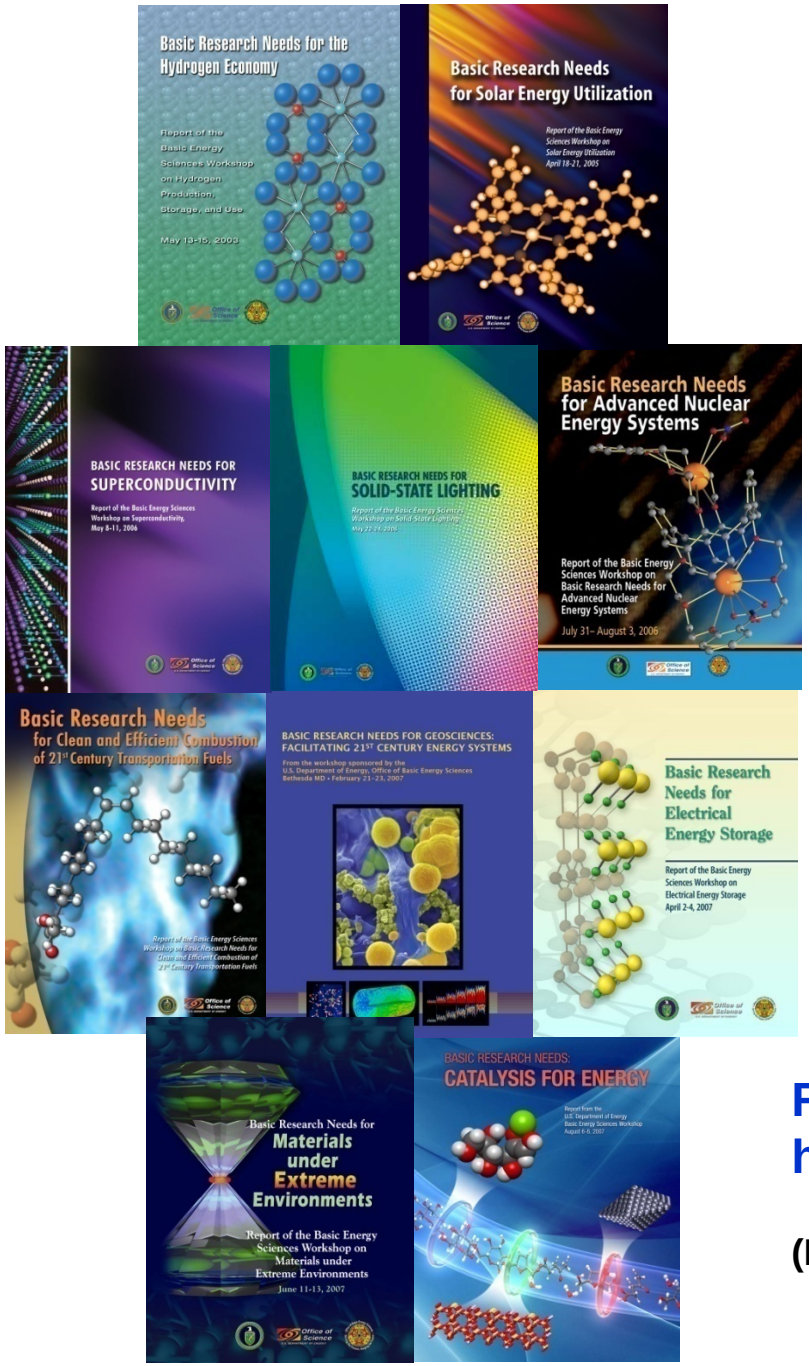
Climate Modeling: Simulating Climate at Regional Scale **Notice DE-PS02-09ER09-15 --Posted March 26, 2009. Formal applications due April 27, 2009.**

RECOVERY ACT - Applications of Nuclear Science and Technology **Notice DE-PS02-09ER09-13 -- Posted March 19, 2009. Formal applications due May 6, 2009.**

RECOVERY ACT - R&D on Alternative Isotope Production Techniques **Notice DE-PS02-09ER09-14 --Posted March 19, 2009. Formal applications due May 15, 2009.**

The Office of Science develops its programs and plans within the context of the DOE mission and in concert with the science community.

- Research areas are identified using federal advisory committees, program and topical workshops, interagency groups, National Academies' studies, and open and targeted solicitations.
- As an example, the Office of Basic Energy Sciences (BES) recently completed an important workshop series....



"Basic Research Needs" Workshops

- Basic Research Needs to Assure a Secure Energy Future
  BESAC Workshop, October 21-25, 2002
  The foundation workshop that set the model for the focused workshops that follow.
- Basic Research Needs for the Hydrogen Economy
  BES Workshop, May 13-15, 2003
- Basic Research Needs for Solar Energy Utilization
  BES Workshop, April 18-21, 2005
- Basic Research Needs for Superconductivity
  BES Workshop, May 8-10, 2006
- Basic Research Needs for Solid-state Lighting
  BES Workshop, May 22-24, 2006
- Basic Research Needs for Advanced Nuclear Energy Systems
  BES Workshop, July 31-August 3, 2006
- Basic Research Needs for the Clean and Efficient Combustion of 21st Century Transportation Fuels
  BES Workshop, October 30-November 1, 2006
- Basic Research Needs for Geosciences: Facilitating 21st Century Energy Systems
  BES Workshop, February 21-23, 2007
- Basic Research Needs for Electrical Energy Storage
  BES Workshop, April 2-5, 2007
- Basic Research Needs for Materials under Extreme Environments
  BES Workshop, June 10-14, 2007
- Basic Research Needs for Catalysis for Energy
  BES Workshop, August 5-10, 2007

Reports available at http://www.sc.doe.gov/bes/reports/list.html

(BESAC = Basic Energy Sciences Advisory Committee)

The scientific challenges that emerge from the workshop series are no longer discussed in terms of traditional scientific disciplines.

Directing Matter and Energy: Five Challenges for Science and the Imagination

BESAC Grand Challenge Subcommittee Report
January 2008

- How do we control materials processes at the level of electrons?
- How do we design and perfect atom- and energy-efficient syntheses of revolutionary new forms of matter with tailored properties?
- How do remarkable properties of matter emerge from the complex correlations of atomic or electronic constituents and how can we control these properties?
- How can we master energy and information on the nanoscale to create new technologies with capabilities rivaling those of living things?
- How do we characterize and control matter away—especially very far away—from equilibrium?
- Addressing these grand challenges is key to making the transition from observation to control of matter.

http://www.sc.doe.gov/bes/reports/files/GC_rpt.pdf

The workshop series inspired a new BES funding opportunity.

Energy Frontier Research Centers (~$100M/yr beginning with FY09 appropriation)

Innovative basic research to accelerate scientific breakthroughs needed to create advanced energy technologies for the 21st century

Awards to be $2M-$5M per year for an initial 5-year period

The Office of Science seeks to engage the Nation's intellectual and creative talent to tackle the scientific grand challenges associated with determining how nature works, leading the scientific community to direct and control matter at the quantum, atomic, and molecular levels, and harness this new knowledge and capability for some of our most critical real-world challenges.

Energy Frontier Research Centers will pursue basic research in areas such as:

- Solar Energy Utilization
- Catalysis for Energy
- Electrical Energy Storage
- Solid State Lighting
- Superconductivity
- Geosciences for Nuclear Waste and CO_2 Storage
- Advanced Nuclear Energy Systems
- Combustion of 21st Century Transportation Fuels
- Hydrogen Production, Storage, and Use
- Materials Under Extreme Environments

U.S. universities, DOE laboratories, and other institutions eligible

FOA opened April 4, 2008 - FOA closed October 1, 2008 - ~260 applications received and reviewed. Announcements coming very soon.

http://www.sc.doe.gov/bes/EFRC.html

Current EFRC Funding Opportunity Announcement

DOE/BES received approximately 260 applications involving some 385 institutions.

The EFRC applications come from lead institutions in 41 states and the District of Columbia.

The approximate breakdown of applications by lead institution is about:

- 71% from universities
- 13% from DOE/NNSA laboratories
- 16% from other institutions (for-profit, nonprofit, and individuals).

Approximately 3800 senior investigators are participating in the EFRC applications; 98% of these come from the U.S. and 2% come from 26 foreign countries.

The average number of investigators per application is 15; the average number of institutions per application is 4.8.

The total requested budget for all applications over the 5-year project period is approximately $5B.

The Office of Science provides opportunities for early career researchers.

(1) Fusion Energy Sciences Plasma Physics Junior Faculty Development Program

(2) Advanced Scientific Computing Research Early Career Principal Investigator Program

(3) High Energy Physics Outstanding Junior Investigator Program

(4) Nuclear Physics Outstanding Junior Investigator Program

(5) SC Early Career Scientist and Engineer Award (SC-ECASE) recognizes researchers at national laboratories. If an SC-ECASE winner is selected for PECASE, they receive ~$50k per year for five years.

University researchers can become involved in many ways.

- Read about the core research areas on our websites and contact program managers to discuss whether your ideas fit within their programs. http://phonebook.doe.gov/
- Volunteer to become a reviewer or participate in a workshop.
- Incorporate our large scientific user facilities into your research. Apply to compete for time at one of them.
- Follow federal advisory committee meetings.
- Respond to open and topical solicitations.

Committees of Visitors are important to the Office of Science.

Every three years, a COV is asked to

(1) assess the efficacy and quality of the process used to solicit, review, recommend, and document proposal actions and to monitor active awards, projects, and programs.

(2) comment on the breadth and depth of portfolio elements and the national and international standing of the portfolio.

Reports and program responses are archived:
http://www.science.doe.gov/SC-2/Committe_of_Visitor.htm

Mechanical engineering researchers contribute to Office of Science programs in many ways.

- At DOE national laboratories...
- At scientific facilities...
- Through research grants...

Examples of mechanical engineers in Office of Science grant programs

- Scalable Methods for Electronic Excitations and Optical Responses of Nanostructures: Mathematics to Algorithms to Observables (BES, DE-FG02-05ER15631)
  - Emily A. Carter, Mechanical and Aerospace Engineering, Princeton University
- Heat Conduction in Nanowire Structures (BES, DE-FG02-02ER45977)
  - Gang Chen, Mechanical Engineering, MIT
- Multiscale Simulation of Thermo-Mechanical Processes in Irradiated Fission-Reactor Materials (BES, DE-FG02-07ER46367)
  - Anter El-Azab, Mechanical Engineering, Florida State University
- Continuum Mechanical and Computational Aspects of Material Behavior (ASCR, DE-FG02-09ER25876)
  - Eliot M. Fried, Mechanical Engineering, McGill University
- Towards Optimal Petascale Simulations (TOPS) (ASCR, DE-FC02-06ER25782)
  - Omar Ghattas, Mechanical Engineering, University of Texas

Examples of mechanical engineers in Office of Science grant programs

- Multiscale Investigation and Modeling of Flow Mechanisms Related to CO2 Sequestration in Geologic Formations (BES, DE-FG02-08ER15991)
  - Frederic Gibou, Mechanical Engineering, UC Santa Barbara
- Kinetics and Spectroscopy of Combustion Gases at High Temperatures (BES, DE-FG02-88ER13857)
  - Ronald Hanson, Mechanical Engineering, Stanford University
- Stress-Coupled Grain Boundary Migration (BES, DE-FG02-07ER46437)
  - Kevin Hemker, Mechanical Engineering, Johns Hopkins University
- Plasticity in Ultra Fine Grained Materials (BES, DE-FG02-07ER46398)
  - Marisol Koslowski, Mechanical Engineering, Purdue University
- Simulations of Turbulent Flows With Strong Shocks (ASCR, DE-FC02-06ER25787)
  - Sanjiva Lele, Mechanical Engineering, Stanford University

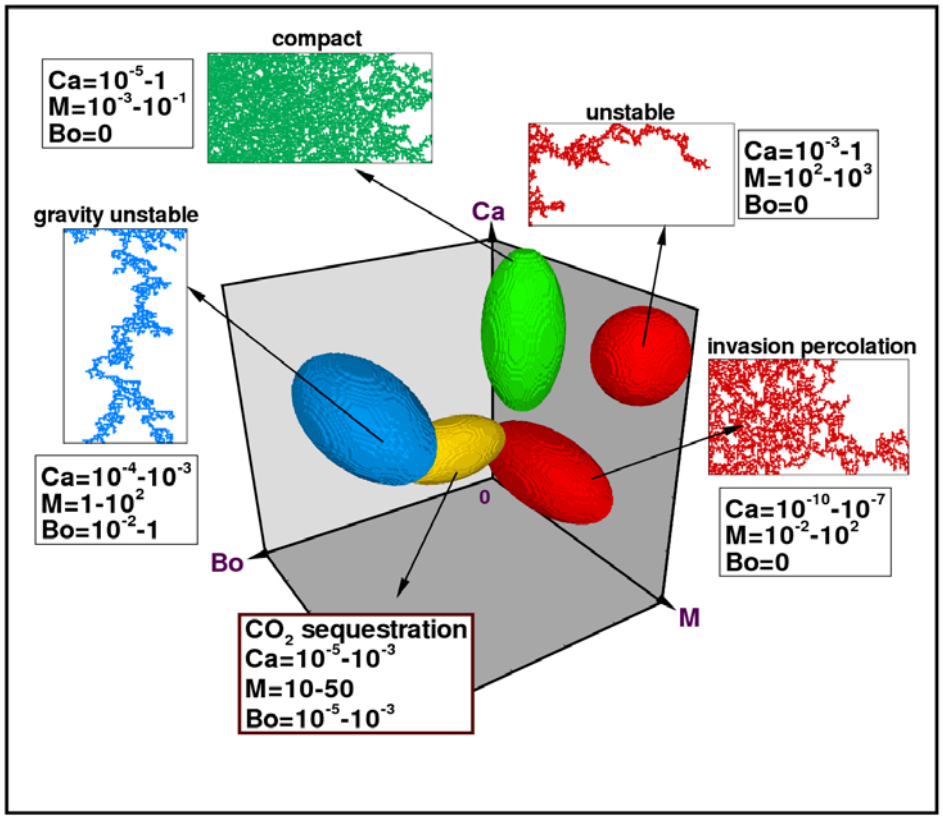
Examples of mechanical engineers in Office of Science grant programs

- Advanced Nonlinear Optical Methods for Quantitative Measurements in Flames (BES, DE-FG02-03ER15391)
  - Robert Lucht, Mechanical Engineering, Purdue University
- Growth Rates of Freshly Nucleated Particles (BER, DE-FG02-05ER63997)
  - Peter H. McMurry, Mechanical Engineering, University of Minnesota
- Investigation of Non-Premixed Turbulent Combustion (BES, DE-FG02-90ER14128)
  - Stephen B. Pope, Mechanical and Aerospace Engineering, Cornell University
- Partitioning of Nanoparticles into Organic Phases and Model Cells (BER, DE-FG02-08ER64613)
  - Jonathan Posner, Mechanical Engineering, Arizona State University
- The Coupling Between Interfacial Charge and Mechanical Deformation at High Temperatures in Ceramics (BES, DE-FG02-07ER46403)
  - Rishi Raj, Mechanical Engineering, University of Colorado

Examples of mechanical engineers in Office of Science grant programs

- Atomic Resolution Imaging and Quantification of Chemical Functionality of Surfaces (BES, DE-FG02-06ER15834)
  - Udo Schwarz, Mechanical Engineering, Yale University
- Hybrid Numerical Methods for Multiscale Simulations of Subsurface Biogeochemical Processes (BER, DE-FC02-07ER64324)
  - Daniel Tartakovsky, Mechanical and Aerospace Engineering, UC San Diego
- Advanced Design Program (ARIES) (FES, DE-FG02-04ER54757)
  - Mark S. Tillack (co-PI), Mechanical and Aerospace Engineering, UC San Diego
- Multiscale Atomistic Simulation of Metal-Oxygen Surface Interactions: Methodological Development, Theoretical Investigation, and Correlation with Experiment (BES, DE-FG02-07ER46446)
  - Judith Yang, Mechanical Engineering & Materials Science, University of Pittsburgh
- Advanced Design Studies (FES, DE-FG02-01ER54656)
  - Minami Yoda, Mechanical Engineering, Georgia Tech

Multiscale Investigation and Modeling of Flow Mechanisms Related to CO_2 Sequestration in Geologic Formations

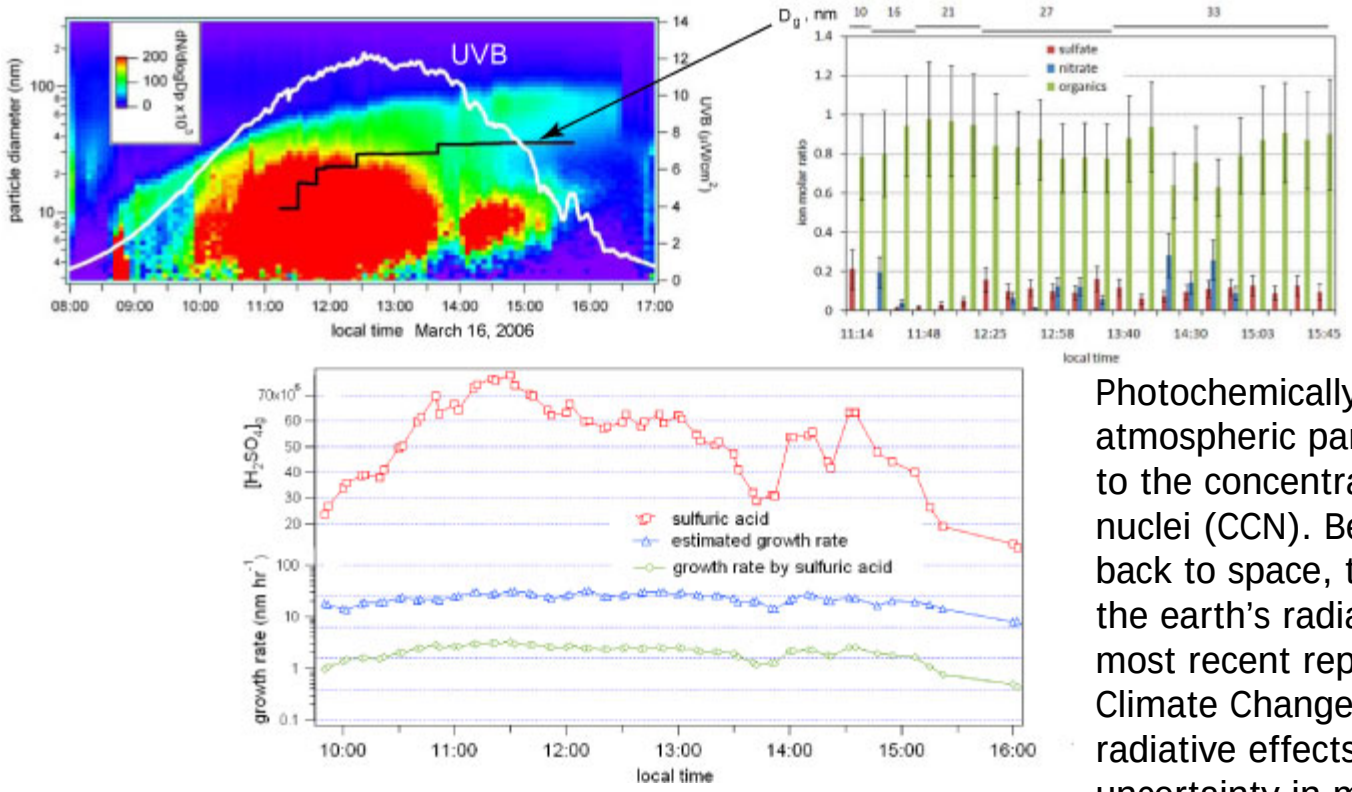


Map of microscopic drainage behavior in the parameter space of *Ca ¡M ¡ Bo*

Sequestration in deep saline aquifers is recognized as one of the most effective methods to limit the atmospheric concentration of carbon dioxide and thereby reduce global warming. The injection and migration of super-critical CO2 in saline aquifers is typically an immiscible drainage process through the resident brine but may also involve imbibition, hysteresis, trapping, dissolution and miscibility. Overall, carbon dioxide sequestration is a geologic scale multiphase fluid dynamic process in natural porous media that is microscopic in nature and must be represented accurately across a hierarchy of length and time scales.

PI: Frederic Gibou, UC Santa Barbara
BES Geosciences Program

Growth Rates of Freshly Nucleated Particles

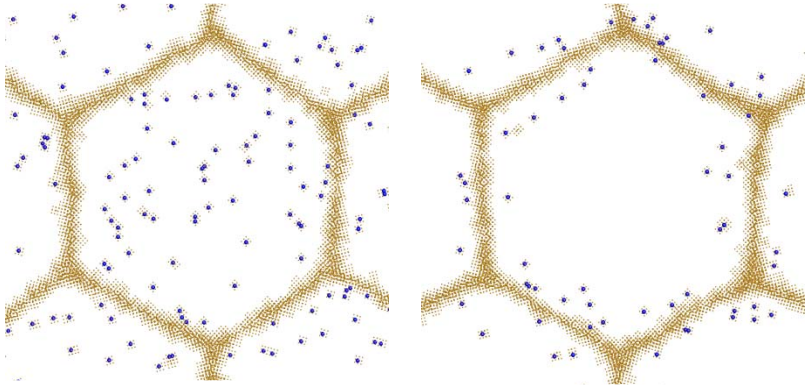


Growth of small particles during a nucleation event at Tecamac Mexico during the MILAGRO MAX-MEX campaign.

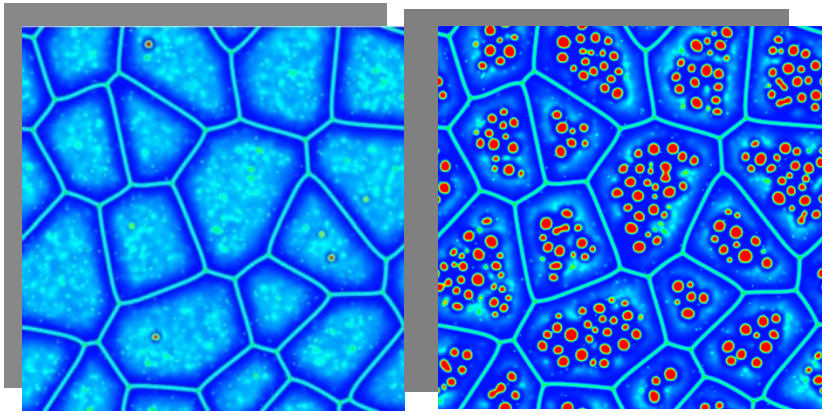
Photochemically-driven formation of new atmospheric particles contributes significantly to the concentrations of cloud condensation nuclei (CCN). Because clouds scatter sunlight back to space, they have a significant effect on the earth's radiation balance. In fact, in its most recent report, the International Panel on Climate Change (IPCC) identified cloud radiative effects as the largest source of uncertainty in models for climate forcing. Therefore, new particle formation (NPF) needs to be accounted for in global climate models. This project involves experimental research that will lead to microphysical models for the growth rates of newly formed particles.

PI: Peter McMurry, U. of Minnesota
BER Atmospheric System Research Program

Multiscale Simulation of Thermo-Mechanical Processes in Irradiated Fission-Reactor Materials



Atomistic (molecular-dynamics) simulation



Mesoscopic (phase-field) simulation

Molecular-dynamics simulation

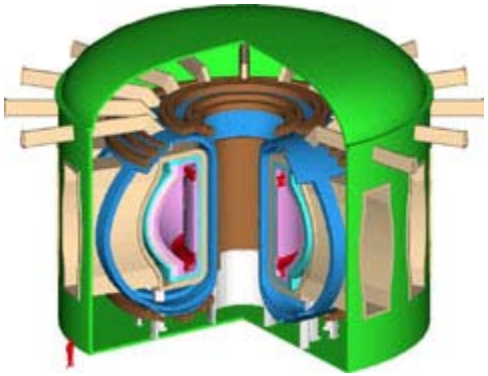
- **Provides insight into point-defect interactions with each-other (clustering) and with the grain boundaries (sink behavior)**
- **Yields diffusion behavior (mechanisms, formation and migration energies, …)**

Comprehensive phase-field approach

- **Explicit incorporation of microstructural heterogeneity**
- **Coupled void nucleation, growth and grain structure evolution**
- **Void-denuded grain-boundary regions observed experimentally**

PI: Anter El-Azab, Florida State University
BES Theoretical Condensed Matter Physics Program

Advanced Fusion Design Studies



(http://aries.ucsd.edu/ARIES/)

This effort encompasses analytical, numerical, and experimental contributions in the area of reactor engineering and thermal-hydraulics, focusing on the evaluation of high heat flux components.

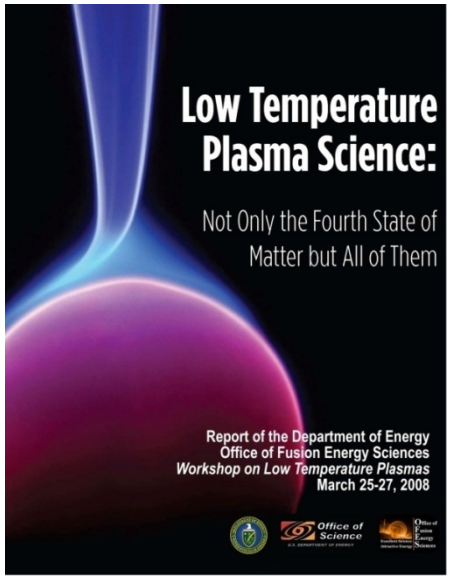
The Advanced Reactor Innovations and Evaluations Study (ARIES) Team is a national team with participants from academia, the national laboratories, and industry that bridges the science and energy missions of the US Fusion Program. Its mission is to "perform advanced integrated design studies of the long-term fusion energy embodiments to identify key R&D directions and provide visions for the program."

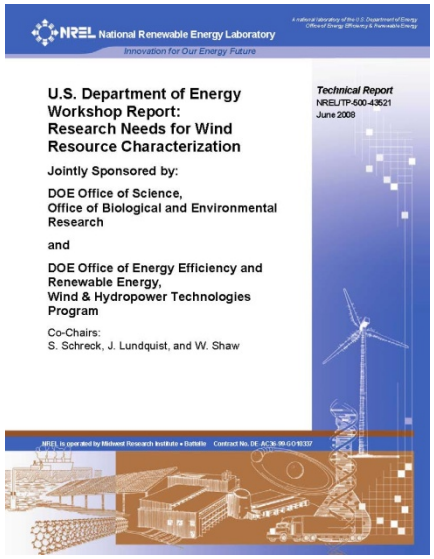
PI: Minami Yoda, Georgia Tech
FES

Two recent ME-relevant workshops

Low Temperature Plasma Science Workshop, March 2008, Office of Fusion Energy Sciences

http://www.science.doe.gov/ofes/programdocuments.shtml





Research Needs for Wind Resource Characterization, January 2008, Office of Biological and Environmental Research and Office of Energy Efficiency and Renewable Energy

http://www.nrel.gov/ce/wrc_workshop/main.cfm

DOE Recovery Act Funding

- Office of Energy Efficiency and Renewable Energy (EERE): $16.8B
  - Weatherization; State Energy Program; Advanced Batteries Manufacturing; Energy Efficiency & Renewable Energy
- Office of Environmental Management (EM): $6.0B
- Office of Electricity Delivery and Reliability (OE): $4.5B
  - Smart Grid and Related Programs
- Office of Fossil Energy (FE): $3.4B
- Office of Science: $1.6B
- ARPA-E: $0.4B

http://www.energy.gov/recovery/

RECOVERY.GOV

Opportunities in DOE Science Programs

Research and Facilities

Advanced Scientific Computing Research (ASCR)

To discover, develop, and deploy the computational and networking tools that enable researchers in the scientific disciplines to analyze, model, simulate, and predict complex phenomena important to DOE.

A particular challenge is fulfilling the science potential of emerging multi-core computing systems and other novel "extreme-scale" computing architectures, which will require significant modifications to today's tools and techniques.

Director: Dr. Michael Strayer

ASCR Programs

Research Areas

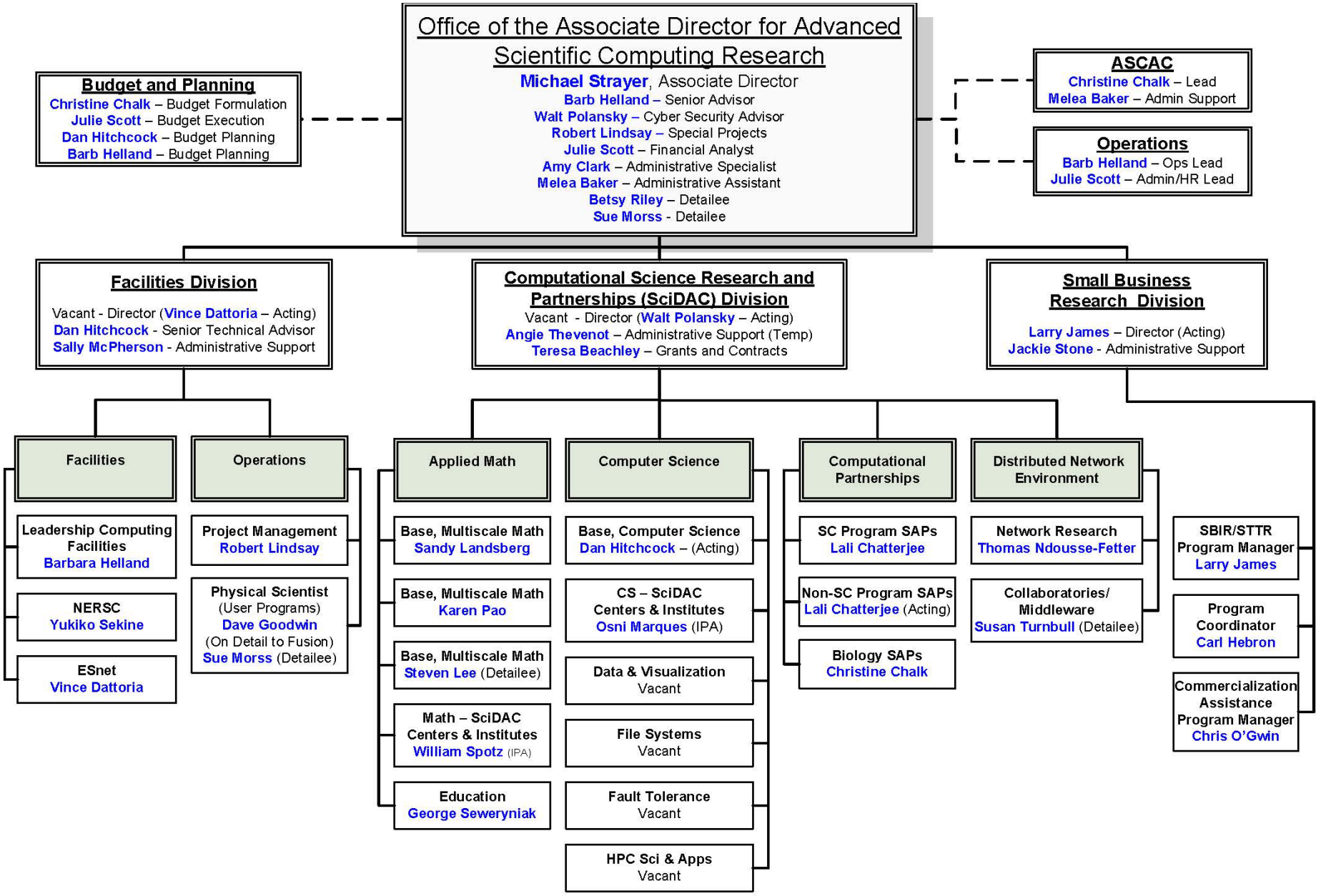
- Applied Mathematics
- Computer Science
- Integrated Networking Environments

User Facilities and Networks

- National Energy Research Scientific Computing Facility (NERSC) at Lawrence Berkeley National Laboratory (LBNL)
- Leadership Computing Facility at Argonne National Laboratory (ANL)
- Leadership Computing Facility at Oak Ridge National Laboratory (ORNL)
- Energy Sciences Network (ESnet)

Cross-Cutting Projects

- Scientific Discovery through Advanced Computing (SciDAC)
- Innovative and Novel Computational Impact on Theory and Experiment (INCITE)
- Multiscale Mathematics Initiative



February 2, 2009

Biological and Environmental Research (BER)

To understand complex biological, climatic, and environmental systems across spatial and temporal scales ranging from sub-micron to the global, from individual molecules to ecosystems, and from nanoseconds to millennia.

This will be accomplished by exploring the frontiers of genome-enabled biology; discovering the physical, chemical and biological drivers of climate change; and seeking the molecular determinants of environmental sustainability and stewardship.

Director: Dr. Anna Palmisano

BER Research Programs

Biological Systems Sciences

Genomics: GTL

Bioenergy Research Centers

Joint Genome Institute

Low Dose Radiation

Radiochemistry, Imaging & Instrumentation

Structural Biology

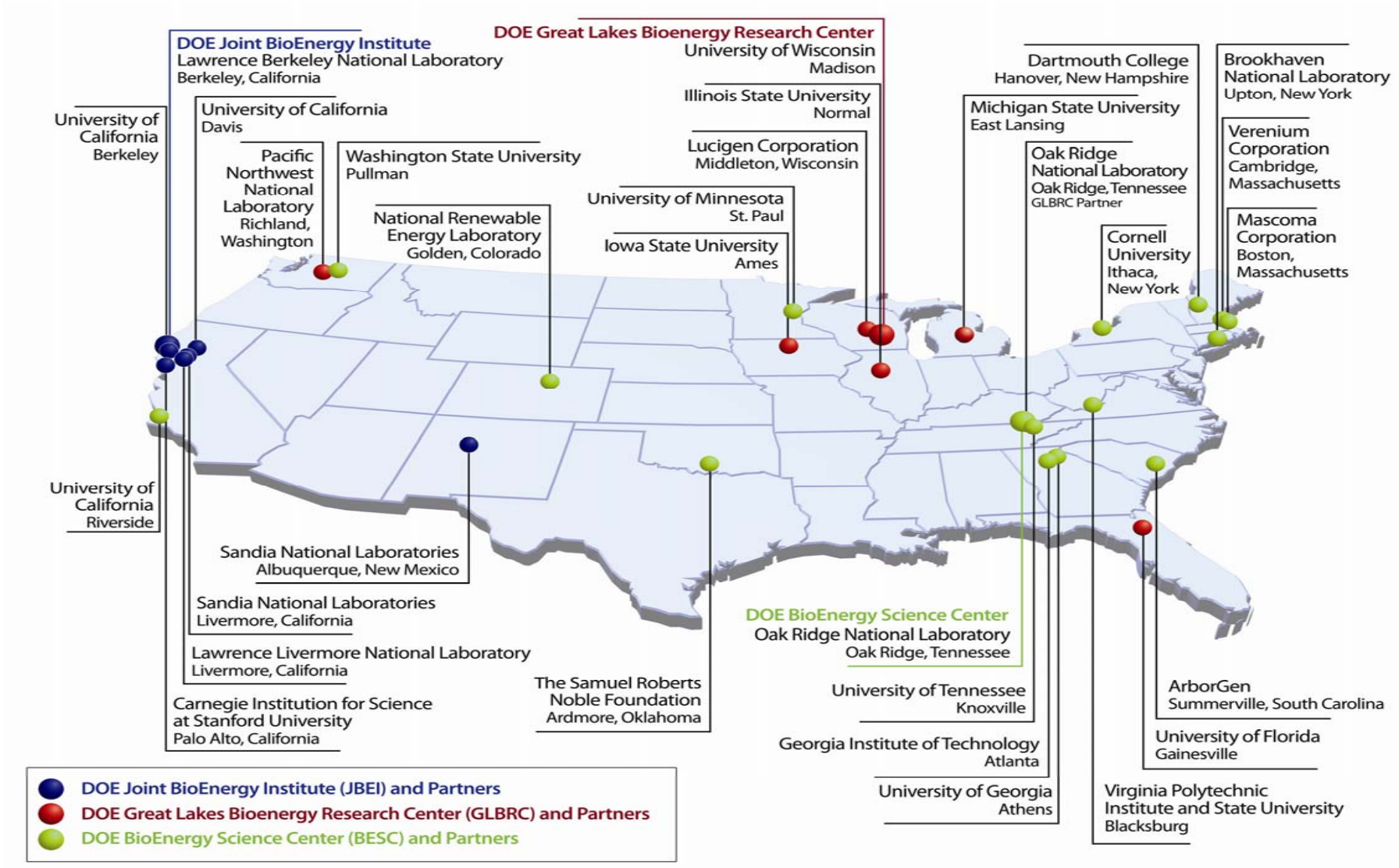
Climate & Environmental Sciences

Climate Change Research

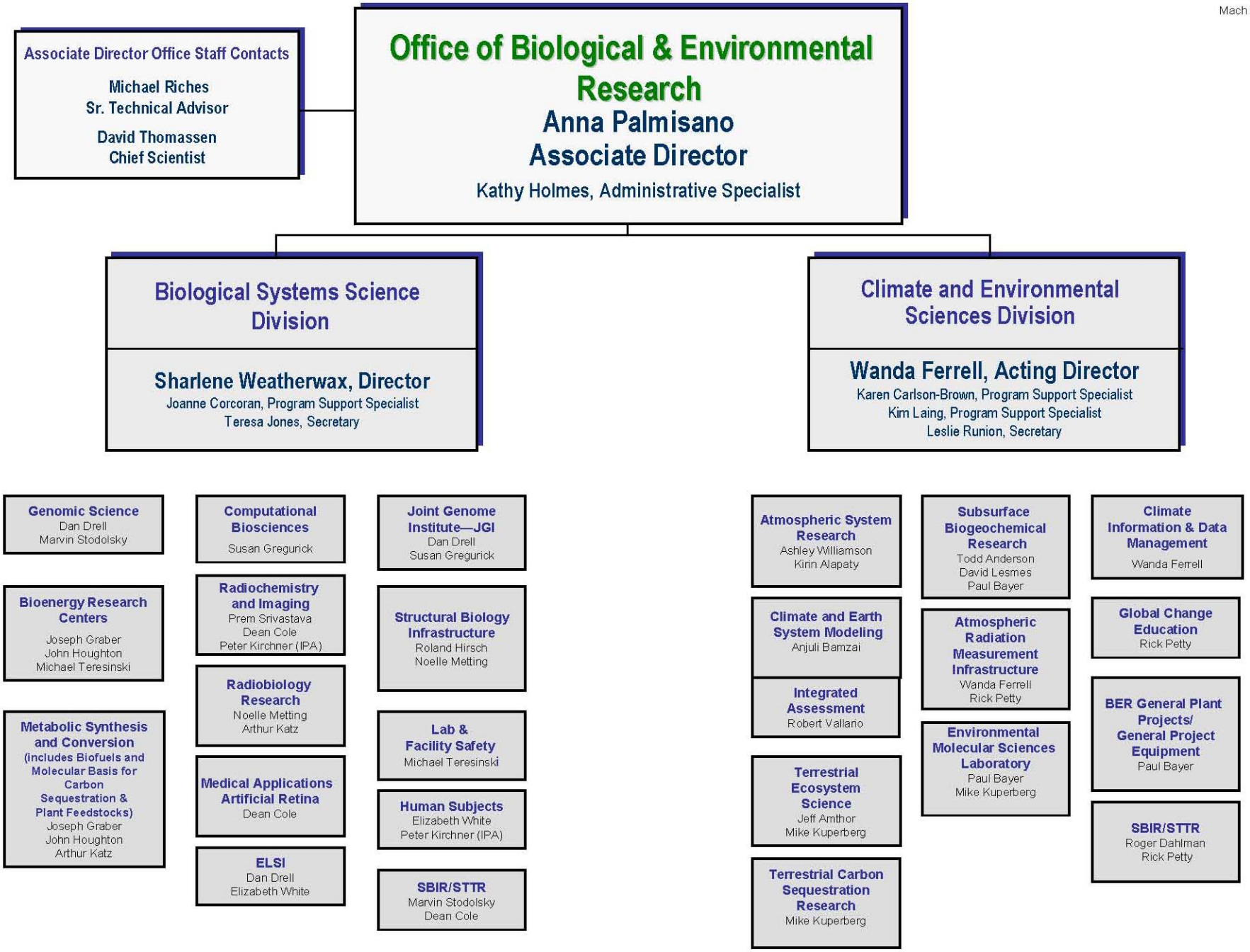
Environmental Remediation Science Program

Environmental Molecular Science Lab

Bioenergy Research Centers: Multi-Institution Partnerships



Mach 2009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Leslie Runion, Secretary
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Marvin Stodolsky
Bioenergy Research Centers
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John Houghton
Michael Teresinski
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(includes Biofuels and Molecular Basis for Carbon Sequestration & Plant Feedstocks)
Joseph Graber
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Basic Energy Sciences (BES)

To support fundamental research to understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels in order to provide the foundations for new energy technologies and to support other aspects of DOE missions in energy, environment, and national security.

Director: Dr. Harriet Kung

BES Research Programs

Materials Sciences & Engineering

Condensed Matter & Materials Physics
- Experimental Condensed Matter Physics
- Theoretical Condensed Matter Physics
- Physical Behavior of Material
- Mechanical Behavior & Radiation Effects

Materials Discovery, Design, & Synthesis
- Materials Chemistry
- Biomolecular Materials
- Synthesis & Processing

Scattering & Instrumentation Sciences
- X-ray Scattering
- Neutron Scattering
- Electron & Scanning Probe Microscopies
- Ultrafast Science & Instrumentation

Chemical Sciences, Geosciences, & Biosciences

Fundamental Interactions
- Atomic, Molecular, & Optical Sciences
- Gas-Phase Chemical Physics
- Condensed-Phase & Interfacial Molecular Science
- Computational & Theoretical Chemistry

Photo- & Bio-Chemistry
- Solar Photochemistry
- Photosynthetic Systems
- Physical Biosciences

Chemical Transformations
- Catalysis Science
- Heavy Element Chemistry
- Separations & Analysis
- Geosciences

Scientific User Facilities: Accelerator & Detector R&D

BES User Facilities

Four synchrotron radiation light sources

- Advanced Light Source
- Advanced Photon Source
- National Synchrotron Light Source
- Stanford Synchrotron Radiation Laboratory

Three neutron scattering facilities

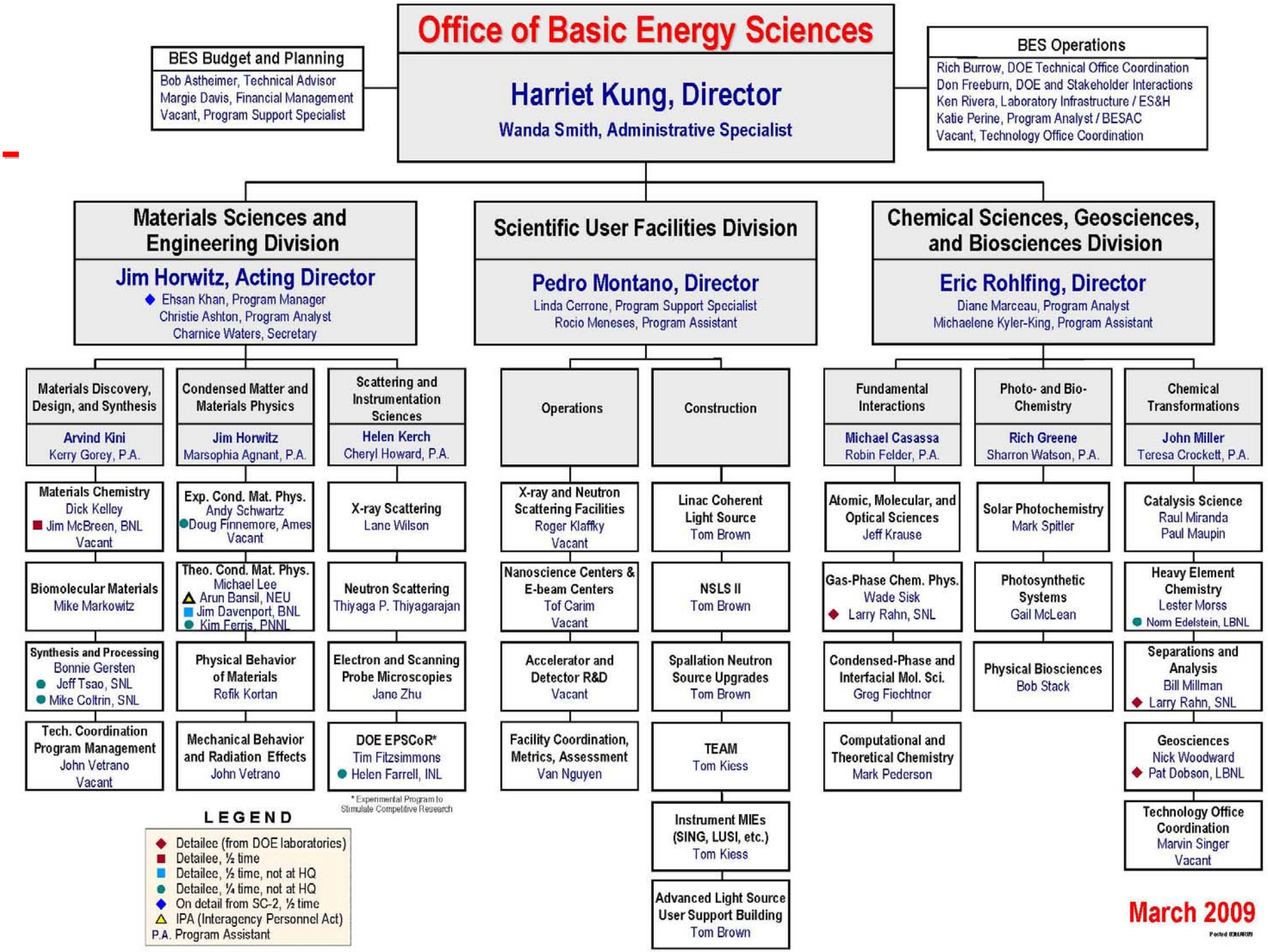
- Spallation Neutron Source
- High Flux Isotope Reactor
- Manuel Lujan Jr. Neutron Scattering Center

Five nanoscale science research centers

- Center for Nanoscale Materials
- Center for Functional Nanomaterials
- Molecular Foundry
- Center for Nanophase Materials Sciences
- Center for Integrated Nanotechnologies

Two facilities under construction

- Linac Coherent Light Source
- National Synchrotron Light Source II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DOE EPSCoR*
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● Helen Farrell, INL
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Nanoscience Centers & E-beam Centers
Tof Carim
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Linac Coherent Light Source
Tom Brown
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Tom Brown
Spallation Neutron Source Upgrades
Tom Brown
TEAM
Tom Kiess
Instrument MIEs (SING, LUSI, etc.)
Tom Kiess
Advanced Light Source User Support Building
Tom Brown
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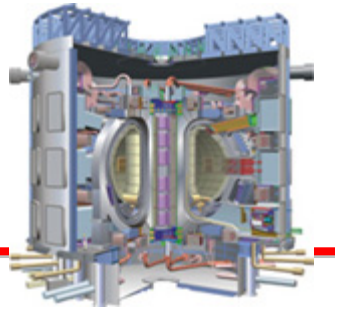
LEGEND
◆ Detailee (from DOE laboratories)
■ Detailee, ½ time
■ Detailee, ½ time, not at HQ
● Detailee, ¼ time, not at HQ
◆ On detail from SC-2, ½ time
△ IPA (Interagency Personnel Act)
P.A. Program Assistant
March 2009

Fusion Energy Sciences (FES)

To expand the fundamental understanding of matter at very high temperatures and densities and the scientific foundations needed to develop a fusion energy source. This is accomplished by studying plasmas under a wide range of temperature and density, developing advanced diagnostics to make detailed measurements of their properties, and creating theoretical/computational models to resolve the essential physics.

Director (Acting): Dr. Steve Eckstrand

FES Areas of Emphasis

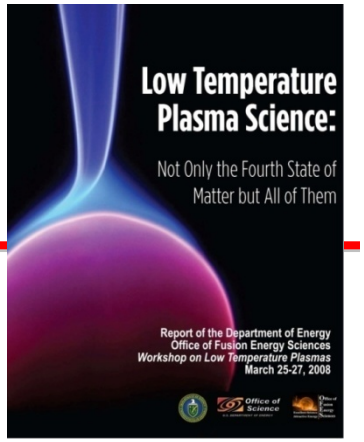


Magnetic Fusion Energy Sciences, which encompasses support for Burning Plasma Science, Advanced Tokamak Physics, Toroidal Confinement Physics, the ITER Project and Program, Theory and Computation, Enabling Technologies, Diagnostics, Materials Science, and International Collaborations;

Plasma Sciences, which encompasses support for Fundamental Properties of Plasmas, High Energy Density Laboratory Plasmas, Atomic Processes, Electromagnetic Confinement, and Low-Temperature Plasmas; and

National/Shared Facilities, which encompasses support for the DIII-D Advanced Tokamak, the Alcator C-Mod Advanced Tokamak, the National Spherical Torus Experiment, ITER, the Madison Symmetrical Torus, and the Large Area Plasma Device.

FES Opportunities



Major Facilities:

DIII-D: Research in ITER-relevant low rotation regimes. Advancing the Advanced Tokamak to complement and look beyond ITER through detailed control of plasma profiles

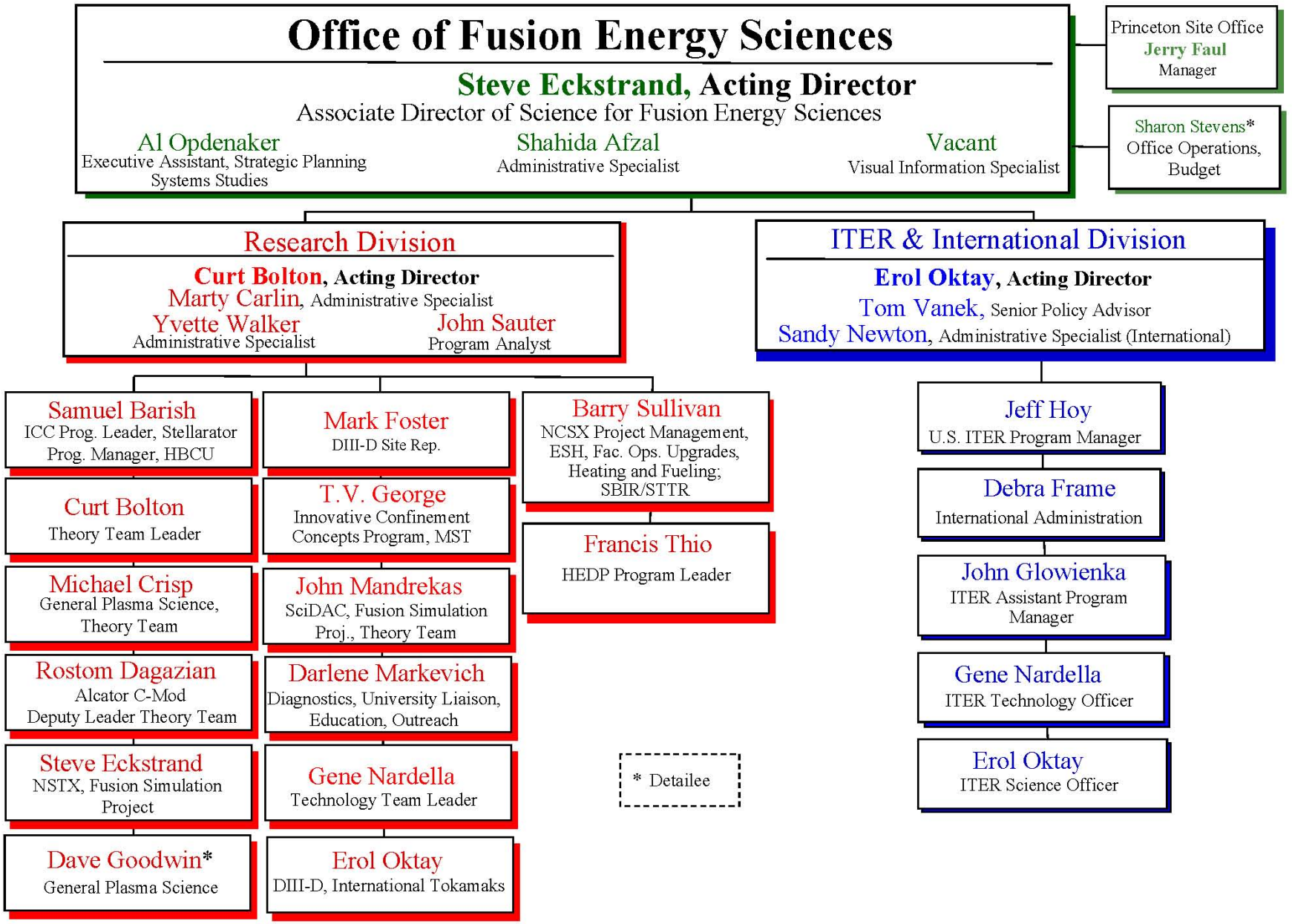
Alcator C-Mod: Research in the steady-state high Z wall, high field tokamak for ITER and beyond. Radiofrequency wave heating and plasma wall interactions at ITER parameters

National Spherical Torus Experiment (NSTX): Research at the extremes of geometry for toroidal confinement and stability understanding. Developing spherical torus scenarios for potential next-step options for domestic activities in ITER era

New Initiatives:

Fusion Simulation Program (FSP) to develop an integrated predictive simulation capability for fusion burning plasmas, fully validated against experiments

Joint Program in High Energy Density Laboratory Plasmas (HEDLP) with NNSA will provide stewardship of this compelling area of fundamental science and fusion-energy inspired basic science.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General Plasma Science,
Theory Team
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Manager
Gene Nardella
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Erol Oktay
ITER Science Officer

09/08

High Energy Physics (HEP)

To understand how our universe works at its most fundamental level. This is accomplished by discovering the most elementary constituents of matter and energy, probing the interactions between them, and exploring the basic nature of space and time itself.

Director: Dr. Dennis Kovar

HEP Areas of Emphasis

- Theoretical and experimental research in elementary particle physics
- Fundamental accelerator science and technology
- Operation of scientific user facilities
- Development, design, and construction of the next generation of facilities
- Three frontiers: Energy frontier; Intensity frontier; Cosmic frontier
- International and interagency collaborations

HEP Program Areas

Proton Accelerator Based Research

Electron Accelerator Based Physics

Non-Accelerator Physics

Theoretical Physics

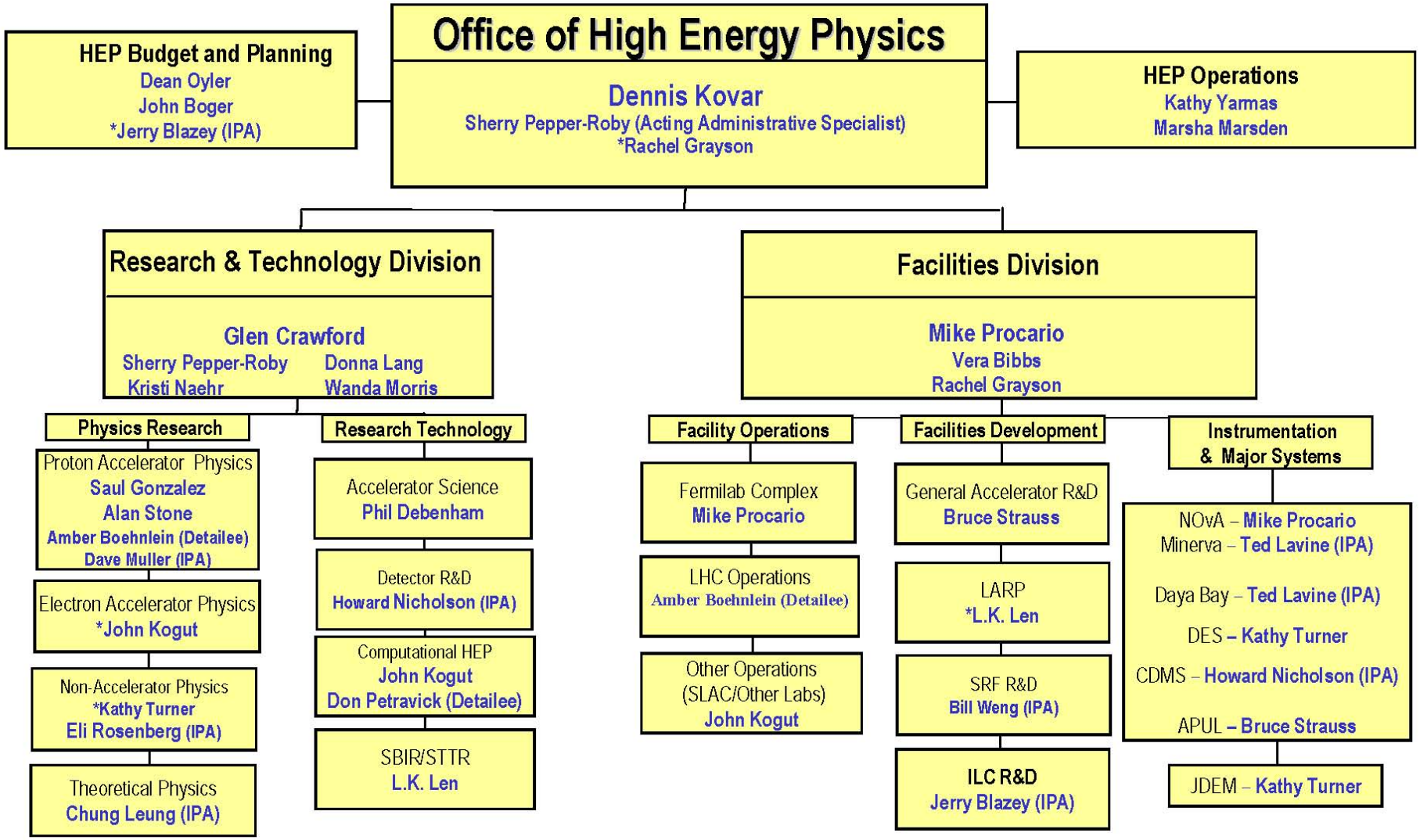
Fermilab Accelerator Complex Operations

Large Hadron Collider Support

Accelerator Science & Development

etc.

HEP Organization Chart



*Denotes base position

Nuclear Physics (NP)

To discover, explore, and understand all forms of nuclear matter. The fundamental particles that compose nuclear matter—quarks and gluons—are relatively well understood, but exactly how they combine to create different types of matter in the universe is still largely a puzzle. To solve this mystery, the NP program supports experimental and theoretical research—along with the development and operation of particle accelerators and advanced technologies—to create, detect, and describe the different forms and complexities of nuclear matter that can exist in the universe, including those that are no longer naturally found.

Director (Acting): Dr. Eugene Henry

NP Research Program Areas

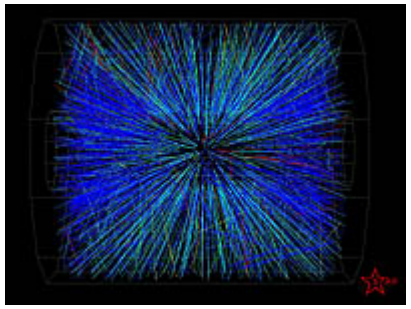
Medium Energy Nuclear Physics

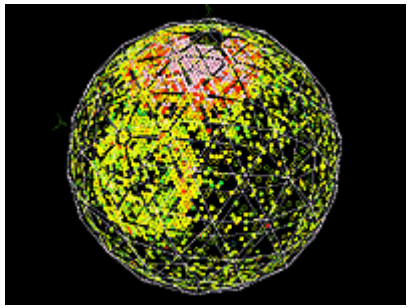
Heavy Ion Nuclear Physics

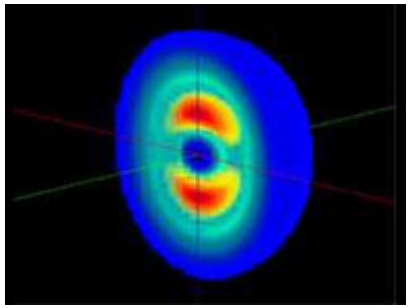
Low Energy Nuclear Physics

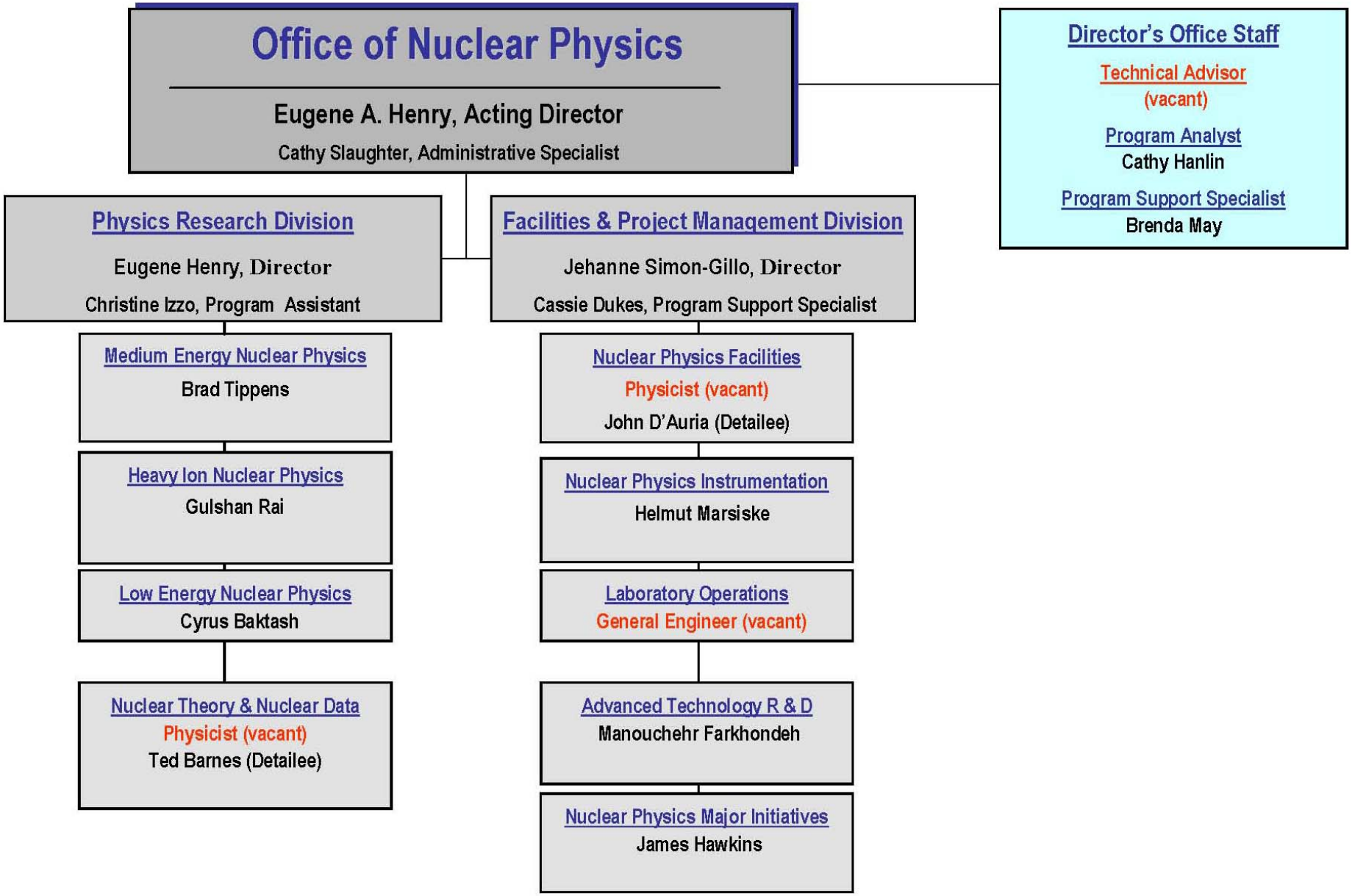
Nuclear Theory

Isotope Production and Applications









September 2008

Thank You

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