Setting Priorities in the Federal R&D Portfolio

Michael Holland
Senior Policy Analyst
Office of Science & Technology Policy

Executive Office of the President (EXOP)

White House Office
(Homeland Security Council, Office of Faith-Based Initiatives, Freedom Corps)

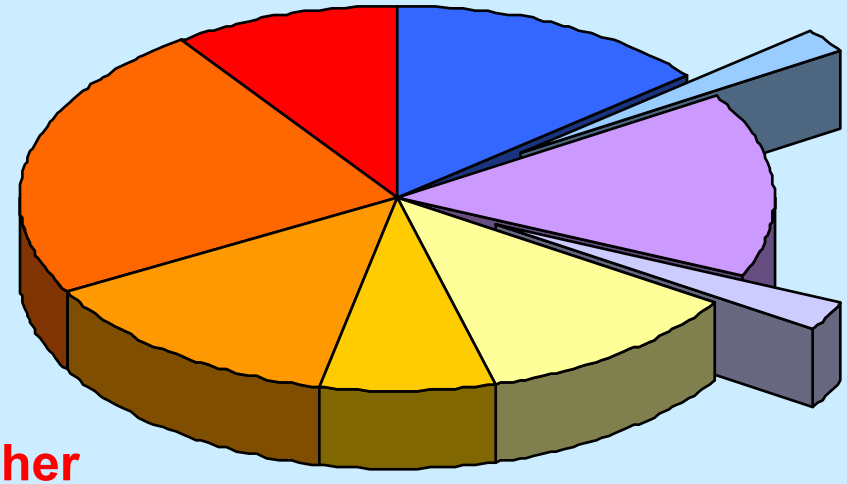
Office of Management & Budget (OMB)	**Office of the Vice President**	**President's Foreign Intelligence Advisory Board**
US Trade Representative (USTR)	**Domestic Policy Council** **Nat'l Economic Council** **Nat'l AIDS Policy**	**National Security Council (NSC)**
Office of Administration	**Council of Environmental Quality (CEQ)**	**Office of National Drug Control Policy**
	Council of Economic Advisors (CEA)	**Office of Science & Technology Policy (OSTP)**

Primarily **career** staff

Primarily **political staff**

Mix of detailees, career, political

FY 2005 Proposed Budget ($2.4 Trillion OL)



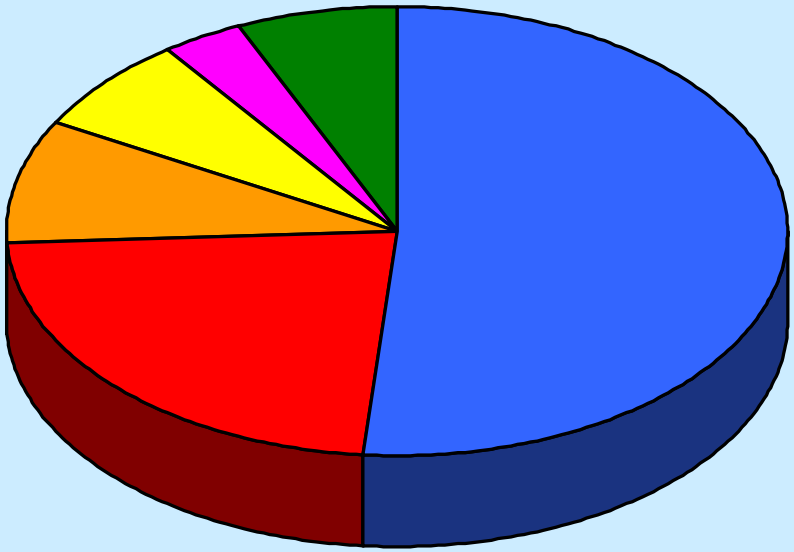
Mandatory Spending

Discretionary Spending

R&D = 14% of discretionary spending

FY 2004 R&D Budget

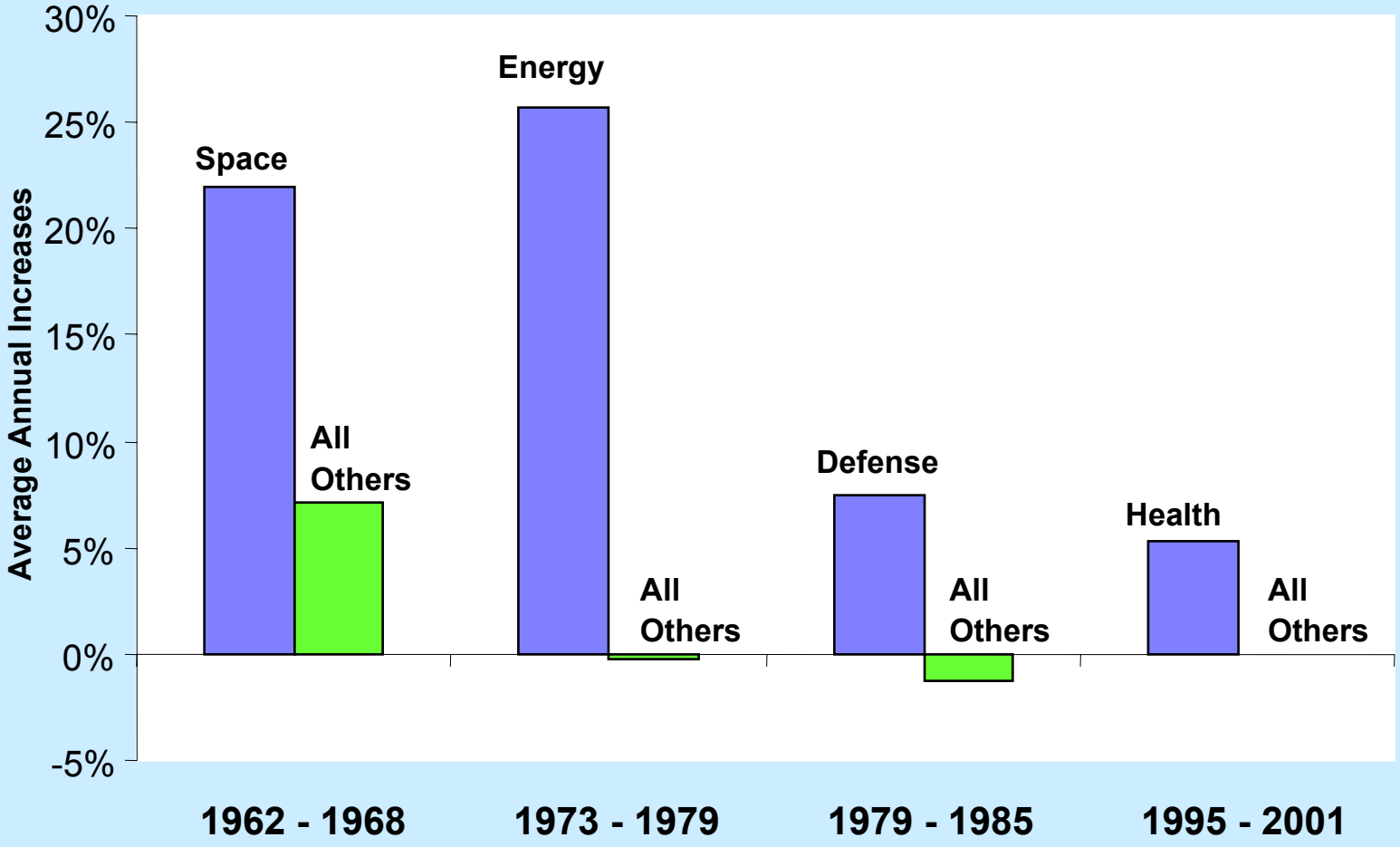
($127 Billion BA)



* USDA, DHS, USGS, EPA, NIST, NOAA, VA, USAID, Smithsonian, and others

Historical R&D Priorities

(obligations, in 1996 constant dollars)



Source: National Science Foundation

So, how do we approach making a case for investment?

Ask the "Obvious" Questions?

- **Political Level (President, Congress)**
  - How does the science benefit society? (jobs, economy, defense,…)
  - How does this alleviate/placate constituent concerns? (budget growth!)
  - How has the program been managing and performing?
  - What have we gotten for our investment to date?
- **Agency Head/ Department Secretary Level**
  - How does the agency mission address administration priorities?
  - How does the science further the mission of the agency?
  - How does the science impact or strengthen other programs or related activities across the Government?
  - How has the program been managing and performing?
  - What have we gotten for our investment to date?
- **Competitive Environment (Program Level)**
  - How does the program further agency mission and administration priorities?
  - How does science advance the program's objectives?
  - How does the science impact or strengthen other programs or related activities across the Government?
  - How has the program been managing and performing?
  - What have we gotten for our investment to date?
- **Internal Environment (Portfolio Balance)**

Presidential Priorities

w/ Direct S&T Coupling

- Winning the War on Terrorism
- Securing the Homeland
- Strengthening the Economy
- A National Energy Strategy
- Improving Government: President's Management Agenda
  (R&D Investment Criteria, PART Analysis)

FY 2006 OSTP/OMB Priorities Memo

1.) R&D for Homeland and National Security

2.) Networking and Information Technology R&D
(includes scientific computing)

3.) Nanotechnology

4.) Priorities for Physical Sciences

5.) Biology of Complex Systems
- non-biomedical biology: plant genomics, animal genomics

6.) Environment and Energy
- climate change
- environmental observations
- hydrogen R&D

Our Policy Officials' Guidance

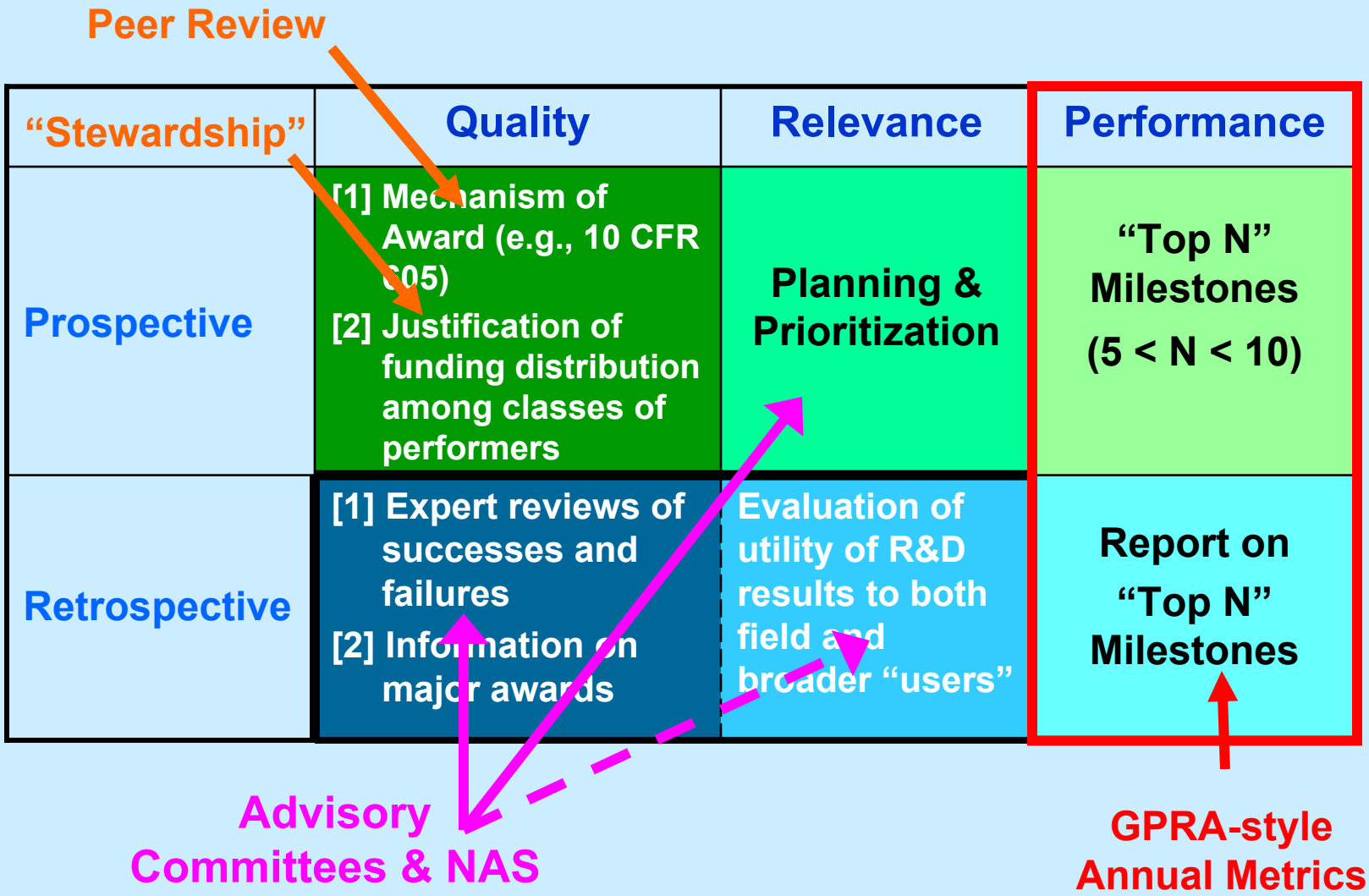
…there is a need for a new emphasis on, and perhaps even a redefinition of, strategic planning

- **As a first principle of planning, machines and instrumentation must be subordinated to a broader view of the field**
- **A second principle of strategic planning must be to acknowledge the impact of one area upon another…**
- **A third important component of a new approach to strategic planning is the international dimension.**

John H. Marburger

Remarks given at FERMI Lab Users Meeting, June 3, 2003

OMB/OSTP Investment Criteria:
Our Framework for Pulling It All Together



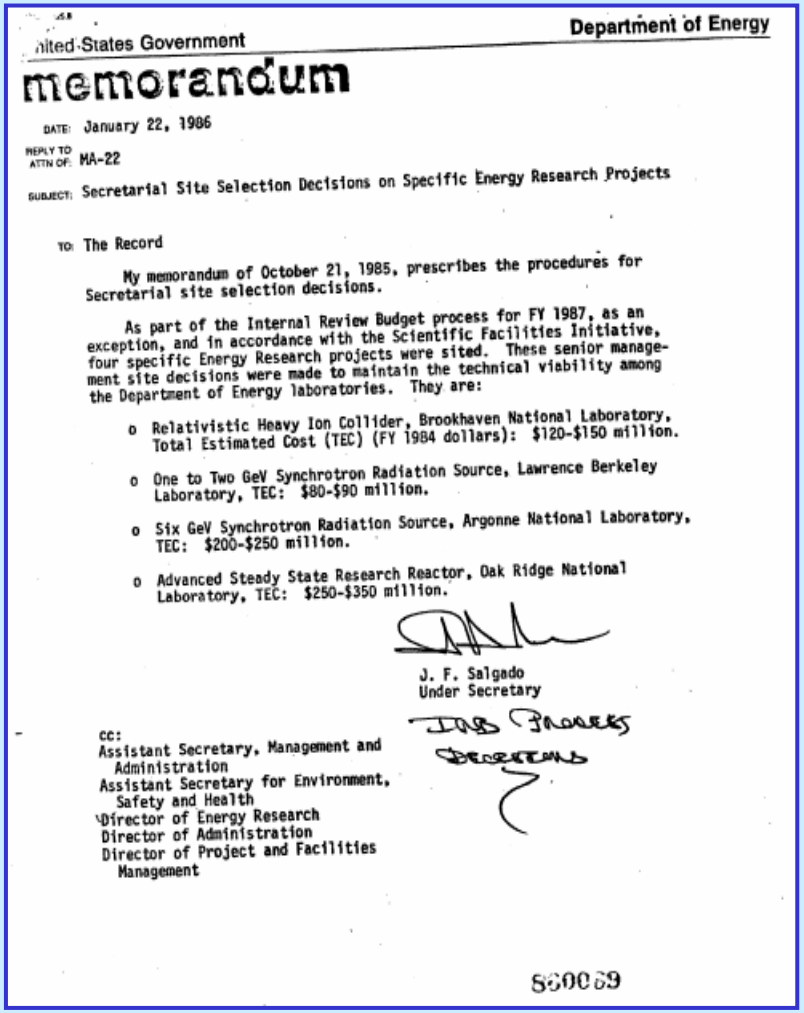
Prospective Relevance I:
Planning & Prioritization by the Community

Seitz-Eastman, 1984

NAS Study called for:

- **A 6 GeV synchrotron light source**
- **An advanced steady state neutron source**
- **A 1-2 GeV synchrotron light source**
- **A high-intensity pulsed neutron source**

Prospective Relevance II:
Planning & Prioritization by the Agency



nited States Government — Department of Energy

memorandum

DATE: January 22, 1986

REPLY TO ATTN OF: MA-22

SUBJECT: Secretarial Site Selection Decisions on Specific Energy Research Projects

TO: The Record

My memorandum of October 21, 1985, prescribes the procedures for Secretarial site selection decisions.

As part of the Internal Review Budget process for FY 1987, as an exception, and in accordance with the Scientific Facilities Initiative, four specific Energy Research projects were sited. These senior management site decisions were made to maintain the technical viability among the Department of Energy laboratories. They are:

- o Relativistic Heavy Ion Collider, Brookhaven National Laboratory, Total Estimated Cost (TEC) (FY 1984 dollars): $120-$150 million.
- o One to Two GeV Synchrotron Radiation Source, Lawrence Berkeley Laboratory, TEC: $80-$90 million.
- o Six GeV Synchrotron Radiation Source, Argonne National Laboratory, TEC: $200-$250 million.
- o Advanced Steady State Research Reactor, Oak Ridge National Laboratory, TEC: $250-$350 million.

J. F. Salgado
Under Secretary

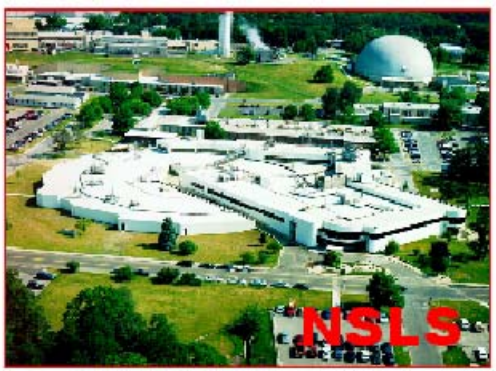
cc:
Assistant Secretary, Management and Administration
Assistant Secretary for Environment, Safety and Health
Director of Energy Research
Director of Administration
Director of Project and Facilities Management

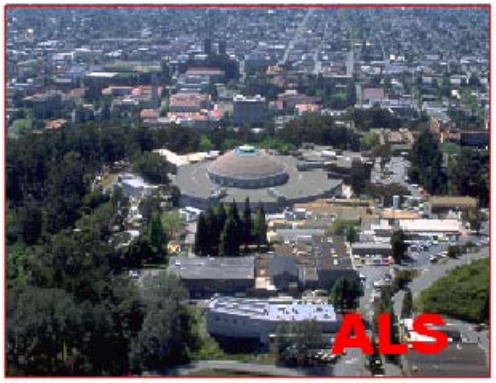
860089

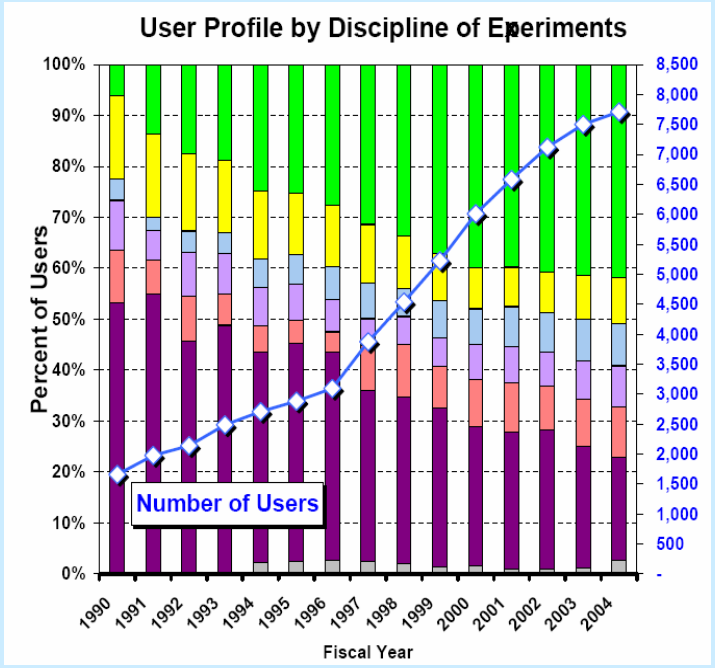
In 1986, Director of Energy Research crafts a solution:

- Relativistic Heavy Ion Collider (RHIC at Brookhaven)
- 1-2 GeV synchrotron light source (the ALS at Berkeley)
- 6 GeV synchrotron light source (the APS at Argonne)
- Advanced steady state neutron source (ANS at ORNL)
  - the high-intensity pulsed neutron source (the SNS) was substituted

Performance:
Measurements that make sense



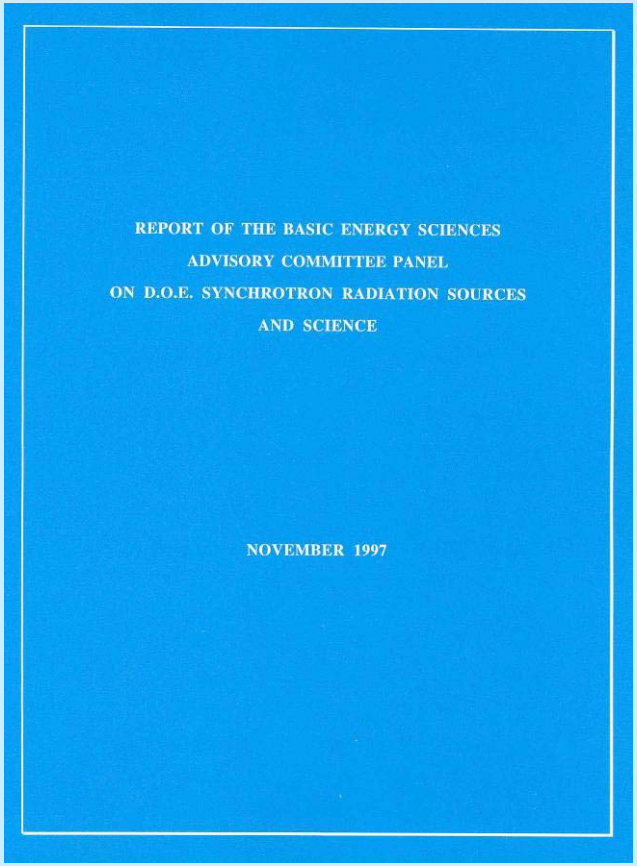


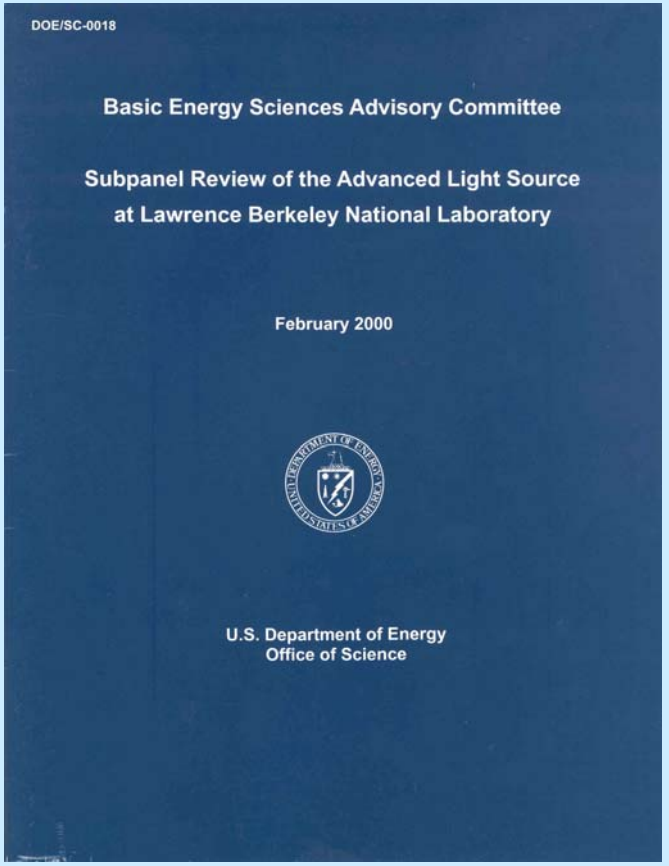


SSRL, NSLS: pre-existing

APS, ALS: "Trivelpiece Plan"

Retrospective Quality & Relevance:
Expert Review of Scientific Productivity & Impact





Birgeneau-Shen, 1997

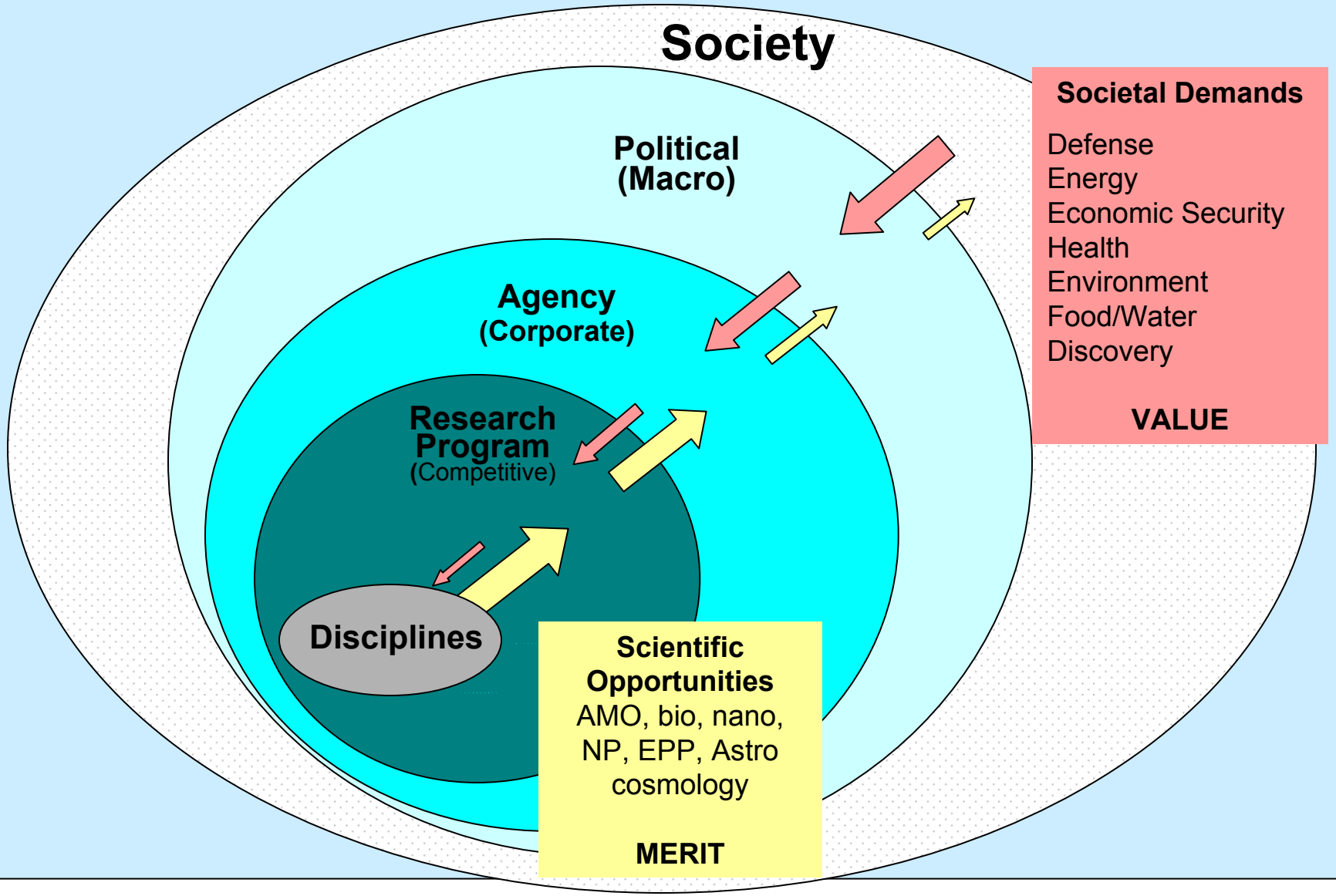
- **ALS in trouble**

Petroff report, 2000

- **ALS fixed**

The Big Challenge: Communication!

Your audiences are varied



When I was at OMB…

Materials Sciences and Engineering
- Catalysis
- Ceramics
- Condensed Matter Physics
- Corrosion
- Electronic Properties of Materials
- Experimental Techniques & Instrument Devel.
- Fluid Dynamics and Heat Flow
- Intermetallic Alloys
- Magnetism and Magnetic Materials
- Materials Physics and Chemistry
- Mechanical, Physical, and Structural Properties
- Metallic Glasses
- Metallurgy, Metal Forming, Welding & Joining
- Nano- and Microsystems Engineering
- Neutron and Photon Scattering
- Nondestructive Evaluation
- Photovoltaics
- Polymer Science
- Radiation Effects
- Superconductivity
- Surface Science
- Synthesis and Processing Science
- Theory, Modeling, & Computer Simulation

Geosciences
- Geochemistry of Mineral-fluid Interactions
- Geophysical Interrogation of Earth's Crust
- Rock-fluid Dynamics
- Biogeochemistry

Biosciences
- Natural Photosynthetic Mechanisms
- Complex Hydrocarbons and Carbohydrates
- Carbon Fixation and Carbon Energy Storage
- Biochemistry, Biocatalysis, Bioenergetics, Biomolecular Materials, and Biophysics

Chemical Sciences
My degree
- Analytical Chemistry
- Atomic, Molecular & Optic
- Chemical Kinetics
- Chemical Physics
- Catalysis
- Combustion Dynamics
- Electrochemistry
- Heavy Element Chemistry
- Interfacial Chemistry
- Organometallic Chemistry
- Photochemistry
- Photosynthetic Mechanisms
- Radiation Chemistry
- Separations Science
- Solar Energy Conversion
- Theory, Modeling, & Simulation
- Thermophysical Properties

Particle & Nuclear Physics
- High Energy and Particle Physics
- Heavy Ion & Medium Energy Nuclear Physics
- Accelerator and Detector R&D
- Particle Astrophysics
- Physics Theory

Fusion Sciences
- Experimental Plasma Physics
- Theory, modeling, and simulation
- Accelerator Physics
- Plasma Diagnostics R&D
- Specialized Materials Science
- Tritium Science
- Microwave Systems R&D
- Integrated Fusion Systems

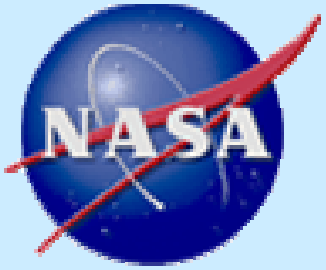
Life Sciences
- uman Genome
- Structural Biology
- Microbial Genome
- Low Dose Radiation Research
- Functional Genomics
- Human Subjects in Research
- Structural Biology Facilities
- Genome Instrumentation
- Computational & Structural Biology

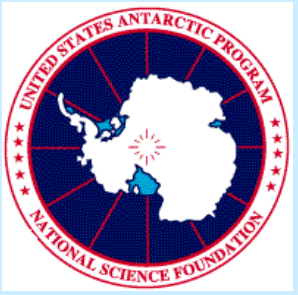
Medical Sciences
- Radiopharmaceutical Development
- Boron Neutron Capture Therapy
- Molecular Nuclear Medical Imaging
- Imaging Gene Expression
- Biomedical Engineering

Environmental Sciences
- Decade to Century Climate Modeling
- Atmospheric Radiation Measurement (ARM)
- Atmospheric Science & Chemistry
- Carbon Cycle Research
- Ocean Sciences
- Ecosystem Function and Response
- Information & Integration
- Integrated Assessment of Climate Change
- Bioremediation of Metals & Radionuclides
- Environmental Molecular Sciences Lab

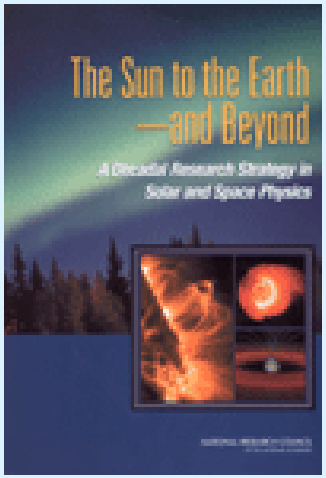
Mathematics and Advanced Computing
- Linear Algebra Libraries
- Scientific Computing & Network Testbeds
- Advanced Computer Science
- Applied Mathematics
- Advanced Computing Facilities
- Advanced Computing Software

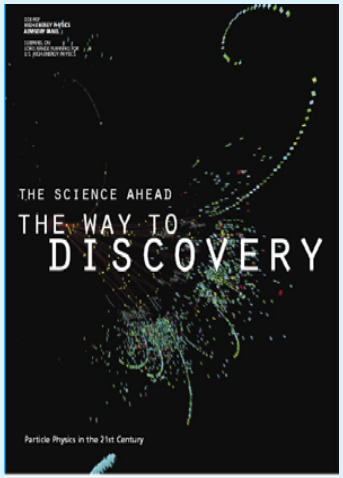
Now that I'm at OSTP….

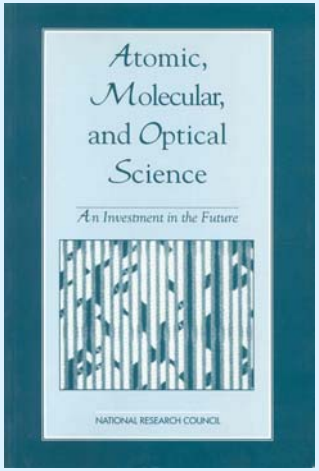


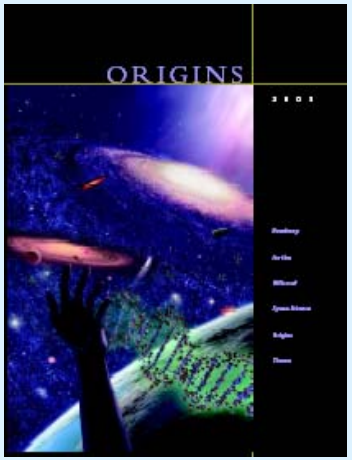


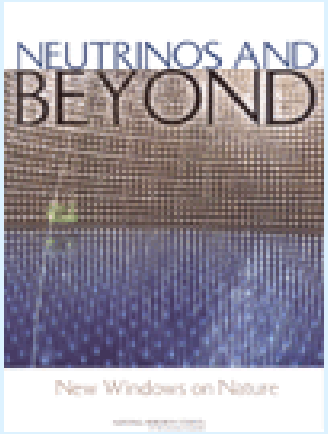

Astronomy and Astrophysics in the New Millennium

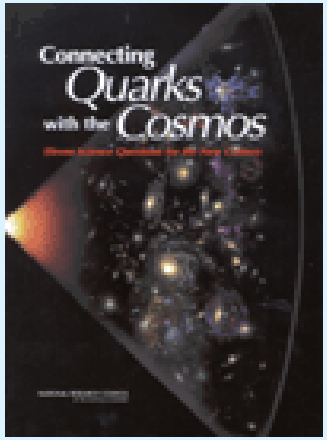

The Sun to the Earth —and Beyond
A Decadal Research Strategy in Solar and Space Physics

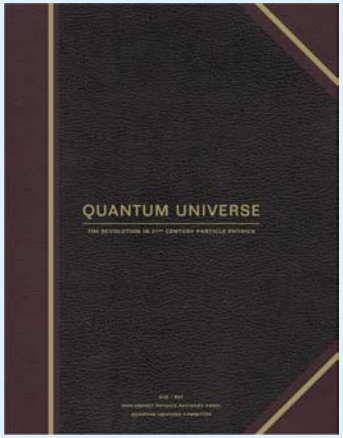

THE SCIENCE AHEAD
THE WAY TO
DISCOVERY
Particle Physics in the 21st Century


Atomic, Molecular, and Optical Science
An Investment in the Future
NATIONAL RESEARCH COUNCIL

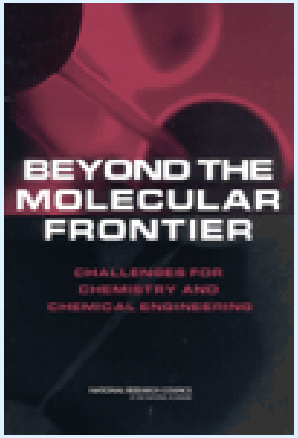

ORIGINS


NEUTRINOS AND
BEYOND
New Windows on Nature

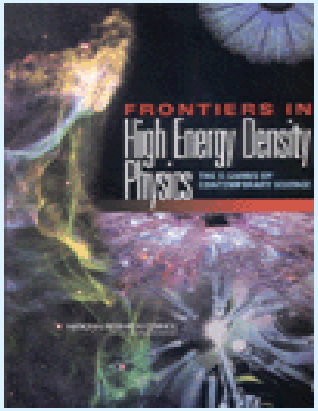

Connecting Quarks with the Cosmos

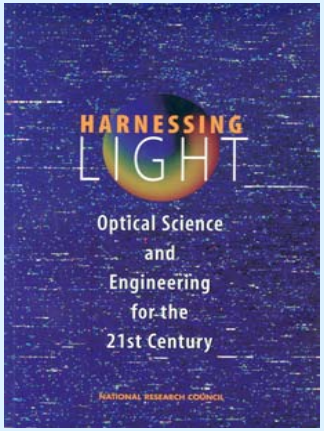

QUANTUM UNIVERSE

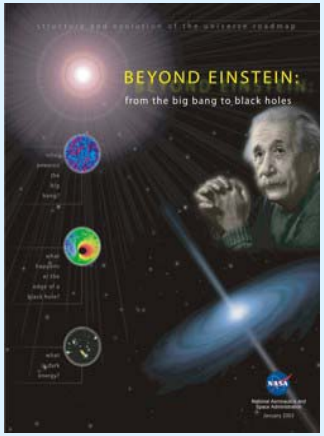

An Assessment of the Department of Energy's Office of Fusion Energy Sciences Program


BEYOND THE MOLECULAR FRONTIER
CHALLENGES FOR CHEMISTRY AND CHEMICAL ENGINEERING


Major Facilities for Materials Research and Related Disciplines

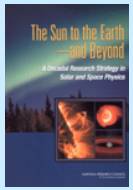

FRONTIERS IN
High Energy Density Physics

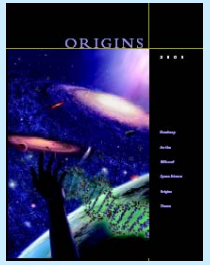

HARNESSING
LIGHT
Optical Science and Engineering for the 21st Century
NATIONAL RESEARCH COUNCIL

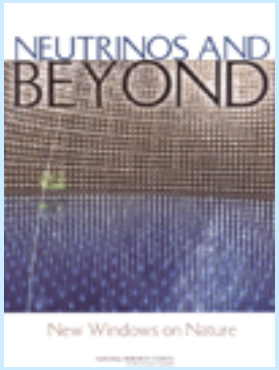

BEYOND EINSTEIN:
from the big bang to black holes

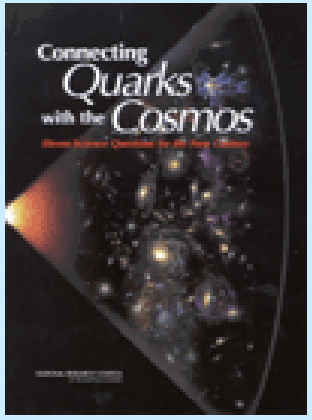

OPPORTUNITIES IN NUCLEAR SCIENCE
A Long-Range Plan for the Next Decade
April 2002

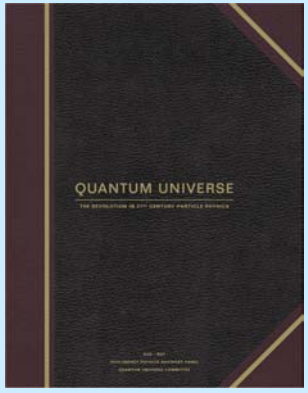
How we really see it….

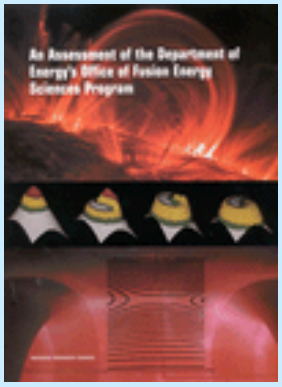


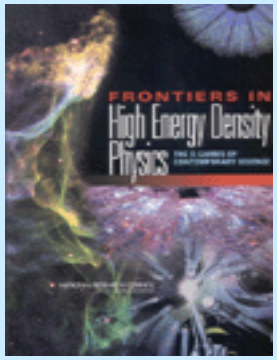


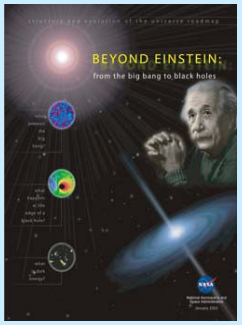




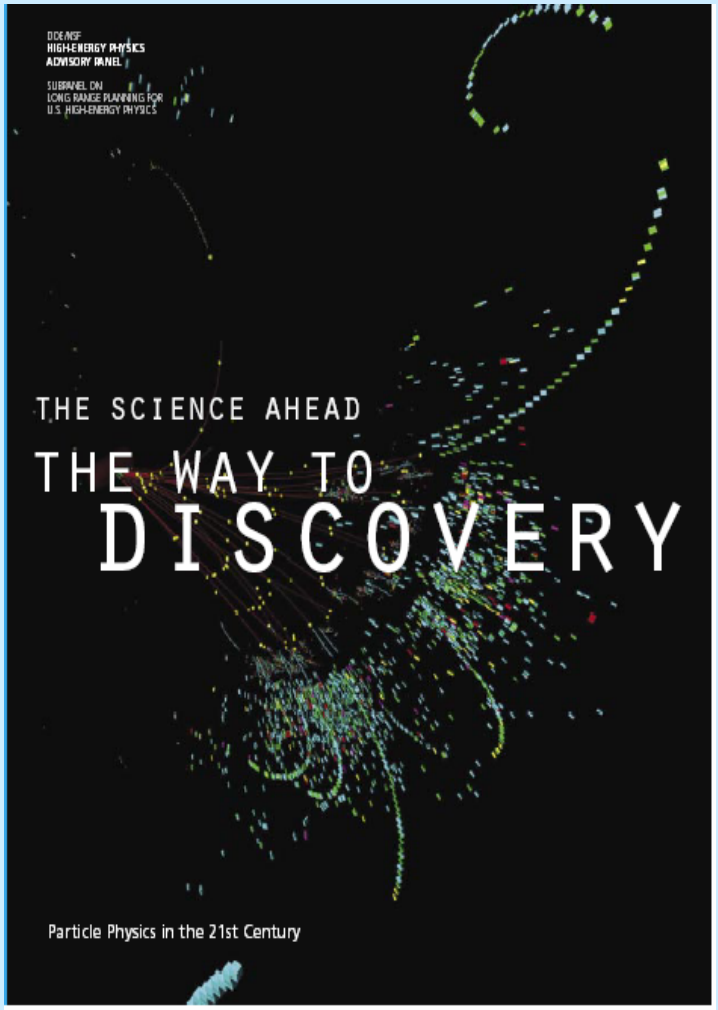








HEPAP Long Range Plan: A Post – Mortem



from Chairman Barry Barish's presentation to the NAS EPP2010 Committee

HEPAP Subpanel Report

- What did it accomplish and where did it fall Short?

MAIN ACCOMPLISHMENTS

1. New definition of particle physics that gives a broader scope to the science
2. Established a ~ 1 TeV Linear Collider as the highest priority long term goal for the field. In a similar frame ACFA in Asia and ECFA in Europe came to similar conclusions
3. Proposed a new mechanism, P5, to evaluate and recommend funding for large projects in a national context

6

HEPAP Subpanel Report

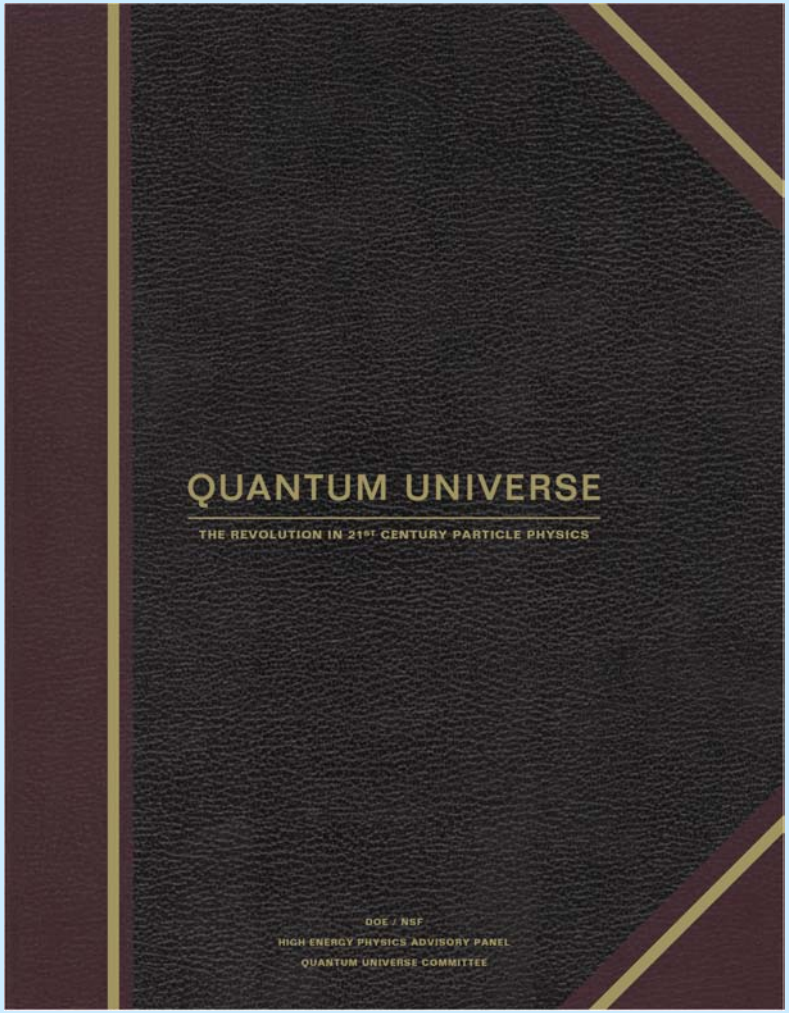
- What did it accomplish and where did it fall Short?

FELL SHORT

1. Did not establish priorities for the program, except for the linear collider
2. Roadmap was little more than a list of known projects
3. Did not grapple with the future roles and programs of our major laboratories – SLAC and Fermilab or adequately take into account plans in the rest of the world.
4. Had limited impact on policy makers or the broader scientific communities

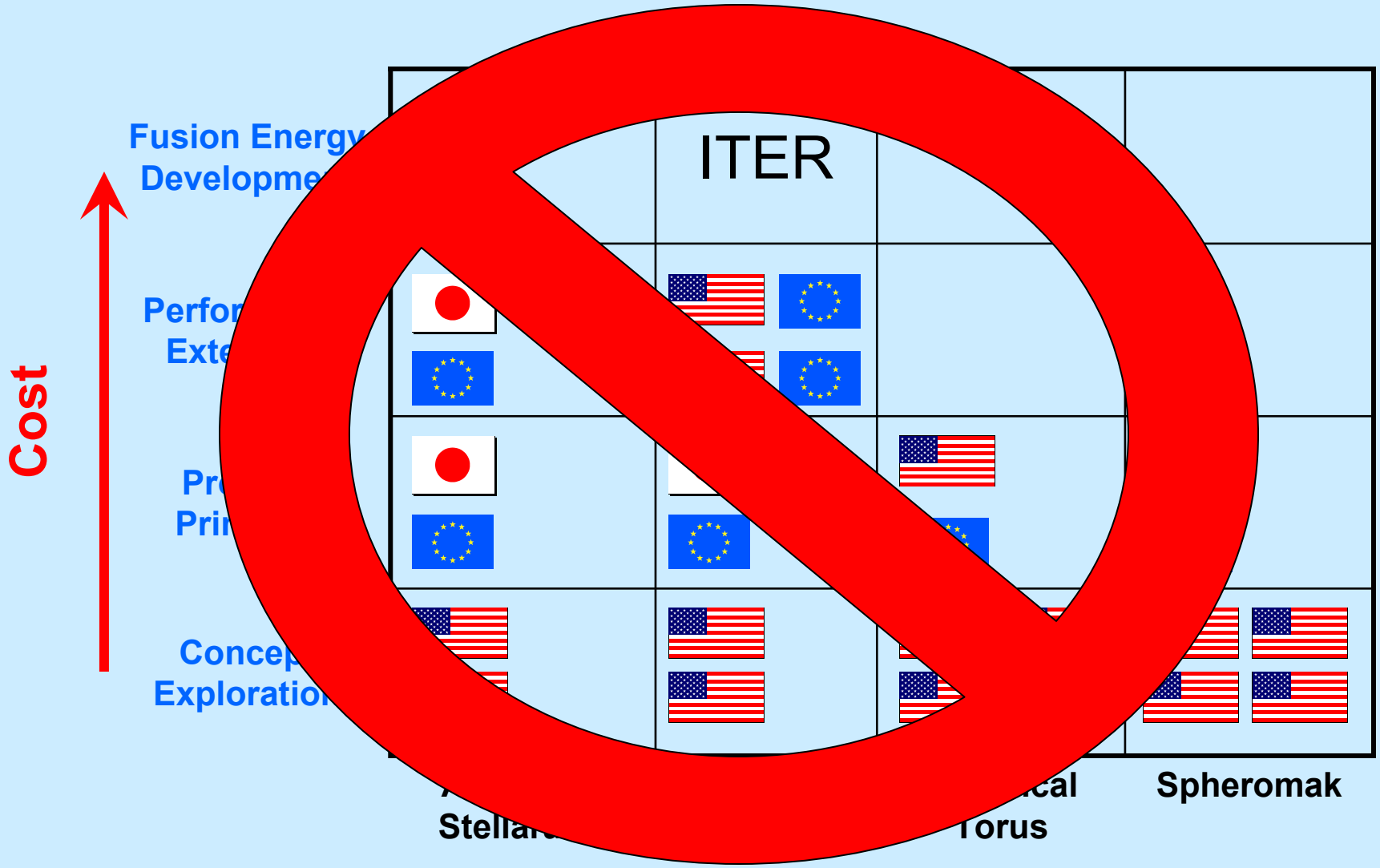
7

DOE/NSF HEPAP *Quantum Universe* Report



- Asks for precisely the same things as *The Science Ahead: The Way to Discovery.*
- Ties EPP to the broader effort in discovery-oriented physical sciences, yet does not subordinate EPP to any other field
- Strong connection to *Physics of the Universe* and Astronomy and Astrophysics Advisory Committee (AAAC) activities
- Very well received in DC

FESAC *Priorities & Balance*



FESAC Priorities Panel:

A scientific and technical presentation of the program

- **Macroscopic plasma behavior**
- **Multi-scale transport behavior**
- **Plasma boundary interfaces**
- **Waves and energetic particles**
- **Fusion engineering science**
- **High-energy density implosion physics**

You can explain how any machine will address these central challenges

These questions now form the basis for a discussion of priorities, *e.g.*, emphasize fusion engineering science **after** burning plasmas have been created and controlled