Communicating about Science: Observations from a Seasoned Program Manager

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Office of Science

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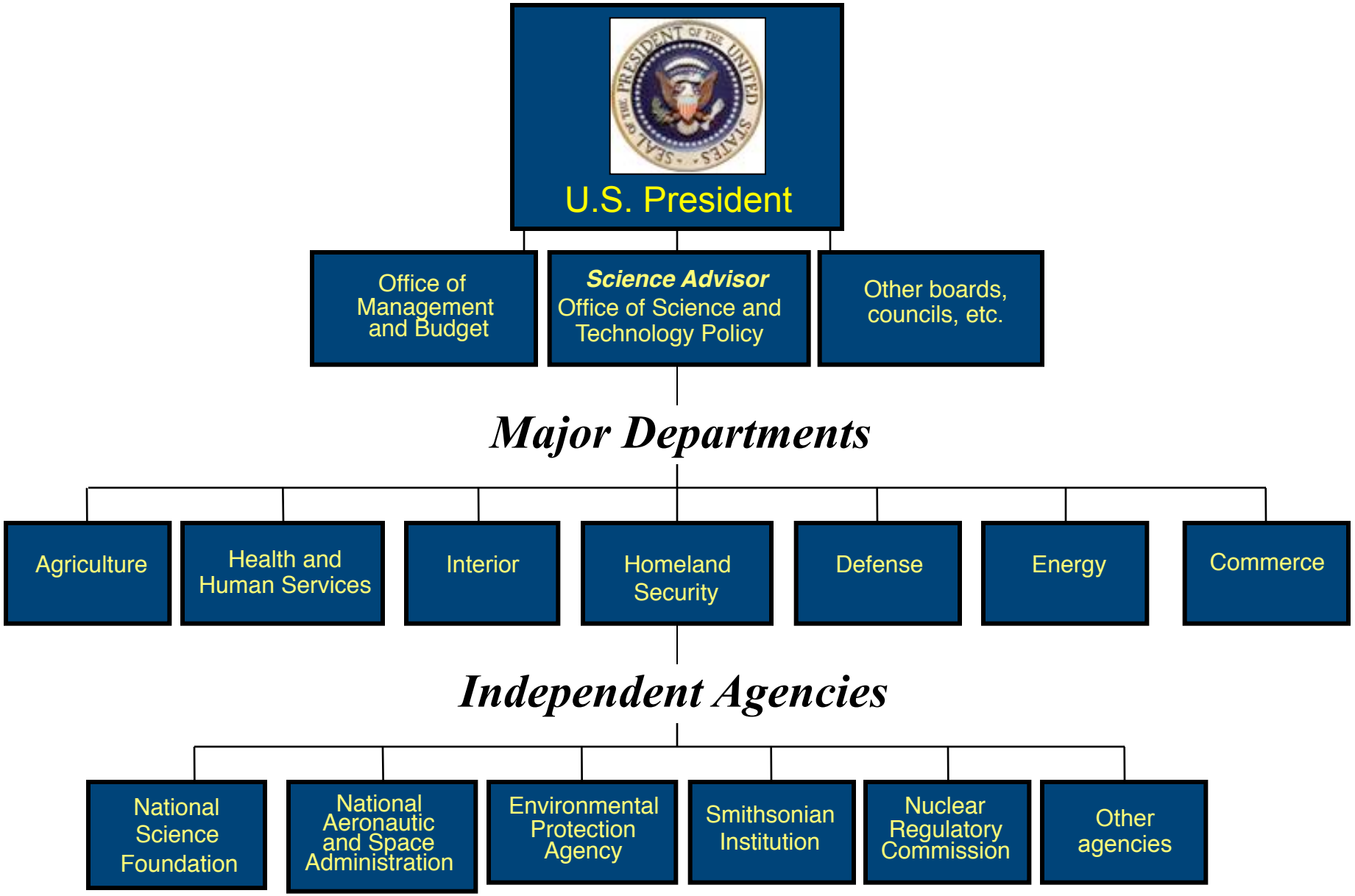
Topics Covered Today

- The Federal Context
- Communicating about Science:
  - Three Important Questions
- The Heilmeier Catechism
- About Solicitations
- Science and Proposals
- Realities of Proposal Evaluation


U.S. President
Office of Management and Budget
Science Advisor
Office of Science and Technology Policy
Other boards, councils, etc.
Major Departments
Agriculture
Health and Human Services
Interior
Homeland Security
Defense
Energy
Commerce
Independent Agencies
National Science Foundation
National Aeronautic and Space Administration
Environmental Protection Agency
Smithsonian Institution
Nuclear Regulatory Commission
Other agencies

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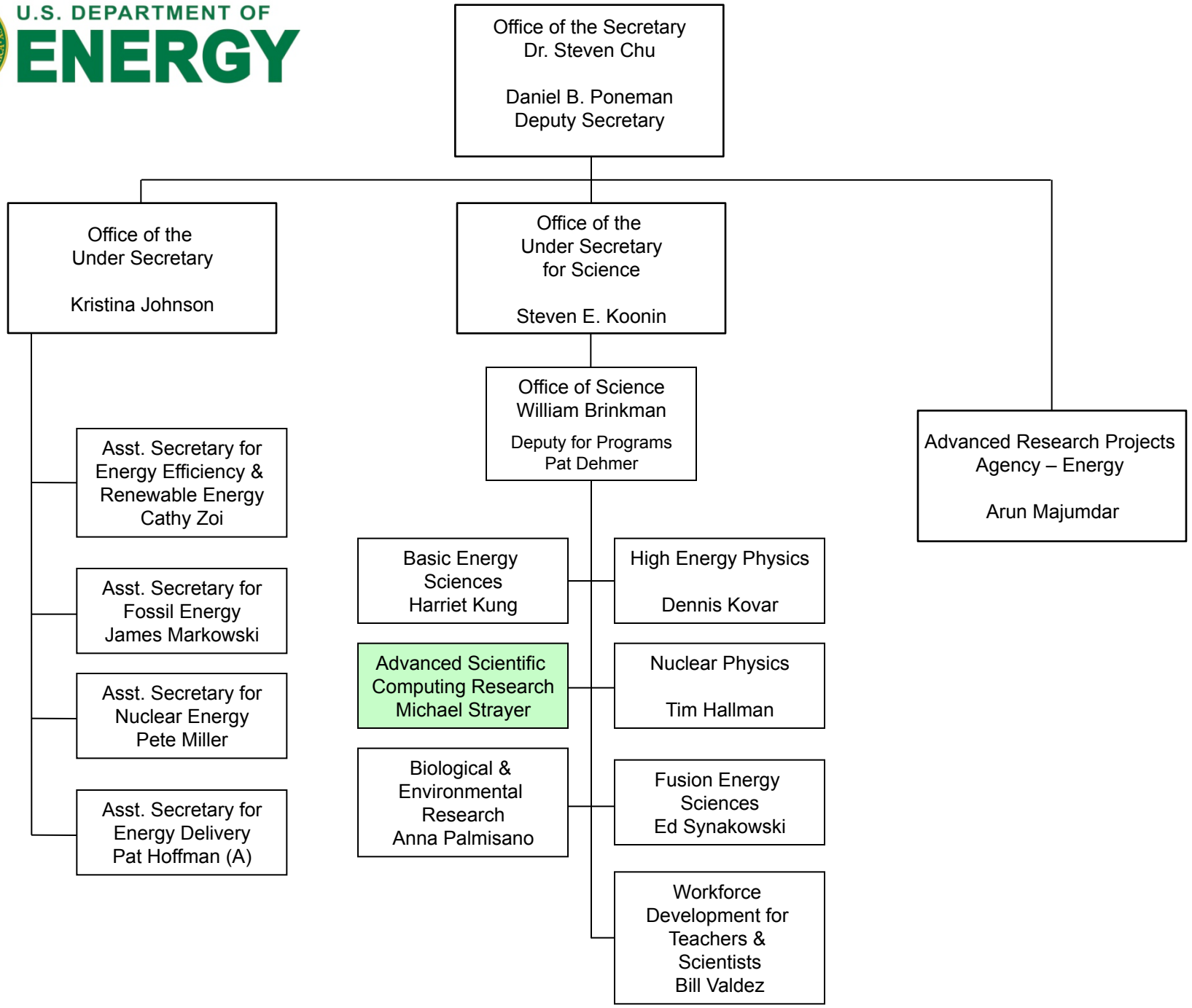

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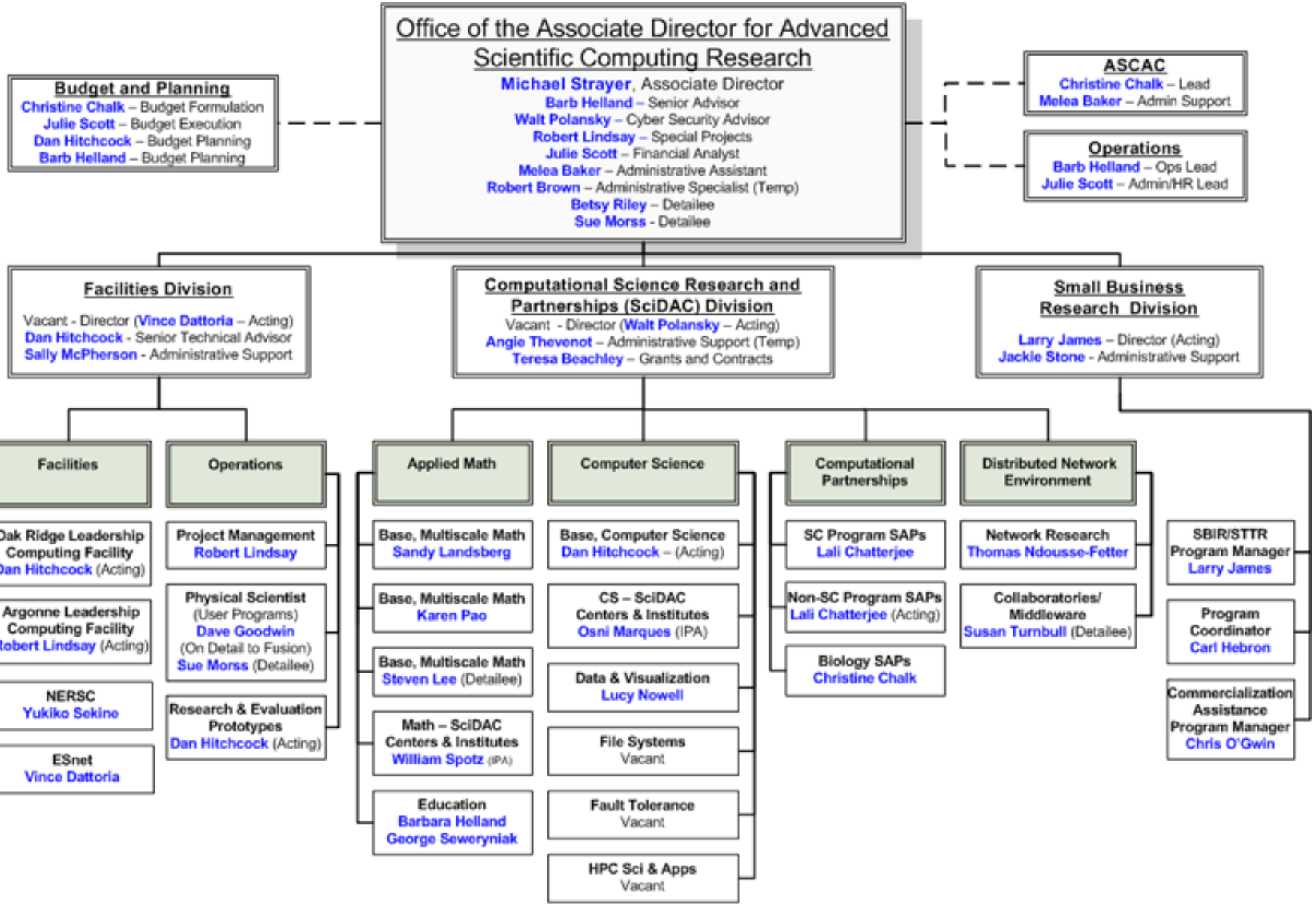
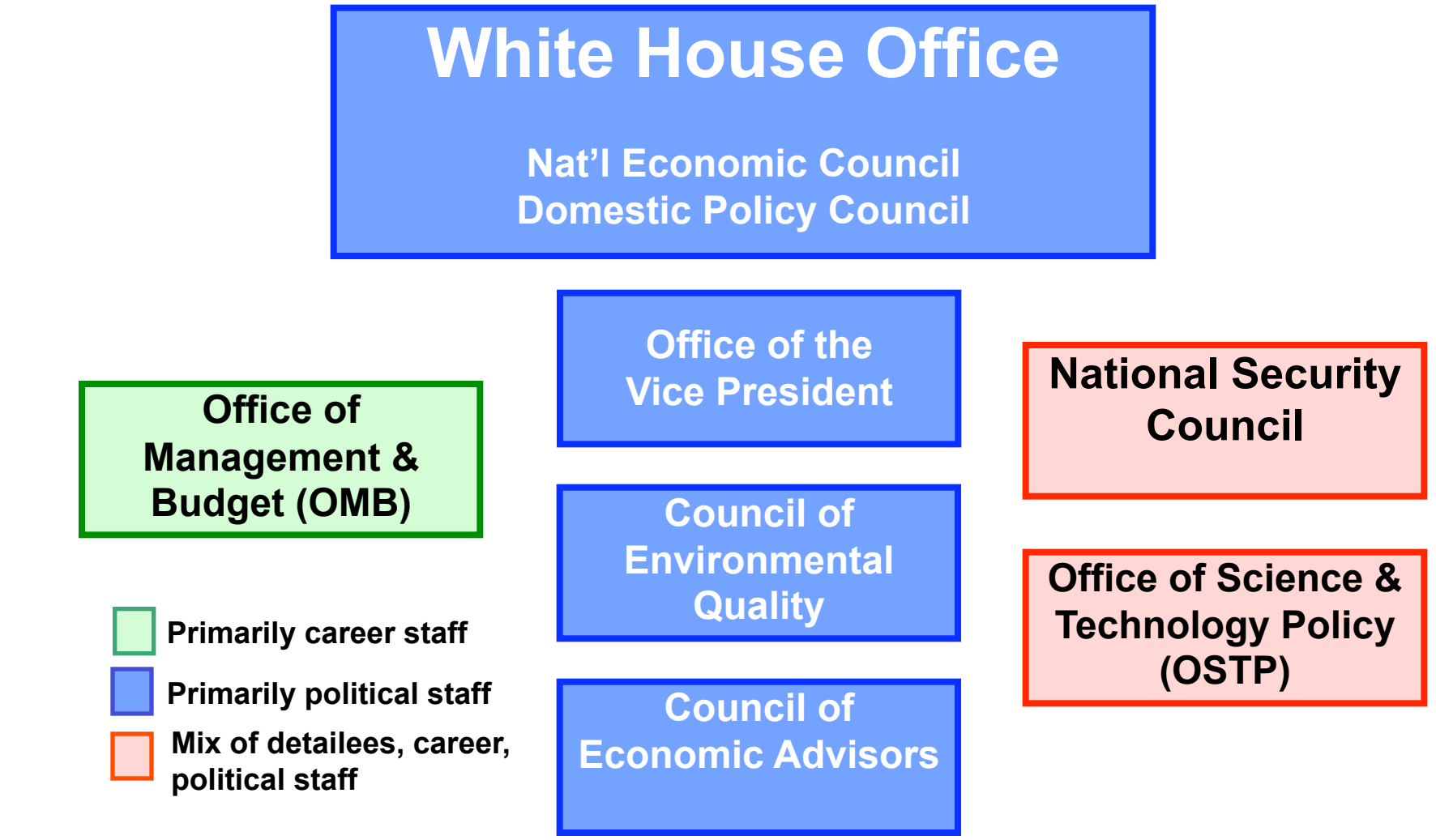
ASCR Organization



OMB and Other Relevant Offices in the Executive Office of the President (EOP)



What does OMB do?

- **Assists the President in the development and execution of his policies and programs**

- **Has a hand in the development and resolution of all budget, policy, legislative, regulatory, procurement, e-gov't, and management issues on behalf of the President**

OMB/OSTP
R&D Investment Criteria

Quality

- Prospective Merit Review of Awards
- Retrospective Expert Review of Program Quality

Relevance

- Definition of Program Direction and Relevance
- Retrospective Outcome Review to Assess Program Design and Relevance

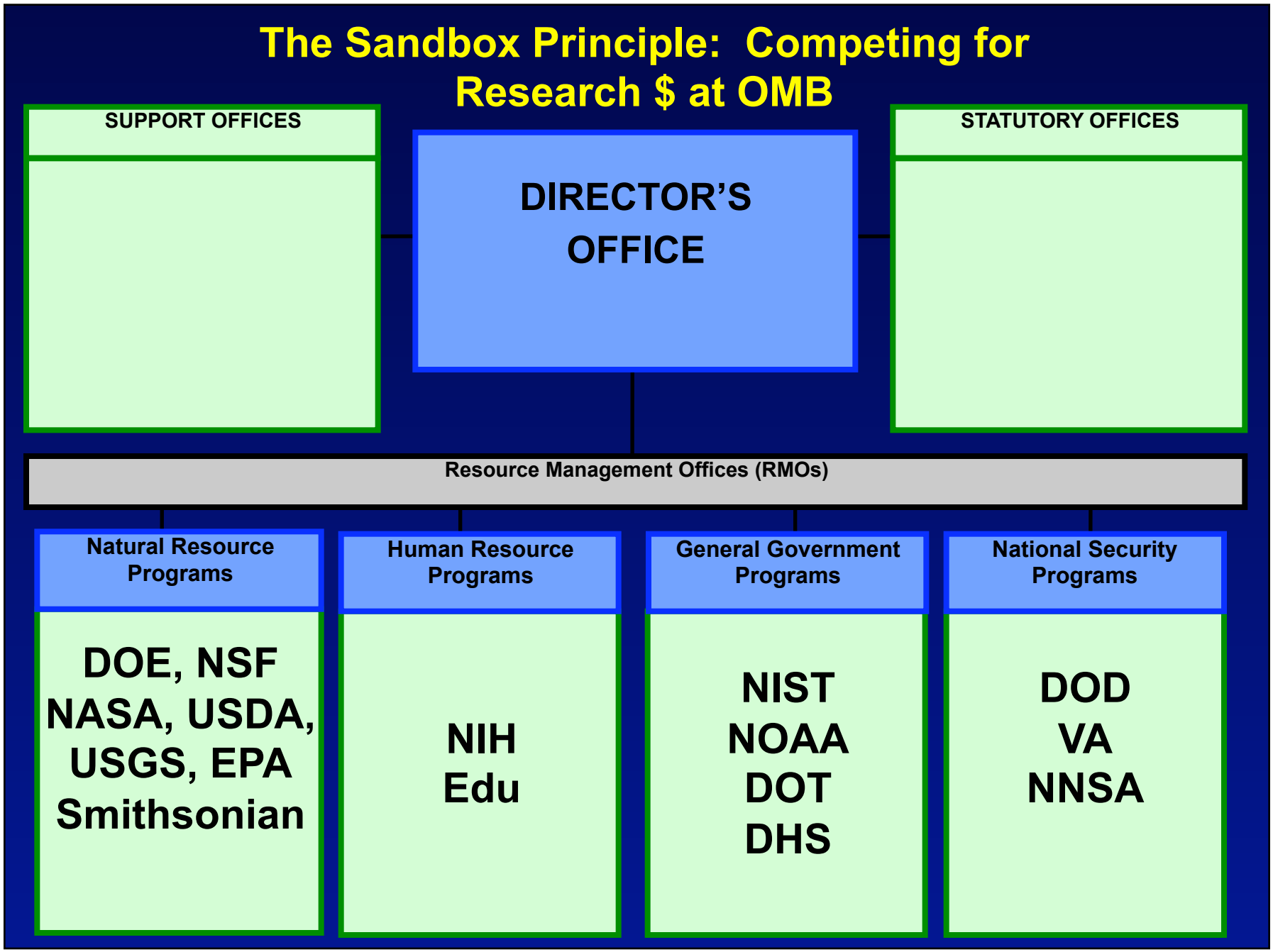
Performance

- Prospective Assessment of Program Inputs and Output Performance Measures
- Demonstration of Performance

The "M" in OMB

R&D Investment Criteria:
One Systematic Evaluation Process

	Quality	Relevance	Performance
Prospective	[1] Mechanism of Award (e.g., 10 CFR 605) [2] Justification of funding distribution among classes of performers	Planning & Prioritization	"Top N" Milestones (5 < N < 10)
Retrospective	[1] Expert reviews of successes and failures [2] Information on major awards	Evaluation of utility of R&D results to both field and broader "users"	Report on "Top N" Milestones



Federal Context

Find Examiners in the OMB Hierarchy

- **Political – make decisions**
- **Director (NB: Pres. Cabinet member)**
- **Deputy Directors**
- **Program Associate Directors or PADs**

- **Career – make recommendations**
- **Deputy Associate Directors or DADs**
- **Branch Chiefs**
- **Program Examiners**

Views of an Important Congressional Supporter

- "Congress is not besieged by groups asking for money that they describe as necessary to help their own narrow interests in the short run. The argument that science funding is a long-term national investment does nothing to set scientists apart. All that sets you apart is that scientists are the only group that thinks they're making a unique argument."

Rep. Boehlert, Chair, House Science Committee

Speech at Brookhaven Lab on March 15, 2004
[www.house.gov/science/press/108/108-206.htm]

How is the President's Budget Made?

(Adapted from OMB Examiner's slides)

Example: FY 2010, If Typical Year (and why it wasn't)

Negotiation process extends over months (dates and internal process vary by agency):

- **Agency internal reviews: March-August '08**
- **OMB sends guidance to agencies: May/June '08**
- **Agencies brief OMB: September-October '08**
- **OMB internal reviews: October-November '08**
- **OMB response ("passback"): Thanksgiving '08**
- **Appeal and settling process: Early December-Early January '09**
- **Budget numbers & text locked: January '09**
- **Budget sent to Congress: Early February '09**
- **Congress appropriates and authorizes: Fall '09**

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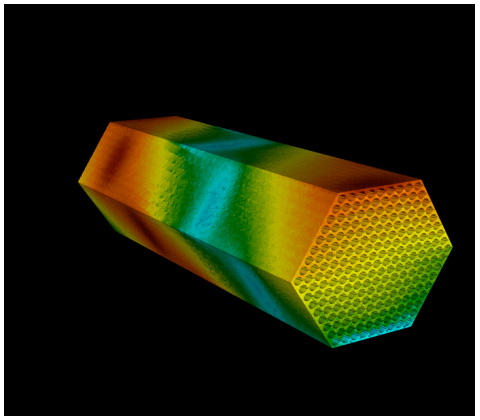
Where Is the Science?

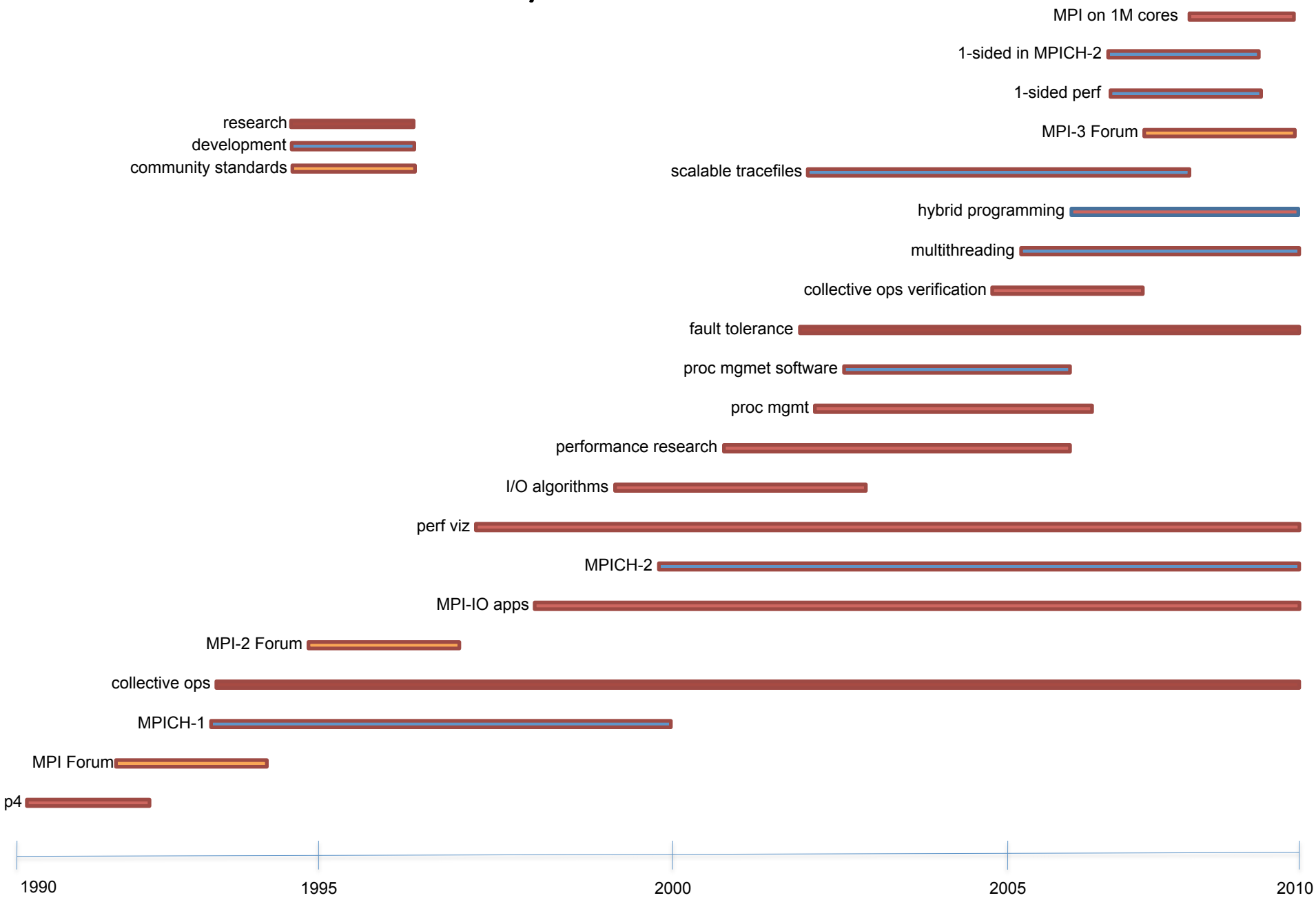
- **For science agencies, the best budget defense for a program (or a project or an agency) is a clear and compelling story about impact on science.**
- **Three important questions to answer:**
  - **What important scientific problem did you (or will you) address?**
  - **How did you (or will you) solve the problem?**
  - **What was the impact of your solution, in terms of important scientific advances or new discoveries made?**

Portable Programming With MPI and MPICH

- Problem
  - Before MPI, development of parallel programs was stalled
  - application writers could not commit to a moving target approach to programming
- Solution
  - Computer scientists – many funded by DOE – joined with parallel computer vendors and application developers to define a standard programming interface: MPI (Message Passing Interface).
  - Argonne computer scientists developed the first complete implementation, MPICH, helping to promote adoption of the standard.
  - DOE-supported computer science research over the last 15 years has enabled MPICH to scale to larger and larger machines, allowing applications to scale as well.
- Impact
  - Nearly all large-scale parallel scientific applications, in all areas of computational science, are written either for MPI directly or for a library in turn implemented in MPI.
  - 14 of the 15 largest machines in the world run MPICH



MPI/MPICH Timeline



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Portable Programming With MPI and MPICH

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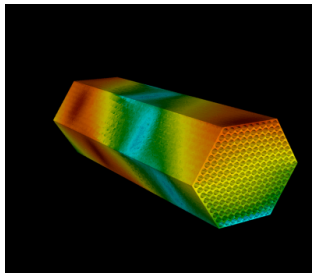

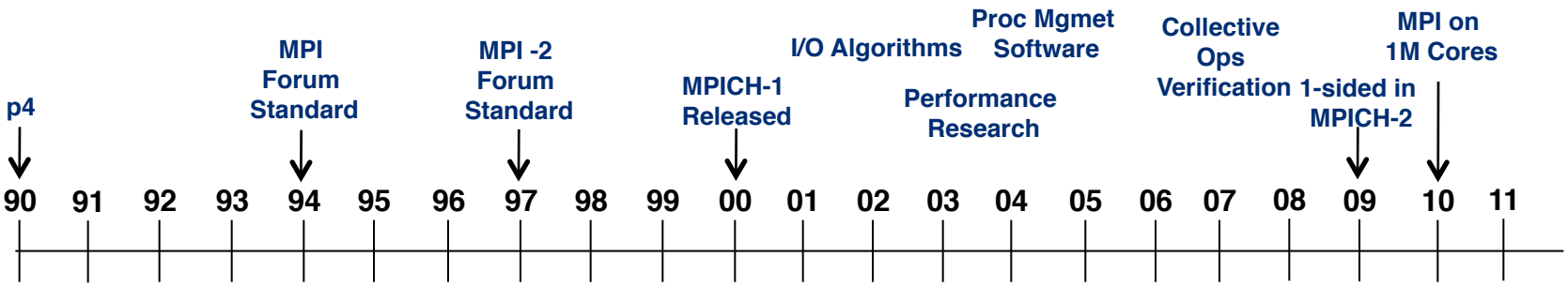

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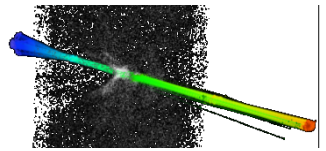
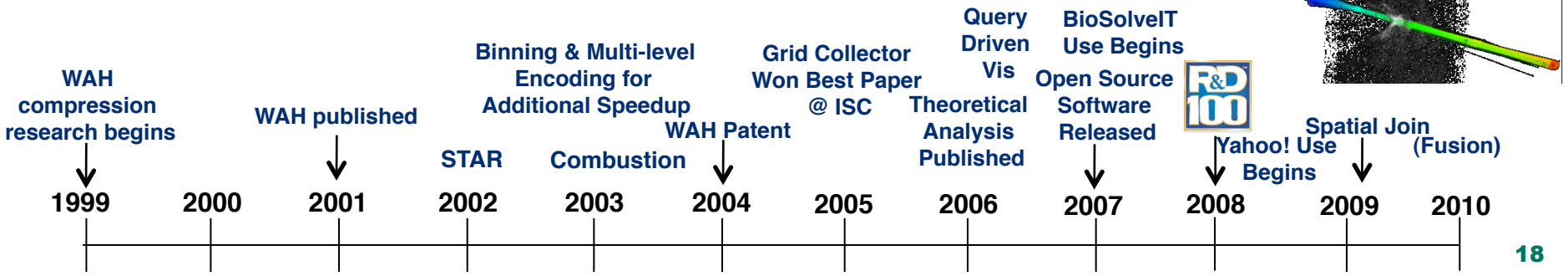
FastBit - Efficient Search Technology for Data Driven Science

- Problem
  - Quickly find records satisfying a set of user-specified conditions in a large, complex data set
  - Example: High-energy physics data –find a few thousand events based on conditions on energy level and number of particles in billions of collision events, with hundreds of variables,
- Solution
  - Developed new indexing techniques and a new compression method for the indexes, achieved 10-100 fold speedup compared with existing methods
  - Efficient software implementation: available open source from http://sdm.lbl.gov/fastbit/ (1000s of downloads), received a R&D 100 Award
- Impact
  - Laser Wakefield Particle Accelerator data analysis: FastBit acts as an efficient back-end for a visual analytics system, providing information for identifying and tracking particles
  - Combustion data analysis: FastBit identifies ignition kernels based on user specified conditions and tracks evolution of the regions
  - Testimonial “FastBit is at least 10x, in many situations 100x, faster than current commercial database technologies” – Senior Software Engineer, Yahoo! Inc





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The Heilmeier Catechism

- What are you trying to do?
- How is it done today? What are the limits of current practice? (literature review)
- What is *new* in your approach?
- What makes you think your approach will work?
- What are the barriers to getting into the marketplace (or workplace) and how can they be removed?
- If you are successful, what difference will it make?
- How long will it take? How much will it cost?
- What are the midterm and final exams?

Do Your Homework BEFORE You Read a Solicitation

- Know the agency (not important for some agencies, but critical for others)
- Know the program
- Know your own strategic plan - values, vision, mission, goals, etc.

What Are Strategic Priorities of the Funding Organization?

- **Read carefully!**
  - **What real-world problems are they trying to solve, for which the solicitation might provide at least a partial solution?**
  - **What are the agency, office and program vision, mission, and goals? (Most agencies and offices publish these, and a solicitation often includes specifics.)**
- **What does "long term" mean to agency and/or office?**
- **What about "high risk"?**
- **What does "prototype" mean to the agency?**
  - **Hint: It is a much higher standard of operational capability to DoD and some non-DOD agencies than many computer scientists think. Before you promise a "prototype," know what you've committed to.**

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Science or Engineering?

- **Which does the funding organization want?**
  - **See their strategic plan, if available.**
  - **DOE, DARPA, and NSF all have strategic plans available on the Internet.**

"Engineering is neither better nor worse than science, but it is different. The basic objective of science is to discover the composition and behavior of the physical world, the 'laws of nature' (better described as the 'facts of nature'; they are not the result of legislation.) The basic objective of engineering is to design useful things."

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The Importance of the SOW

- **The Statement of Work (SOW) is NOT the same as the technical description of your proposed research.**
- **The SOW must be understandable to Contracting Officers.**
- **The SOW should include a clear statement of *milestones* and *deliverables*.**
  - **Milestones?!**
  - **Capability delivered, not software versions**
  - **Deliverables? Hardware, prototype and/or operational systems, documentation, algorithms, reports, publications, workshops, toolkits, code libraries, etc.…**
- **Some evaluators read this FIRST!**
- **Most read it carefully and multiple times.**
- **Show value!**

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Project Metrics for Success

- **How will you (and the program officer) know when to declare success or failure?**
  - **Are any metrics spelled out in the solicitation? Or in cited literature?**
- **How will you recognize when you're on the wrong path?**
- **Provide metrics that help to market your results.**
  - ***Measurable* impact on client costs, capabilities, efficiency, completeness, accuracy, timeliness, etc.…**
  - **Set goals you can surpass (for most but not all agencies)!**
- **Provide metrics that show this is an excellent investment of taxpayer funds!**

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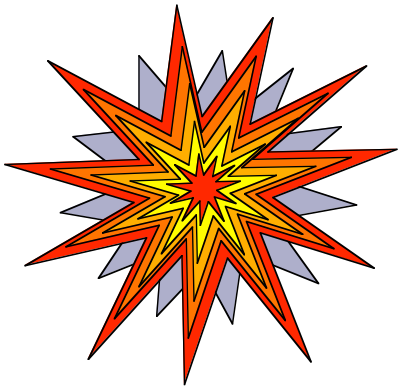
The WBS

- Though less used for basic research, for agencies that require it, the Work Breakdown Schedule (WBS) provides answers to key questions:
  - *What* am I paying for? (Tasks!)
  - *Who* am I paying for and how much of each person do I get for the money? (Preferably by name!)
- This is NOT just a cost evaluation document! It provides insight into the people who will do the work and how much time each will devote to it.
- Awards can be won or lost with the WBS.

How Long to Evaluate a Proposal?

- **Realities**
  - The time between proposal due-date and announcement of awards includes time for a contracting officer to do many things, so that time is NOT all available for proposal review.
  - People who read proposals are VERY busy, and reading proposals is often a small part of what they do.
  - They probably have a lot of proposals to read.
  - They have forms to fill out and reports to file related to the solicitation, competing for reading time.



Thank You!

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