HEP Budget for Physicists

Glen Crawford
DOE Budget Process (Historical)

“This meeting was called in order to discuss the meat. It has been pointed out that there is no more meat. A motion has been made to fight over the bones.”

George Booth, The New Yorker April 28, 1980
Budget Planning Cycle

Increasing complexity, detail

Community

Cong

OMB

DOE

SC

HEP
There are Four Big Hurdles in SC Budget Formulation

#1 – Inside SC
(Feb. – April FY 200N)
- Each AD-ship determines program priorities within constraints of the funding guidance provided by the Director of SC.
- Each AD presents program priorities to Director of SC.
- The Director of SC determines program priorities within constraints of the funding guidance provided by DOE.

#2 – Inside DOE
(April – July FY 200N)
- The Director of SC and the DOE Assistant Secretaries present their program priorities to DOE.
- DOE determines overall agency priorities.
- SC prepares President’s Budget. Each SC AD responsible for preparation of AD-ship budget.

#3 – OMB
(Aug. – Dec. FY 200N)
- DOE budget submitted to OMB.
- Each AD defends program budget at OMB hearing in early September.
- OMB provides “Passback” guidance to DOE in late November.
- Discussions between DOE and OMB refine final budget numbers.
- SC prepares President’s Budget. Each SC AD responsible for preparation of AD-ship budget.

#4 – Congress
[February FY 200(N+1)]
- President’s Budget presented to Congress.

[Mar. – Sept. FY 200(N+1)]
- Agencies present their budgets to Congress in formal hearings.
- Congress appropriates funding for 13 appropriations bills for FY 200(N+2), using the “President's Budget as a starting point for the Congressional Budget and appropriations.”

From the comments of Ellen Burns, Office of Congressman Vern Ehlers, May 2004
Budget Formulation - General Guidelines

- Budget formulation is not simple
  - Multi-dimensional
    - (Operations/ Construction/ R&D; labs/ universities;...)
  - Dynamic
  - Strongly coupled
  - With significant boundary conditions

- We try to proceed using a few basic guidelines
  - Project-like activities on planned profiles
  - Facility operations based on operations plan
  - Core research (lab/university) at level-of-effort
  - If funds remain, they can be used for new initiatives
In recent years, more emphasis on budget integration, planning and transparency

- Motivated in part by focus on good project management practice throughout DOE
- Baselined construction projects are “protected” in budget planning
  - Emphasis on getting new projects ready for baseline

However, this is a long-lead process

- All significant (>\$2M) projects must be identified and approved internally at least 1 year before $$ flows
  - Projects involving civil construction have even longer lead times
- Not well-matched to basic research R&D style where one can implement new ideas quickly
  - Source of frustration for the community
### Example: FY2010 HEP Budget

<table>
<thead>
<tr>
<th>(Dollars in Thousands)</th>
<th>FY 2009 Actual</th>
<th>FY 2009 Recovery Act</th>
<th>FY 2010 Approp</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Proton Accelerator-Based Physics</strong></td>
<td>401,368</td>
<td>107,990</td>
<td>434,153</td>
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<td><strong>Electron Accelerator-Based Physics</strong></td>
<td>32,030</td>
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<td><strong>Non-Accelerator Physics</strong></td>
<td>101,138</td>
<td>4,445</td>
<td>99,625</td>
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<td><strong>Theoretical Physics</strong></td>
<td>66,148</td>
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<td><strong>Advanced Technology R&amp;D</strong></td>
<td>195,042</td>
<td>116,690</td>
<td>182,316</td>
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<tr>
<td><strong>Total, High Energy Physics</strong></td>
<td>795,726</td>
<td>236,500</td>
<td>810,483</td>
</tr>
</tbody>
</table>

This budget is embedded in the larger Office of Science budget (see next slide). Congress usually allows redistribution between HEP subprograms.
### FY 2010 Funding Status

(budget authority in thousands of dollars)

<table>
<thead>
<tr>
<th></th>
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<tr>
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<td>Base Approp.</td>
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<td>Fusion Energy Sciences</td>
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<td>Science Program Direction</td>
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<td>192,295</td>
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<td>Workforce Development</td>
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<td>26,083</td>
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<td>Safeguards and Security</td>
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<td>80,603</td>
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<td>6,256,230</td>
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<td>+262,733</td>
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<td>ARPA-E</td>
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<td>Safeguards and Security (reimbursable)</td>
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<td>Congressionally-directed projects</td>
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<td>SBIR/STTR</td>
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<td>Use of prior year balances</td>
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<td>—</td>
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<td>Unallocated</td>
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<tr>
<td>Total, Science</td>
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<td>6,372,636</td>
<td>4,941,682</td>
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<td>4,903,710</td>
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</table>
Publicly Visible HEP Budget Product

Overview of the program for interested layman, NOT intended to be

- Comprehensive
- Prescriptive
- Highly detailed

Main goal is to be a description of the program which is

- Compelling
- Consistent
- Reflecting research priorities

High Energy Physics

Funding Profile by Subprogram

<table>
<thead>
<tr>
<th></th>
<th>FY 2006 Current Appropriation</th>
<th>FY 2007 Request</th>
<th>FY 2008 Request</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Energy Physics</td>
<td></td>
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</tr>
<tr>
<td>Proton Accelerator-Based Physics</td>
<td>362,157</td>
<td>376,536</td>
<td>389,672</td>
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<tr>
<td>Electron Accelerator-Based Physics</td>
<td>112,291</td>
<td>117,460</td>
<td>79,763</td>
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<td>Non-Accelerator Physics</td>
<td>54,205</td>
<td>59,271</td>
<td>72,430</td>
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<tr>
<td>Theoretical Physics</td>
<td>47,984</td>
<td>52,056</td>
<td>56,969</td>
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<td>Advanced Technology R&amp;D</td>
<td>121,801</td>
<td>139,476</td>
<td>183,464</td>
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<td>Subtotal, High Energy Physics</td>
<td>698,238</td>
<td>764,799</td>
<td>782,238</td>
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<tr>
<td>Construction</td>
<td>—</td>
<td>10,300</td>
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<tr>
<td>Total, High Energy Physics</td>
<td>698,238</td>
<td>775,099</td>
<td>782,238</td>
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</tbody>
</table>

Stanford Linear Accelerator Center (SLAC) Line Operations (non-add)

- (56,100) (52,100) (32,500)

High Energy Physics, excluding SLAC Line Operations (non-add)

- (642,138) (722,999) (749,738)

Public Law Authorizations:


Mission

The mission of the High Energy Physics (HEP) program is to understand how our universe works at its most fundamental level. We do this by discovering the most elementary constituents of matter and energy, exploring the basic nature of space and time itself, and probing the intersections between them. These fundamental ideas are at the heart of physics and hence all of the physical sciences. To enable these discoveries, HEP supports theoretical and experimental research in both elementary particle physics and fundamental accelerator science and technology. HEP underpins and advances the DOE missions and objectives through this research, and by the development of key technologies and trained manpower needed to work at the cutting edge of science.
Some examples of recent HEP budgets on our website: [http://www.science.doe.gov/hep/budget/HEPBudgetpage.shtm](http://www.science.doe.gov/hep/budget/HEPBudgetpage.shtm)

- Narrative format set by DOE CFO, OMB, Congress
- The major HEP subprogram categories are “tool-based”, that is, divided by what sort of facility/experiment is used to perform the research.
  - This does not always align with the major scientific thrusts.
- HEP management was restructured in 2008 to better align with the budget structure
  - Program managers have budget control (and responsibility) for their own programs.
  - Overall strategic vision coordinated by Associate Director for HEP and Division Directors
HEP Organization Chart

Office of High Energy Physics

Dennis Kovar
Sherry Pepper-Roby

Research & Technology Division
Glen Crawford
Janice Hannan
Kristi Naehr
Wanda Morris

Facilities Division
Mike Procario
Vera Bibbs
Rachel Grayson

HEP Budget and Planning
Dean Oyler
John Boger
*Jerry Blazey (IPA)

Research & Technology Division

Research Technology
Accelerator Science
Phil Debenham
Detector R&D
Howard Nicholson (IPA)
Computational HEP
John Kogut
Alan Stone
SBIR/STTR
L.K. Len

Facility Operations
Fermilab Complex
Mike Procario
LHC Operations
Amber Boehnlein (Detailee)
Other Operations
(SLAC/Other Labs)
John Kogut

Facilities Development
General Accelerator R&D
Bruce Strauss
LARP
*L.K. Len
SRF R&D
Bill Weng (Detailee)
ILC R&D
Jerry Blazey (IPA)

Facility Operations

Physics Research
Proton Accelerator Physics
Saul Gonzalez
*Alan Stone
Amber Boehnlein (Detailee)
Dave Muller (IPA)

Electron Accelerator Physics
*John Kogut

Non-Accelerator Physics
*Kathy Turner
Eli Rosenberg (IPA)

Theoretical Physics
Chung Leung (IPA)

Instrumentation & Major Systems
NOvA – Mike Procario
Minerva – Ted Lavine
Daya Bay – Ted Lavine
DES – Kathy Turner
CDMS – Howard Nicholson (IPA)
APUL – Bruce Strauss
JDEM – Kathy Turner

*Denotes base position
• Write financial plans (labs) and grants (universities, others) based on appropriated (or expected) budget

• Initial plan usually based on “worst case” of House or Senate mark. DOE CFO sets overall funding level.
  ➢ In addition, program may hold back funds for pending decisions, possible rescissions, contingency

• Subsequent plans can rearrange funding distribution or priorities
  ➢ In case of Continuing Resolutions, can get stuck in holding pattern, making execution difficult
  ➢ This has become the rule rather than the exception

• Generally try to implement “big picture” priorities identified by the scientific community
  ➢ After the fact, review/ discuss outcomes with advisory groups
Recent Budget History

- HEP FY 2009 funding is +10% compared to FY 2008 and above OMB Cost-of-Living (COL) from FY 2007
- HEP received $236.5 million in Recovery Act funding
- HEP FY 2010 Appropriations is about OMB COL compared to FY 2009

Recent Budget History

- HEP FY 2009 funding is +10% compared to FY 2008 and above OMB Cost-of-Living (COL) from FY 2007
- HEP received $236.5 million in Recovery Act funding
- HEP FY 2010 Appropriations is about OMB COL compared to FY 2009

![Recent Budget History Chart]

- **Millions (FY 2008 dollars)**
- **Fiscal Year**
- **Actual Dollars**
- **FY 2008 Dollars (OMB Inflators)**
- **Recovery Act**
- **COL**

U.S. DEPARTMENT OF ENERGY
Office of Science
Managed according to approved baselines by designated Project Manager. Extent of oversight tailored to total project cost (TPC)

- Decision process in R&D phase still ill-defined for smaller projects, handled case-by-case
  - How to cross the “valley of death” between proof-of-principle R&D and cutting metal?

- New rules and guidelines for how to report costs both pre- and post-baseline
  - Available on request

- Complex dance between project and budget requirements/timelines (see following slide)
**Budget Process**
- Externally driven by Congress and Office of Management and Budget

  - Cares about
    - How much $$ do you want to spend? When? Why?
    - What color is the $$? (operating, equipment, other)

  - Construction projects automatically get higher visibility due to extra reporting requirements and financial controls

**DOE Project Management Process**
- Internally driven by DOE Office of Engineering and Construction Management (OECM) and SC Office of Project Assessment (Lehman)

  - Cares about
    - What Phase is the project in?
    - Is it ready to go to the next Phase? (Critical Decisions or CD’s, e.g. CD-0)
    - Cost, schedule, technical readiness

  - Larger projects automatically get higher visibility in DOE due to layered approval levels

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DOE Budget Requests REQUIRE appropriate CD’s are passed before requesting/spending $$
## Strata of DOE Projects

<table>
<thead>
<tr>
<th>Threshold</th>
<th>Triggers</th>
<th>DOE Jargon</th>
<th>Decision Maker</th>
<th>Consequences</th>
<th>Recent Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Civil Construction:</strong></td>
<td>Extensive Budget Reporting</td>
<td>Line Item Const.</td>
<td><strong>if TPC &gt;$400M:</strong> Dep. Sec. <strong>if TPC &gt;$100M:</strong> Director, Office of Science <strong>if TPC &gt;$20M:</strong> Assoc. Dir.</td>
<td>Budget Reporting and Tracking; Congressional visibility; OMB apportionment</td>
<td>NuMI LBNE</td>
</tr>
<tr>
<td>Total Project Cost (TPC) &gt;$20M</td>
<td>Extensive Project Reporting</td>
<td>MI E</td>
<td><strong>if TPC &gt;$20M:</strong></td>
<td>Earned Value Management; DOE project reporting (PARS); OMB performance tracking (PART)</td>
<td>U.S. LHC NOvA Daya Bay DES</td>
</tr>
<tr>
<td>Total Project Cost (TPC) &gt;$5M</td>
<td>DOE Project Management System</td>
<td>MI E</td>
<td>AD’s delegate</td>
<td>DOE Project Management (CD-process, reviews)</td>
<td>Run II Detector Upgrades Minerva</td>
</tr>
<tr>
<td>Total Estimated Cost (TEC) &gt;$2M</td>
<td>Budget Reporting</td>
<td>Major Item of Equip. (MI E)</td>
<td>HEP program manager</td>
<td>MI E tracking; Request in FY+2 budget</td>
<td>VERITAS T2K</td>
</tr>
</tbody>
</table>
Backup
DOE Budget Timeline

Start Here (FY+2)

Pre-CRB Internal

Cong Rollout

Jan

CRB Initial

Jun

Cong Budget DUE

CRB Final

Jun

OMB Submission

Oct

OMB Hearings

OMB Passback

Cong Hearings

Cong Rollout

Jan

Q&A

Initial Fin Plan

FY Starts

Revise Fin Plan

(repeat as needed)