Outlook at NSF

High Energy Physics Advisory Panel
14 February 2005

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FY05/FY06 Budgets at NSF

- **FY05 enacted:** -3.2% overall; R&RA -1.7%
  - Big surprise: only the 4th decrease in 50 years
  - Omnibus bill passed quickly (other pressures in our bill, VA, HUD, Independent Agencies)
- **FY06 request:** +2.4% overall; R&RA +2.7%
  - R&RA essentially restored to FY04 level
  - Did well, relatively speaking: DOE/OS (-3.8%), NASA Universe Division (flat), NIH (+0.7%), Basic Research across the Federal Govt (-1%)
  - … but we don't spend request dollars (FY05 request was +3%), the story is not over
  - … and New House Appropriations Subcommittee Struc
    - Number of Cardinals reduced from 13 to 10
    - NSF, NASA and OSTP moved to new Science, State, Justice and Commerce Subcommittee (generally viewed as good news)
    - Chaired by Rep Frank Wolf (R-VA)

Managing with Tight Budgets

- Goals
  - Ensure the most compelling science gets done
  - Ensure capability to respond to new opportunities
  - MPS workforce that reflects the diverse face of the US
- Strategies
  - Strong, flexible core (fewer targeted solicitations, decreased numbers of Centers as competition permits)
  - Facility stewardship (e.g., increases for LHC and Gemini; decrease for CESR)
  - Broaden participation by integrating it with our research strengths (eg, LIGO, PREMs, URCs, REUs, Hampton PFC, LHC-QuarkNet, CROP, Mariachi, ASPIRE)

MPS Highlights

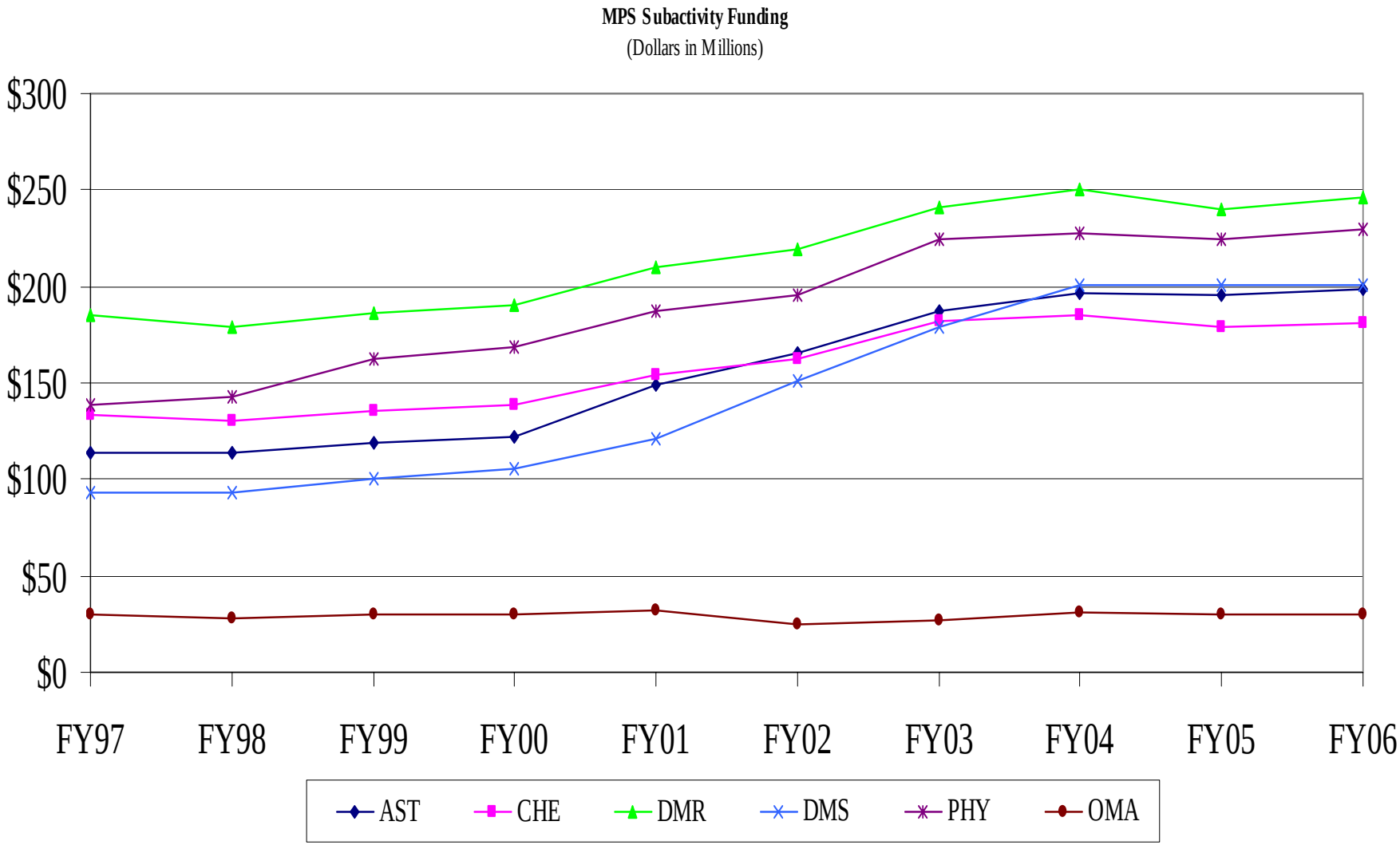
- Significant investments
  - Physics of the Universe (continuing)
  - Mathematical Sciences (continuing)
  - Nanoscale Science and Engineering (mainstreaming)
  - Cyberinfrastructure/Cyberscience/Theory (growing)
  - Molecular Basis of Life Processes, Sustainability (defining)
- Facilities
  - Increases for LHC and Gemini, ramping of CESR
  - ALMA and IceCube under construction
  - New start for RSVP (subject to successful baselining)
  - Adv LIGO in queue, “slated for FY08”
- Investing in future facilities
  - Design & Development funding for GSMT, LSST, UG Lab, RSVP, Next generation x-ray light sources

MPS by Division

(Dollars in Millions)

	FY 2003 Actuals	FY 2004 Actuals	Change from 03 to 04	FY 2005 CP	Change from 04 to 05	FY 2006 Request	Change from 05 to 06
AST	187.07	196.63	5.11%	195.10	-0.78%	**198.64**	1.81%
CHE	181.61	185.12	1.93%	179.45	-3.06%	**181.37**	1.07%
DMR	241.39	250.65	3.84%	240.50	-4.05%	**245.70**	2.16%
DMS	178.79	200.35	12.06%	200.38	0.01%	**200.38**	0.00%
PHY	224.50	227.77	1.46%	224.94	-1.24%	**230.14**	2.31%
OMA	27.34	31.07	13.64%	29.49	-5.09%	**30.00**	1.73%
Total, MPS	1040.70	1091.59	4.89%	1069.86	-1.99%	**1086.23**	1.53%
R&RA	4054.43	4293.34	5.89%	4220.55	-1.70%	**4333.49**	2.68%
NSF	5369.34	5652.01	5.26%	5472.82	-3.17%	**5605.00**	2.42%

Ten-Year Funding History



Budgetary Outlook

- Almost $3B behind NSF doubling act number for FY06
- Flat, small growth at best
  - President and Congress do recognize basic research and NSF's central role in supporting the sciences
- **The Budgetary Environment**
  - **Huge Federal budget deficit: $400B**
    - **≈ 20% Federal Budget**
    - **≈ NonDefense, Discretionary spending**
  - **President's Goal: reduce deficit to ≈$200B by FY2009**
    - **NB: deficit increased slightly in FY06 request**
  - **National Priorities – War on Terrorism, Homeland Security, and the Economy – not well matched to basic research**
  - **China!**
    - **Driving up prices of commodities (oil, steel, nickel, …)**
    - **$160B trade deficit**
    - **Financing the US Federal Gov't**

Science Funding: The Big Picture

World GDP: $50T
- **US: $11T**
- China: $6T
- Japan: $4.3T
- Germany: $2.4T
- UK: $1.8T
- France: $1.7T

US: $11T
- **Fed Govt: $2.4T**
- Local/state: $1T
- WalMart: $0.26T
- Exxon: $0.21T
- GM: $0.20T

NB: Debt: $8T (ouch!)

US Fed Budget: $2.4T
- Mandatory: $1.3T
- Defense: $400B
- Interest on Debt: $200B
- **Discretionary: $450B**

NB: Deficit: $0.4T (20% ouch!)

R&D Budget: $130B
- Defense: $55B
- **NonDefense: $75B**

Basic Research
- NIH: $27B
- NASA: $5B (Earth+Space Science)
- **NSF: $5.6B**
- DOE: $3.5B (Office of Science)
- NIST, NOAA, EPA, CDC, USGS, …

Elementary Particle Physics

- Stunning opportunities for breakthroughs in our understanding of the Universe and the laws that govern it
  - Articulated well in Quantum Universe
- NSF shares stewardship of EPP with DOE and works with DOE to realize the grand opportunities
- Strong, broad program in place that maps well to the breakthrough opportunities
- Bold plans for the future

Present Program

(detail from Jim Whitmore)

- EPP and Particle Astrophysics/Cosmology Theory Programs
- Experimental EPP
  - Support of University groups at Tevatron, LHC, BaBar, MiniBooNE, MINO, K2K/Super-K, BTeV
- Particle/Nuclear Astrophysics
  - CDMS, Milagro, HiRes, Auger, STACEE/Veritas, AtaCama Telescope
- Facilities
  - CESR, LHC, IceCube, LIGO
- Other Related Activities
  - 3 PFCs (KITP, KICP, Hampton), experimental tests of gravity, CAREER awards, Cyber/Grid activities, MRI

First String Installed at IceCube

Future (Near Term)

- LHC (“Energy Frontier”)
  - Operations, computing ramping up
- RSVP (“Sensitivity Frontier”)
- Physics of the Universe
  - ACT, Auger, CDMS, LSST, CMB, Theory
- Neutrino Physics (“New Physics Frontier”)
  - Formation of NuSAG
  - First 3 charges on neutrino physics

Bold Plans for the Future

- Deep Underground Lab
  - Planning grant for science community awarded
  - Site planning grants to be awarded
- International Linear Collider Activities
  - University R&D program (with DOE)
  - FALC (with DOE)
- Muon Colliders and Neutrino Superbeams
  - MICE (with DOE and UK)
- Strategic planning activities
  - Quantum Universe
  - APS Neutrino Study
  - EPP2010

RSVP

- Two experiments (MECO and KOPIO) at Sensitivity Frontier
  - Complement Energy Frontier investments at Tevatron, LHC
  - Joint venture with DOE: "parasitic" use of RHIC Complex (AGS) for two compelling experiments
- Timeline
  - 1999: Proposed as MREFC project
  - 2000: NSB approved for new start queue
  - 2004: Congress appropriated funds for FY05 const start
  - Summer 2004 – Spring 2005: Baselining activities led by Willis/Kotcher
  - Spring 2005: NSF cost, schedule and technical review
  - Summer 2005: Subject to successful baselining, NSB authorization of construction funds
  - 2005 – 2010: Construction
  - 2011 – 2015: Operations

Bump in the Road: Revised Timeline

- **Fall/Winter 04:** Internal reviews led by Willis/Kotcher reveal significant cost increases -- construction, operations, and duration of experiment
  - Thus far, largely associated with the "parasitic operation" assumption
  - Plans for RHIC operations & the RHIC complex and stewardship (now NP) have changed
  - **No Firm Numbers yet**
- **Winter – Spring 05:** HEPAP sub-panel will assess scientific value of KOPIO and MECO in the context of the US and World EPP programs
- **Spring 05:** RSVP baseline complete; NSF reviews cost, schedule and technical aspects of baseline
- **Summer 05:** With HEPAP advice and the results of the NSF Spring 2005 baseline review NSF, in consultation with DOE, will make a decision on how to proceed
  - **All options open: re-design, de-scope, termination**

Charge to HEPAP

DOE and NSF request that HEPAP appoint a sub-panel to provide advice on the science value of the RSVP project in the context of the US and World EPP programs, specifically:

- Evaluate the science value of MECO in the context of the US investment in EPP, assuming a sensitivity of 10^{-17}, 10^{-16}, or 10^{-15} can be achieved
- Evaluate the science value of KOPIO in the context of the US investment in EPP, assuming 10 or 100 events can be observed
- Place the science value of each in the context of the broad US particle physics program, recognizing the fiscal environment and the impact on other investments at NSF .
- Place the science value of each in the broad context of the international EPP program and assess any potential overlap or complementarity with work being planned elsewhere. How has this context changed since 1999, when the RSVP project was proposed?

Back Up Slides

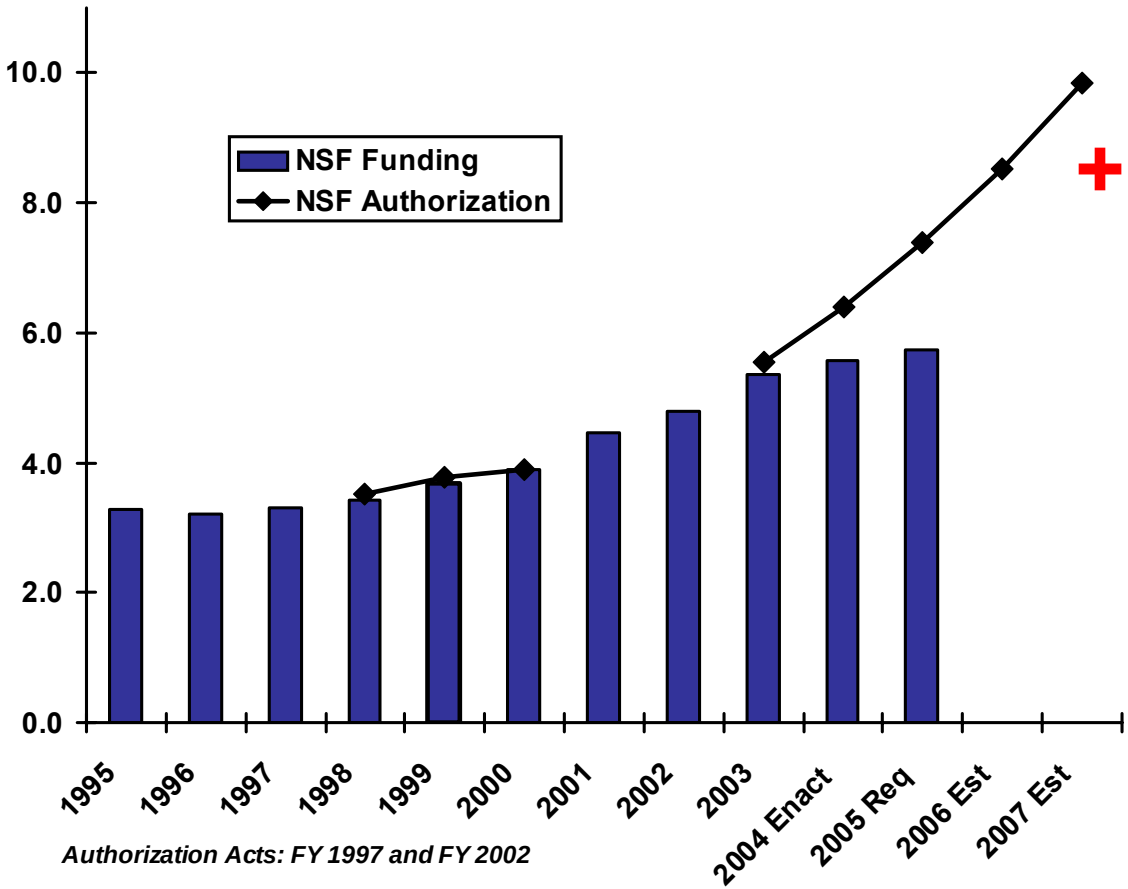
NSF Funding

FY 1995 – 2005 Request

$$ in Millions

NSF Funding and Authorizations

FY 1995- 2007 Estimates



Authorization Acts: FY 1997 and FY 2002

+68% since 1998

leveling off

Fundamental Science and Engineering

Physics of the universe, a set of activities that build on the National Science and Technology Council report of the same name and partner with the Department of Energy and NASA in exploring the mysteries of dark matter and dark energy, the earliest phases in development of the universe, the fundamental nature of time, matter and space, and the role of gravitation.

Fundamental mathematical and statistical science, activities that strengthen the core of the Mathematical Sciences priority area and enable effective partnering with other disciplines.

Physical sciences at the nanoscale, activities that provide the foundation for efforts to develop nanoscale technologies in partnership with other NSF activities and the government-wide National Nanotechnology Initiative.

Cyberinfrastructure and the cyberscience it enables, connecting with NSF's high priority activities in this area and related activities government-wide in Networking and Information Technology R&D.

Molecular basis of life processes, a set of activities linked to the biology of complex systems that will enable explorations in areas such as how disordered collections of molecules assemble themselves into the elements of living systems, how proteins fold and membranes work, and how physiological processes such as breathing and thinking emerge out of complex, coupled arrays of individual reactions.

MPS Cyberinfrastructure

	FY 2004 Actual	FY 2005 Current Plan	FY 2006 Request
AST	$3.92	$6.40	$8.90
CHE	$2.35	$5.40	$8.40
DMR	$10.00	$16.20	$21.60
DMS	$1.10	$1.40	$1.80
PHY	$3.73	$8.00	$12.40
OMA	$0.10	$0.00	$0.00
MPS TOTAL	$21.20	$37.40	$53.10
SCI (CISE)	$112.29	$123.60	$124.96

MPS Facilities

(Dollars in Millions)

Facilities	FY 2004 Actual	FY 2005 Current Plan	FY 2006 Request	Change over FY 2005 Amount	Change over FY 2005 Percent
Cornell Electron Storage Ring (CESR)	18.00	16.62	14.71	-1.91	-11.49%
GEMINI Observatory	13.27	14.81	18.50	3.69	24.92%
Large Hadron Collider (LHC)	7.00	10.50	13.50	3.00	28.57%
Laser Interferometer Gravitational Wave Observatory (LIGO)	33.00	32.00	32.00	0.00	0.00%
MSU Cyclotron	15.65	17.50	17.50	0.00	0.00%
Nanofabrication (NNUN/NNIN)	2.80	2.80	2.80	0.00	0.00%
National High Magnetic Field Laboratory (NHMFL)	24.50	25.50	25.50	0.00	0.00%
Rare Symmetry Violating Processes (RSVP)	6.00	2.30	0.00	-2.30	-100.00%
National Astronomy and Ionosphere Center (NAIC)	10.54	10.52	10.60	0.08	0.76%
National Center for Atmospheric Research (NCAR)	1.17	1.17	1.17	0.00	0.00%
National Optical Astronomy Observatories (NOAO)	41.35	37.92	37.36	-0.56	-1.48%
National Radio Astronomy Observatory (NRAO)	54.98	47.03	47.40	0.37	0.79%
Other MPS Facilities	13.39	12.70	11.70	-1.00	-7.87%
Total, MPS	**$241.65**	**$231.37**	**$232.74**	**$1.37**	**0.59%**

Priority Areas

MPS Investments in NSF Priority Areas

(Dollars in Millions)

	FY 2004 Actual	FY 2005 Current Plan	FY 2006 Request	Change over FY 2005 Amount	Change over FY 2005 Percent
Biocomplexity in the Environment	4.70	4.03	3.36	-0.67	-16.6%
Nanoscale Science and Engineering	111.48	131.62	95.82	-35.80	-27.2%
Mathematical Sciences	70.23	70.23	70.23	0.00	0.0%
Human and Social Dynamics	0.53	0.50	0.50	0.00	0.0%

MPS Centers

(Dollars in Millions)

Centers	FY 2004 Actual	FY 2005 Current Plan	FY 2006 Request	Change over FY 2005 Amount	Change over FY 2005 Percent
Chemistry Centers	17.44	13.01	14.81	1.80	13.84%
Materials Centers	57.20	57.00	58.00	1.00	1.75%
Mathematical Sciences Research Institutes	15.05	17.15	17.15	0.00	0.00%
Nanoscale Science and Engineering Centers	12.28	12.28	12.51	0.23	1.87%
Physics Centers	14.27	18.72	19.52	0.80	4.27%
Science and Technology Centers	14.77	15.60	15.60	0.00	0.00%
Total, MPS	**$131.01**	**$133.76**	**$137.59**	**$3.83**	**2.86%**