NSF Advisory Panel on Light Source Facilities

Workshop at LLNL, CA

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Outline

- Context of Workshop & Charge to Panel
- Interagency collaboration and roles
- NSF/MPS support for major facilities
- Opportunities and constraints

Purpose of Workshop

- NSF/MPS charged Advisory Panel July 07 to advise on NSF/MPS's role in support of future light source facilities
- Panel is formally a subcommittee of MPSAC (Liaison: Monica Olvera de la Cruz)
- First panel meeting at NSF on Aug 23, 07
- Panel decided to conduct workshop & site visits to conduct its business
- Panel report expected Spring 2008

NSF Advisory Panel on Light Source Facilities
Charge to Panel

The Panel is charged to provide guidance to the Directorate for Mathematical and Physical Sciences regarding future NSF stewardship and/or partnership in support of coherent light source facilities and instrumentation. Specifically:

- What is the current view of opportunities for future research using major advanced light source facilities, and what facilities are envisioned to carry out such research in the U.S.?
- What does the Panel see as the most effective role for NSF in helping to develop, construct, instrument and operate such facilities?
- Do university-based light sources now under discussion in the community (for example, a soft X-ray Free Electron Laser and/or an Energy Recovery Linac) have a critical role to play in realizing the opportunities?

Context

1. Science drivers in research fields likely to use major light source facilities
2. Potential for interagency, private sector, and international partnership
3. DOE and other federal agency plans
4. Education and future workforce needs
5. Multidisciplinary nature of the anticipated user communities
6. Budget outlook and balance for NSF, MPS and DMR
7. NSF's responsibility to maintain appropriate balance at all levels among funding modes, including individual investigators, groups, centers and instrumentation as well as major facilities

Possible Outcomes May Include

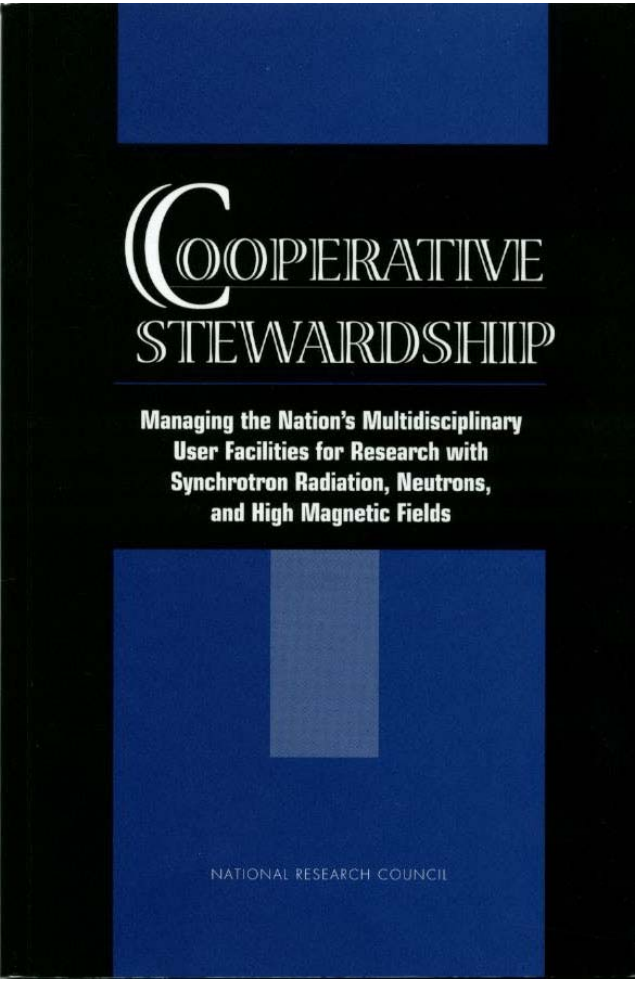
- NSF support for construction and stewardship of major new light source(s), and/or
- NSF support for research, conceptual development and engineering design projects related to future light sources, and/or
- NSF partnership via facilities stewarded by DOE

Expect Panel to advice on ALL possible outcomes.

NO hidden agenda - MPS seeking informed community input.

NOT seeking guidance on planning for any specific facility.

Interagency Cooperation & Roles



- Relevant agencies: NSF, DOE, NIH,…
- Modes of cooperation/coordination:
  1. Facility stewardship
  2. User community
  3. Training & Education
  4. Instrument Development
  5. Technology R&D

Interagency Task Force on Light Sources (OSTP; to appear?)

Current federally-supported synchrotron facilities in the U.S.

- SSRL at SLAC (1974)
- CHESS at Cornell (1980)
- NSLS at Brookhaven (1982)
- SRC at U Wisconsin (1985)
- ALS at Berkeley (1993)
- APS at Argonne (1996)

- Under construction: LCLS at SLAC

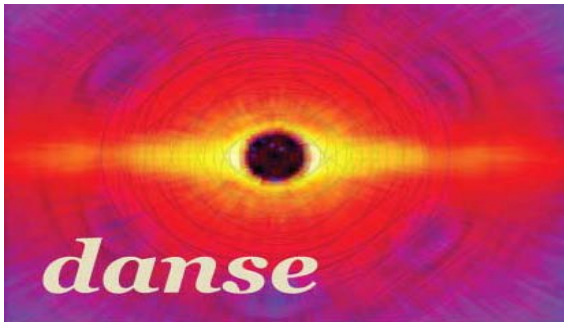
Federal support for fundamental materials research in academia

• **NSF**		
– DMR	08 request	**$283M**
– Other	*est*	***$100M?***
• **DOE Basic Energy Sciences**		
– BES FY08 request (total)		$1.45B
• Materials Core Research		$311M
• Che/Geo/Bio Core Research		$254M
• Facilities Ops / Constr / Research		$884M
– For materials research at universities	*est*	***~$110M***
• **Defense agencies (to universities)**		
– AFOSR, ONR, ARO, DARPA	*est*	***~$50M?***
• **Other (NIH, NASA…to universities)**	*est*	***~$30M?***

Models for Interagency Coordination

Model 1: DANSE (Neutron data analysis network for SNS @ ORNL)

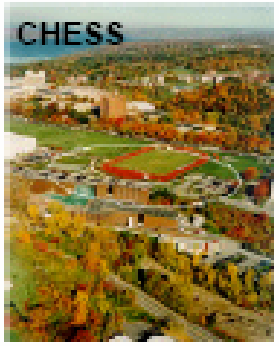
- IMR-MIP: Mid-Scale Instrumentation Projects – Instrumentation for Material Research
- ~$2M - $20M per instrument
  - e.g. synchrotron & neutron beamline instrumentation, high-field magnets…
- 2 types of proposals
  - Conceptual & Engineering Design
  - Construction
- 7 design awards made to date

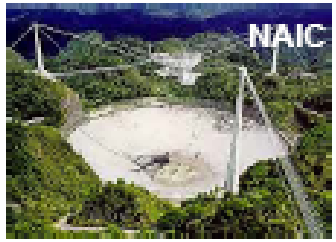


Model 2: NSF/DMR supports for 6 beamlines (primarily for academic users) at neutron scattering at NIST.

World Class Major Facilities

Keep University Researchers at the Frontier





Facilities in Development & Under Construction

Facilities under Construction:

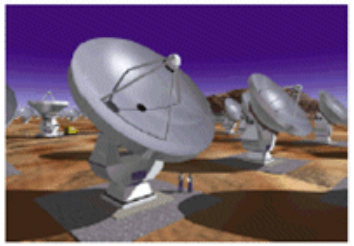
- ALMA: new baseline, early operations increases to $8.2M.
- IceCube: operations initiated at $1.5M level
- Advanced LIGO: construction begins FY 2008.
- LHC: coming online soon, delay?

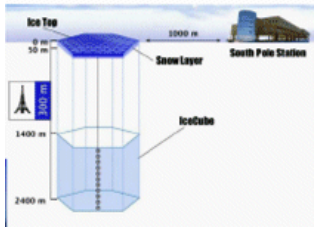
Design and Development:

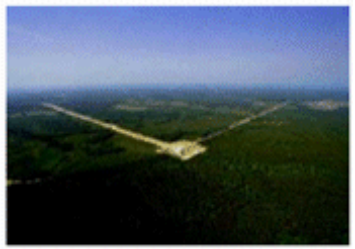
- DUSEL: will begin formally in FY 2008, $6.0M, building on previous Discovery Research. Just concluded S3 reverse site visit.
- GSMT (TMT + GMT): $5M R&D.
- LSST: $2-3M R&D.
- ATST: In "readiness" stage. Cultural & EIS challenges.

Other Projects:

- Light source: planning to convene panel on NSF role.
- ILC: Cost? When?







AMERICAN COMPETITIVENESS INITIATIVE

Major Facilities Challenges (NSF)

- Cost approaching O($1B) for new projects
- M&O approaching O(1) of Division budgets
- R&D and M&O covered by Division budgets
- Balance 1: core programs vs facilities M&O
- Balance 2: Stewardship vs user facility vs instrumentation vs training vs technology development

Major Research Equipment & Facilities Construction Account (MREFC)

- Supports acquisition, construction & commissioning
- Directorate support R&D and M&O
- Eligibility: project must represent an outstanding opportunity to enable research and innovation, as well as education and broader societal impacts
- Should offer possibility of transformative knowledge
- Serve urgent contemporary R&E need for years
- Total construction cost > 10% of originating unit's budget

Prioritizing Criteria

1. Scientific and technical criteria assessed by researchers in a field or interdisciplinary area
2. Agency strategic criteria assessed across fields
3. National criteria assessed across fields

Strong competition within MPS & NSF

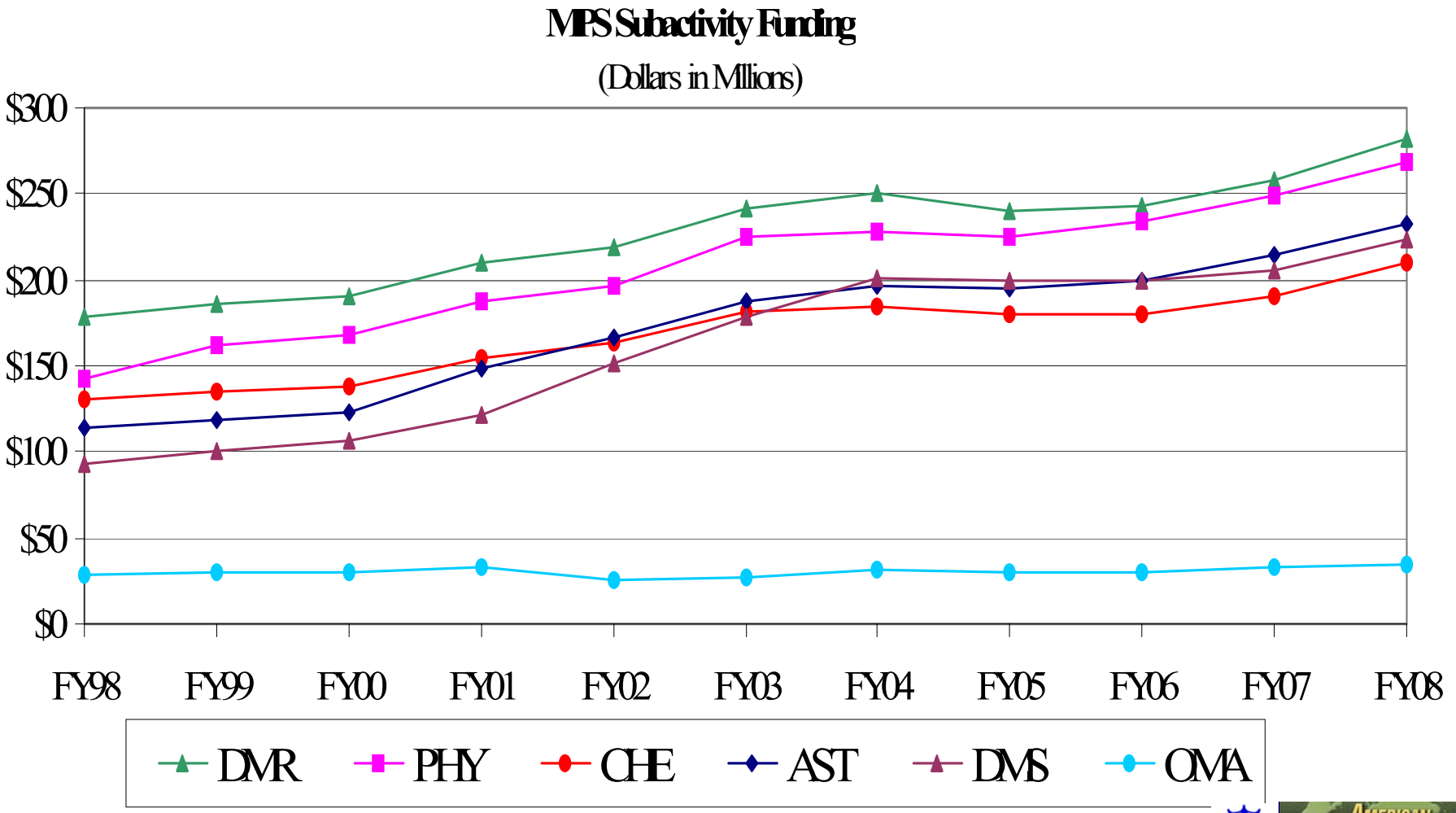
MPS by Division

	FY 2005 Actuals	FY 2006 Actuals	Change from 05 to 06	FY 2007 Request	Change from 06 to 07	FY 2008 Request	Change from 07 to 08
AST	195.11	$199.75	2.4%	$215.11	7.7%	$232.97	8.3%
CHE	179.26	180.70	0.8%	191.10	5.8%	210.54	10.2%
DMR	240.09	242.59	1.0%	257.45	6.1%	282.59	9.8%
DMS	200.24	199.52	-0.4%	205.74	3.1%	223.47	8.6%
PHY	224.86	234.15	4.1%	248.50	6.1%	269.06	8.3%
OMA	29.80	29.9	0.3%	32.40	8.4%	34.37	6.1%
Total, MPS	1,069.36	1,086.61	1.6%	1,150.30	5.9%	1253.00	8.9%
R&RA	4234.82	4449.25	5.1%	4,765.95	7.1%	5,131.69	7.7%
NSF	5480.78	5645.79	3.0%	6,020.21	6.6%	6429.00	6.8%

FY08 Omnibus: NSF +2.5%, R&RA +1.1%

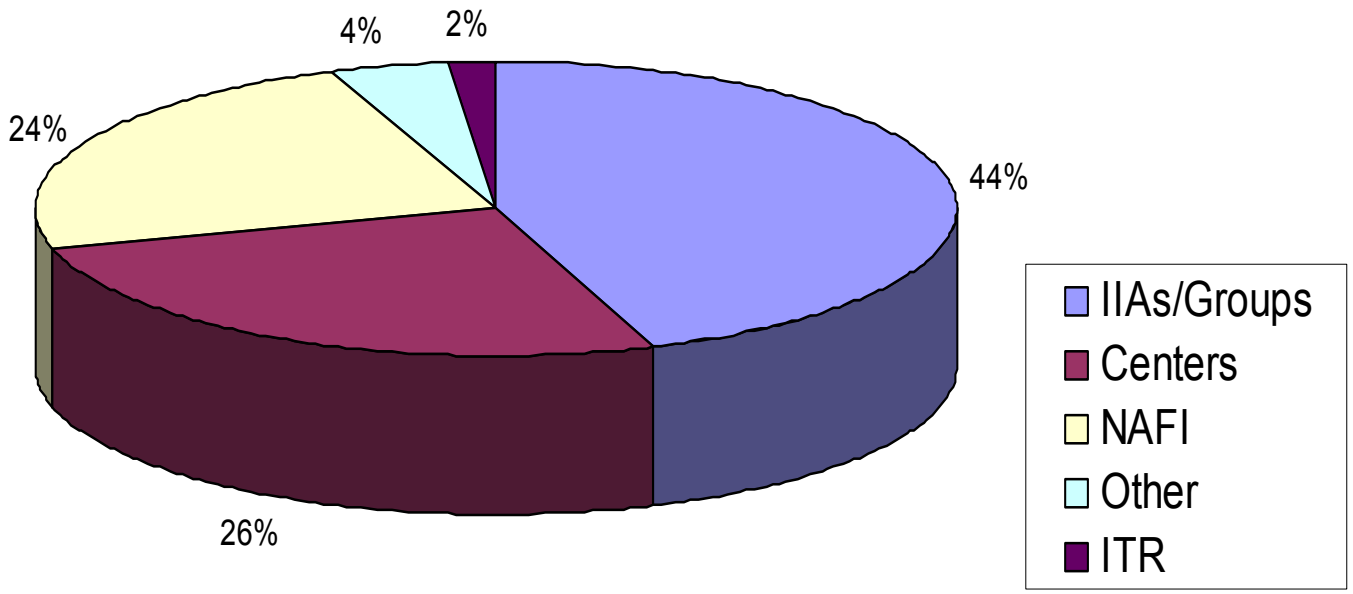
Ten-Year Funding History

MPS Average increase over last 5 years: 1.4%, last 10 years: 5.9%.



DMR Program Balance

FY 2006
$252.2M
(includes MRI)



Supports about 2000 faculty members, 600 postdocs, 2500 grad students and 1500 undergraduates "on budget"

Committee of Visitors: ***Balance is about right***

Maintain individual investigator share of total

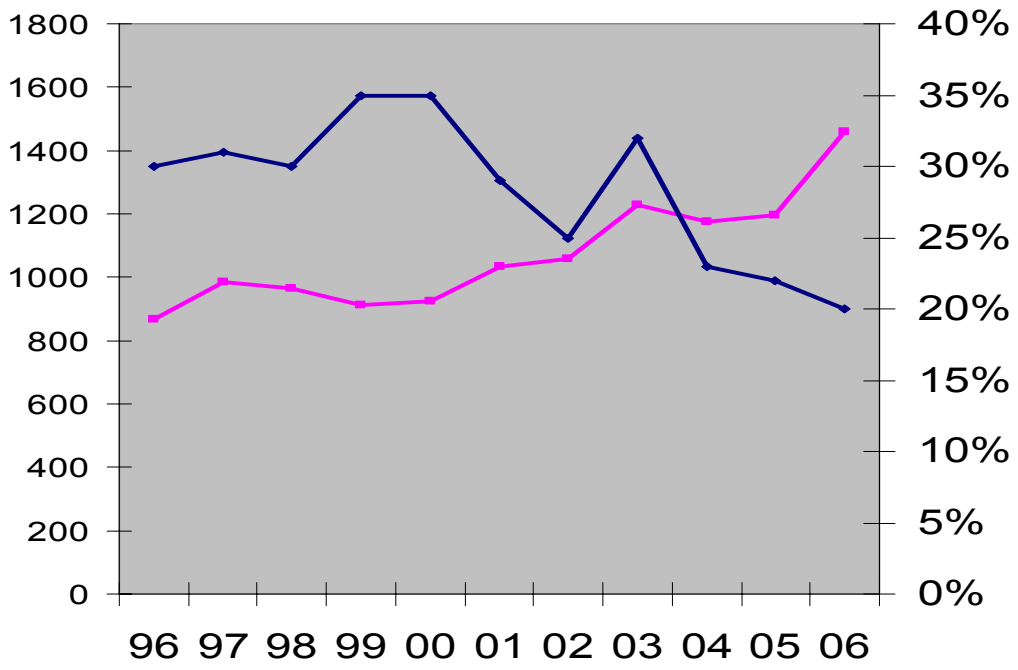
DMR National User Facilities

Stewardship for science and engineering research and education

ranging far beyond "materials"

- **National High Magnetic Field Laboratory**
  - Florida State University, University of Florida, LANL
- **Neutron Facility**
  - CHRNS at the National Center for Neutron Science, NIST
- **Synchrotron Facilities**
  - CHESS at Cornell University
  - SRC at the University of Wisconsin
  - *University-based groups using DoE facilities*
- **National Nanotechnology Infrastructure Network**
  - 13 Universities
  - ***NSF-ENG lead***, plus DMR, CHE, BIO co-funding

DMR Proposal Pressure & Success Rates (Research Grants)



Proposals

Success Rate

- **Many strong proposals declined essentially for lack of funds**
- **Grant sizes not keeping pace with 'scientific' inflation**
- **DMR is lowest success rate in MPS but NSF-wide average is no better**

DMR Facilities & Instrumentation – Challenges

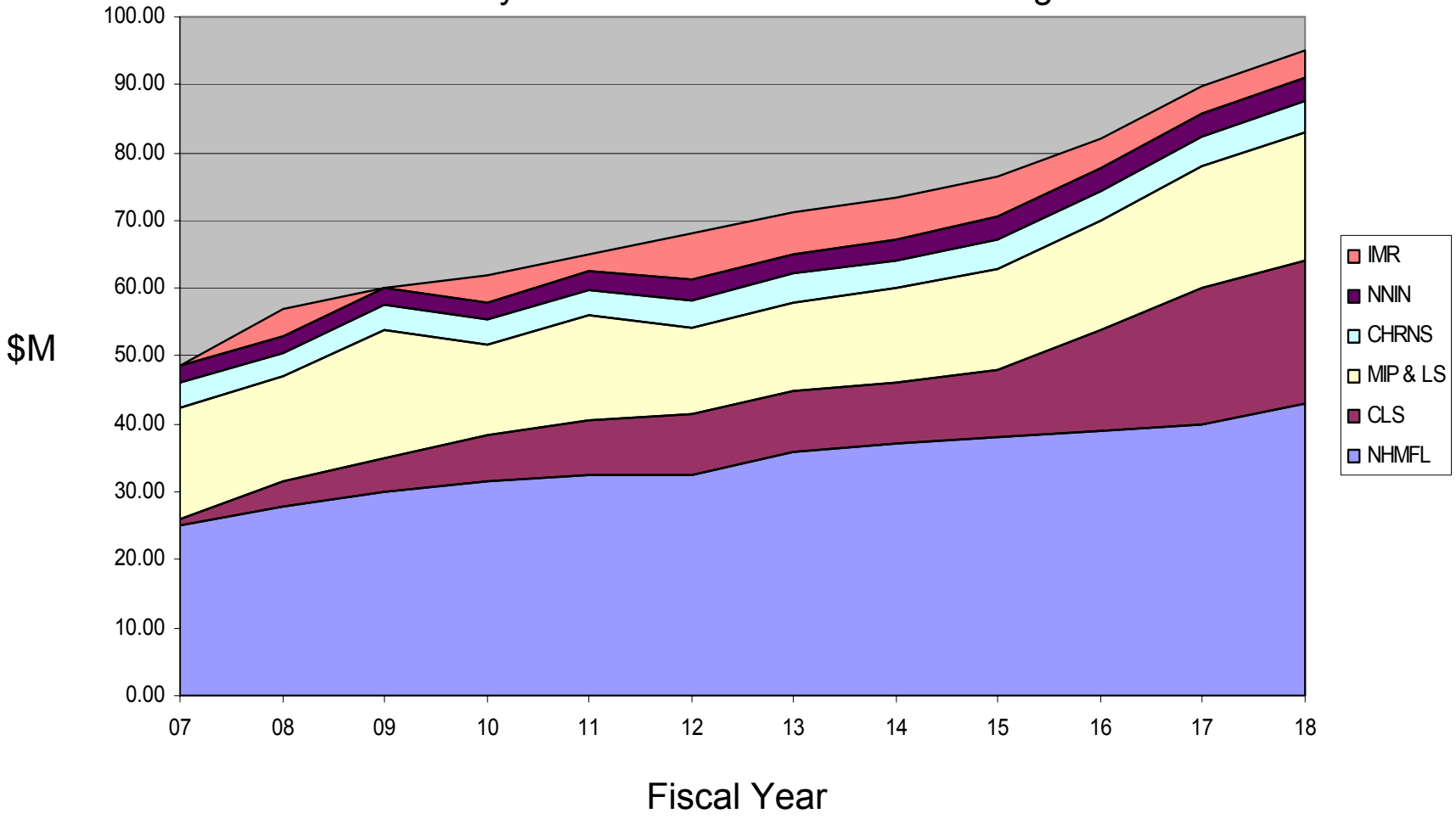
- Stewardship of the NHMFL
  - DMR currently provides ~95% of NSF funding
  - Operating costs increasing substantially
  - Serving an increasingly broad user community
  - **Partnership is essential**
- Future of university-based synchrotron facilities?
- Stewardship of a future major light source?***
- Support for neutron & nano facilities
- Support for mid-scale & 'small' instrumentation
  - e.g. NSF support for beamlines at national facilities
  - Developing/acquiring 'bench-scale' instrumentation

Instrumentation and Facilities

One Possible Scenario for DMR

Assumes 5% growth after 2008; CLS development, 50% M&O starting 2016

NAFI stays at ~20% of DMR total excluding MRI



Expect Panel Advice On

- Exciting opportunities in CLS in US
- NSF's role in future light source facilities
- Role of university based facilities
- Interagency cooperation & roles
- Balance of portfolio within MPS