

National Science Foundation

Instrumentation, Infrastructure, Innovation

2010 NSF EPSCoR Project Directors and Project Administrators Meeting

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<http://www.nsf.gov/od/oia/>



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The poster features the NSF logo at the top left and the title 'NATIONAL SCIENCE FOUNDATION MAJOR RESEARCH INSTRUMENTATION' at the top right. Below the title, a list of 'MRI GOALS' is presented, followed by a grid of small images illustrating various research activities. At the bottom, contact information is provided.

NSF NATIONAL SCIENCE FOUNDATION
MAJOR RESEARCH INSTRUMENTATION

MRI GOALS

- Catalyzing new knowledge and discoveries
- Empowering the Nation's scientists and engineers
- Providing state-of-the-art research instrumentation
- Enabling research-intensive leadership institutions
- Building capacity for a diverse workforce
- Developing next generation instrumentation
- Promoting academic-private sector partnerships

MRI@NSF.GOV
www.nsf.gov/od/oia/programs/mri

National Academies Report (2006)

Advanced Research Instrumentation and Facilities

- The need for particular instruments has broadened, crossing scientific and engineering disciplines → **not limited to a single discipline.**
- Instruments once of interest only to specialists are required by a wide array of scientists to solve critical research problems → **shared use.**
- The need for new types of instruments—such as distributed networks, cybertools, longitudinal surveys, and sensor arrays—is increasing → **flexibility to accommodate evolving and disparate fields.**
- Researchers have become increasingly dependent on advanced instruments that require highly specialized knowledge and training for their proper use and greatest effectiveness → **operations and maintenance.**



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NSF

Strategic Plan FY 2006-2011



VISION: Advancing discovery, innovation, and education beyond the frontiers of current knowledge, and empowering future generations in science and engineering.

GOALS:

Discovery: Advancing frontiers of knowledge

Learning: S&E workforce and scientific literacy

Research Infrastructure: Advanced instrumentation and facilities

Stewardship: Supporting excellence in S&E research and education



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Instrumentation Programs at NSF

Program Title	Solicitation
BIO/DBI: Improvements in Facilities, Communications, and Equipment at Biological Field Stations and Marine Laboratories (FSML)	NSF 05-550
BIO/DBI: Instrument Development for Biological Research (IDBR)	NSF 10-563
CISE/CNS: Computing Research Infrastructure (CRI)	NSF 08-570
GEO/AGS: CubeSat-based Science Missions for Space Weather and Atmospheric Research	NSF 10-537
GEO/AGS: Atmospheric Sciences Mid-Size Infrastructure Opportunity	NSF 07-602
GEO/AGS: Graduate Student and Optical Instrumentation Support Related to the Advanced Modular Incoherent Scatter Radar (AMISR)	NSF 05-584
GEO/EAR: Earth Sciences: Instrumentation and Facilities (EAR/IF)	NSF 10-561
GEO/OCE: Oceanographic Centers and Facilities: Oceanographic Instrumentation	NSF PD 98-5410
GEO/OCE: Oceanographic Technology and Interdisciplinary Coordination Program (OTIC)	NSF PD 98-1680
MPS/AST: Advanced Technologies and Instrumentation (ATI)	No Publication Number
MPS/CHE: Chemistry Research Instrumentation and Facilities: Departmental Multi-User Instrumentation (CRIF:MU)	NSF 09-546
MPS/CHE: Chemistry Research Instrumentation and Facilities: Instrumentation Development (CRIF:ID)	NSF 04-534
MPS/DMR: Instrumentation for Materials Research	NSF 07-600
MPS/DMR: Instrumentation for Materials Research -Major Instrumentation Projects (IMR-MIP)	NSF 10-552
MPS/DMS: Scientific Computing Research Environment for the Mathematical Sciences (SCREMS)	NSF 07-502
Crosscutting: High Performance Computing System Acquisition: Towards a Petascale Computing Environment for Science and Engineering	NSF 08-573
Crosscutting: Major Research Instrumentation (MRI)	NSF 10-529



The Major Research Instrumentation (MRI) Program¹

<http://www.nsf.gov/od/oia/programs/mri/>

¹The MRI program is coordinated by the Office of Integrative Activities (OIA) in collaboration with Directorates and Offices across NSF.



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MRI: A Shared Instrument Program

- Supporting the **acquisition** of major state-of-the-art instrumentation, thereby improving access to, and increased use of, modern research and research training instrumentation shared by the Nation's scientists, engineers, and graduate and undergraduate students;
- Fostering the **development** of the next generation of major instrumentation, resulting in new instruments that are more widely used, and/or open up new areas of research and research training;
- Enabling academic departments, disciplinary and cross-disciplinary units, and multi-organization collaborations to **integrate research with education**;
- Supporting the acquisition and development of research instrumentation that makes use of, advances, and/or expands the Nation's **cyberinfrastructure** and **high performance computing capability**;
- Promoting substantive and meaningful **partnerships for instrument development** between the academic and private sectors

Provides support for instruments that are too costly, or otherwise not appropriate for other NSF programs



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MRI: Eligible Organizations

- **Ph.D. granting institutions of higher education:** accredited colleges and universities that have awarded more than 20 Ph.D.s or D.Sci.s in all NSF-supported fields during the combined previous two academic years. Additionally, any organization that has awarded a Ph.D. or D.Sci. in NSF-supported fields during the combined previous two academic years is considered to be a Ph.D.-granting institution if the only degrees it awards in NSF-supported fields are Ph.D.s or D.Sci.s.
- **Non-Ph.D. granting institutions of higher education:** accredited colleges and universities (including two-year community colleges) that award Associate's degrees, Bachelor's degrees, and/or Master's degrees in NSF-supported fields, but have awarded 20 or fewer Ph.D./D.Sci. degrees in all NSF-supported fields during the combined previous two academic years.
- **Non-degree granting organizations:** Not-for-profit organizations that do not award Associate's degrees, Bachelor's degrees, Master's degrees, and/or Ph.D.s or D.Sci.s. Non-degree-granting organizations also include institutions of higher education that award all of their degrees outside of NSF-supported fields.



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MRI Proposals: The Basics

- **Submission limit:**

- 3 per organization: *If three proposals are submitted, at least one of the proposals must be for instrument development.*

- **Cost-sharing** at the level of 30% of the ***total project cost*** is required for Ph.D.-granting institutions and non-degree-granting organizations. ***Cost-sharing is not required for non-Ph.D. granting institutions***

- Restrictions on organization submission eligibility (e.g., current solicitation NSF 10-529)

- Next submission deadline anticipated in January 2011



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MRI-FY08¹

Major Research Instrumentation – FY08

**2008 Award
Snapshot - Overall**

Number Reviewed: 810

Dollars Requested : \$515.8 million

Number of Awards: 224 (39 DEV, 185 ACQ)

MRI Amount Awarded: \$93.2 million

NSF Amount Awarded: \$101.0 million

Overall Success Rate: 27.7%

Mean Award: \$451,000

Median Award: \$330,000

Number of Institutions that Participated: 449

Number of Institutions Awarded: 184

¹Last MRI competition not affected by one-time funding from the American Recovery and Reinvestment Act (ARRA)



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MRI-FY08¹

Major Research Instrumentation – FY08

2008 Award Snapshot – By Institution Type

	Ph.D.	non-Ph.D.	Non-degree	MSI
# reviewed	472	304	34	74
Mean request	\$765 K	\$430 K	\$704 K	\$555 K
Median request	\$568 K	\$323 K	\$559 K	\$397 K
# awards	129	84	11	24
NSF \$ awarded	\$73.7 M	\$22.4 M	\$4.8 M	\$9.8 M
MRI \$ awarded	\$67.8 M	\$21.2 M	\$3.9 M	\$9.3 M
Success rate	27.3%	27.6%	32.4%	32.0%
Mean award	\$571 K	\$267 K	\$440 K	\$407 K
Median award	\$465 K	\$211 K	\$474 K	\$309 K



¹Last MRI competition not affected by one-time funding from the American Recovery and Reinvestment Act (ARRA)

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MRI-FY08¹

Major Research Instrumentation – FY08

**2008 Award
Snapshot – EPSCoR**

Number of Proposals Reviewed: 181

Dollars Requested : \$116.5 M

Number of EPSCoR-eligible Awards: 50

Amount Awarded to EPSCoR-eligible Awards: \$20.2 M

EPSCoR Amount Awarded to MRI Awards: \$2.0 M

EPSCoR-eligible Success Rate: 27.6%

Eligible proposals co-funded by EPSCoR: 17

Mean award: \$404,000

Median award: \$295,000



¹Last MRI competition not affected by one-time funding from the American Recovery and Reinvestment Act (ARRA)

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The MRI Program

Two MRI competitions in 2009

- January, 2009 (“MRI09”): \$100M FY09 + \$100M ARRA
 - no “mixing” of funds
- August, 2009 (“MRI-R²”): \$200M ARRA-only funds (ongoing)
- Institutional submission limits (2 ACQ + 1 DEV)
- Cost sharing requirements per ACA

Impact of ARRA on MRI

- ~2100 proposals in 2009 (FY08: 842)
 - OIA coordination
 - Directorates and Offices: merit review, award recommendations
 - Coordinating committee: 9 Directorate/Office Coordinators, 17 Divisions
- Awards in 2009: ~650 (FY08: 225)
- Resources to fund more and larger proposals: ~90 > \$1M (FY08: 17)
 - Award limit up \$6 million for MRI-R²



The MRI Program

MRI09 - Summary of Awards

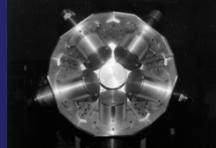
- 187 Awards: FY09 \$\$ | 197 Awards: ARRA \$\$
- 48% Success Rate Overall (384/801)
- \$4M Max Award Size (40 awards > \$1M with 4 > \$2M)
- Average Request: \$600,000
- \$100M in MRI ARRA funds awarded in FY09

EPSCoR:

-76 awards (42 ARRA)

- 46% success rate

1) \$1,222,620 Award – MPS/PHY
Hope College, **Rhodes College**, ...
Neutron Detector Array



Collaborative proposal among 9 PUIs to develop the Large-area multi-Institutional Scintillator Array (LISA), to facilitate physics measurements with rare isotope beams at the National Superconducting Cyclotron Laboratory.

2) \$3,948,000 Award – BIO/DBI
Vanderbilt University
900 MHz NMR Spectrometer



NMRs are frequent requests to MRI because they enable leading-edge scientific research spanning a wide range of disciplines. Most proposals request 400-600 MHz instruments, and request < \$1 million. The availability of ARRA funding made possible the support of this meritorious \$4 million proposal.



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EPSCoR and the MRI Program

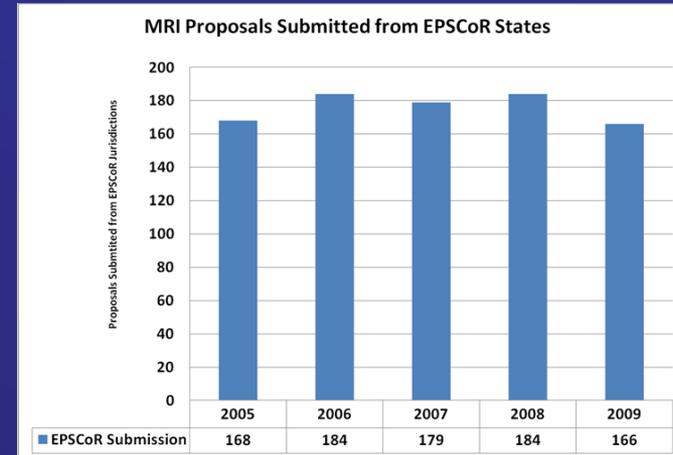
MRI Proposal Success Rates

→ **Comparable success rates**

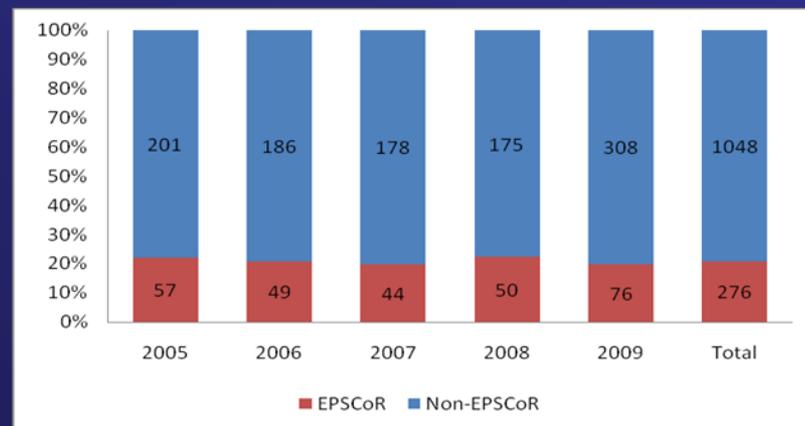
	Non-EPSCoR	EPSCoR	Total
2005	33%	34%	33%
2006	30%	27%	30%
2007	30%	24%	29%
2008	28%	27%	28%
2009	51%	46%	50%
Total	34%	31%	34%

EPSCoR MRI Submissions

→ **Constant rate of submission**



EPSCoR MRI Award % → **Constant award fraction**



The MRI Program Does Not Support:

- **Construction, renovation or modernization of rooms, buildings or research facilities** (instruments must be able to decouple from their host environment);
- **Large, specialized experimental facilities** (constructed with significant amounts of common building material using standard building techniques);
- **General purpose and supporting equipment** (e.g., general purpose computers/laboratory equipment, fume hoods, cryogen storage systems);
- **Sustaining infrastructure and/or building systems** (e.g., electrical, plumbing, HVAC, toxic waste disposal, telecommunications);
- **General purpose platforms or environments** (e.g., fixed, non-fixed structures, manned vehicles);
- **Instrumentation used primarily for science and engineering education courses.**
- **Multiple pieces of equipment** that serve to outfit a laboratory.

→ **MRI does not support “infrastructure”...**



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Academic Research Infrastructure - Recovery and Reinvestment (ARI-R²)

Highlights

- Update of 1990s ARI program – last solicitation 1996
- NSF-SRS report indicates \$3.6B in infrastructure deferred projects
- One-time opportunity using \$200M in ARRA funding
- Repair or renovation of a *single existing* research facility
 - New construction not supported
 - Shared research space
 - Shared research training space
 - Bricks-and-mortar, mobile, or virtual
 - All NSF-supported research areas

Solicitation closed → awards coming soon...



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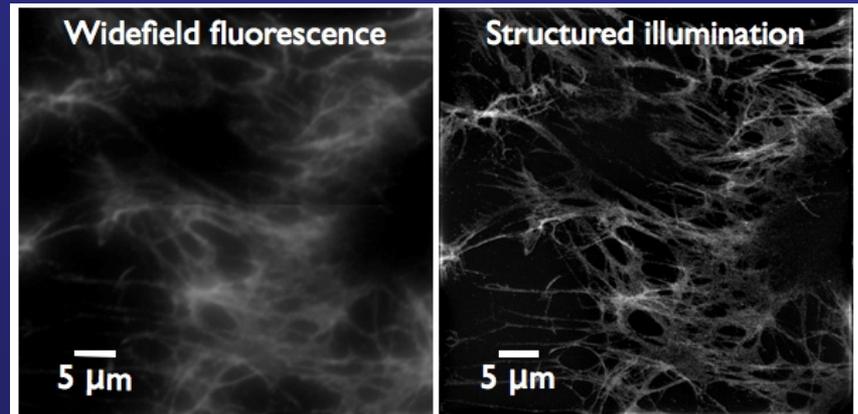
Thoughts on Innovation

Instrument development can open new capabilities

Characterized by:

- a demonstrated need for a **new or upgraded instrument** that can provide enhanced or **potentially transformative use** and performance
- open up **new areas of research and research training**
- a need for **longer timescales** involving design, construction, testing and commissioning
- a need for **enhanced performance** including accuracy, reliability, resolving power, throughput speed, sample capacity, flexibility of operation, breadth of application, user-friendliness, and/or new types of measurement or information gathering.
- **greater risk to complete.**
- have **potential as a commercial product**

Scientists at the NSF Center for Biophotonics Science and Technology Center (University of California, Davis) have developed the world's most powerful commercial, Wide-Field Light Microscope. OMX (Optical Microscopy eXperimental) significantly increasing the resolution of light microscopes by overcoming the diffraction limit of light.



The comparison shows the difference between fluorescence imaging with a conventional microscope (left) and with the OMX microscope (right).

→ Use the opportunity to submit 3 proposals!



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Summary

- “Capacity Building” through investments in research instrumentation is an important part of NSF’s portfolio...
- Numerous instrumentation programs exist at NSF → contact NSF to know what is available, and where you might fit...
- The MRI program awaits your proposals. Once at NSF, your chances are as good as anyone's.
You can't get an award without submitting a proposal!
- The development “track” for MRI provides a mechanism to spur innovation. Use all three submission slots for MRI!



Thank You!



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