

Nuclear Science Advisory Committee

National Science Foundation Directorate for Mathematical and Physical Sciences



**F. Fleming Crim
Assistant Director for
Mathematical and Physical Sciences**

October 15, 2015



Mathematical and Physical Sciences

Nuclear Science Advisory Committee

National Science Foundation Directorate for Mathematical and Physical Sciences



Budget

Mid-scale Instrumentation

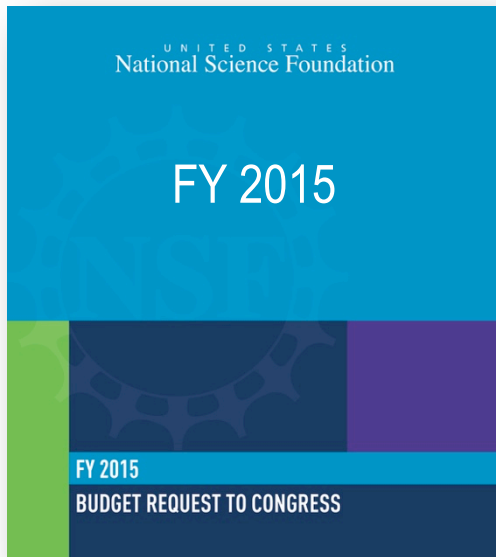
Long Range Plan



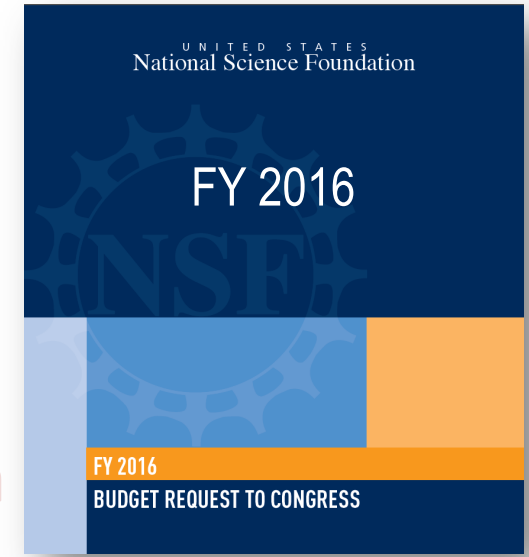
Mathematical and Physical Sciences

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Budget

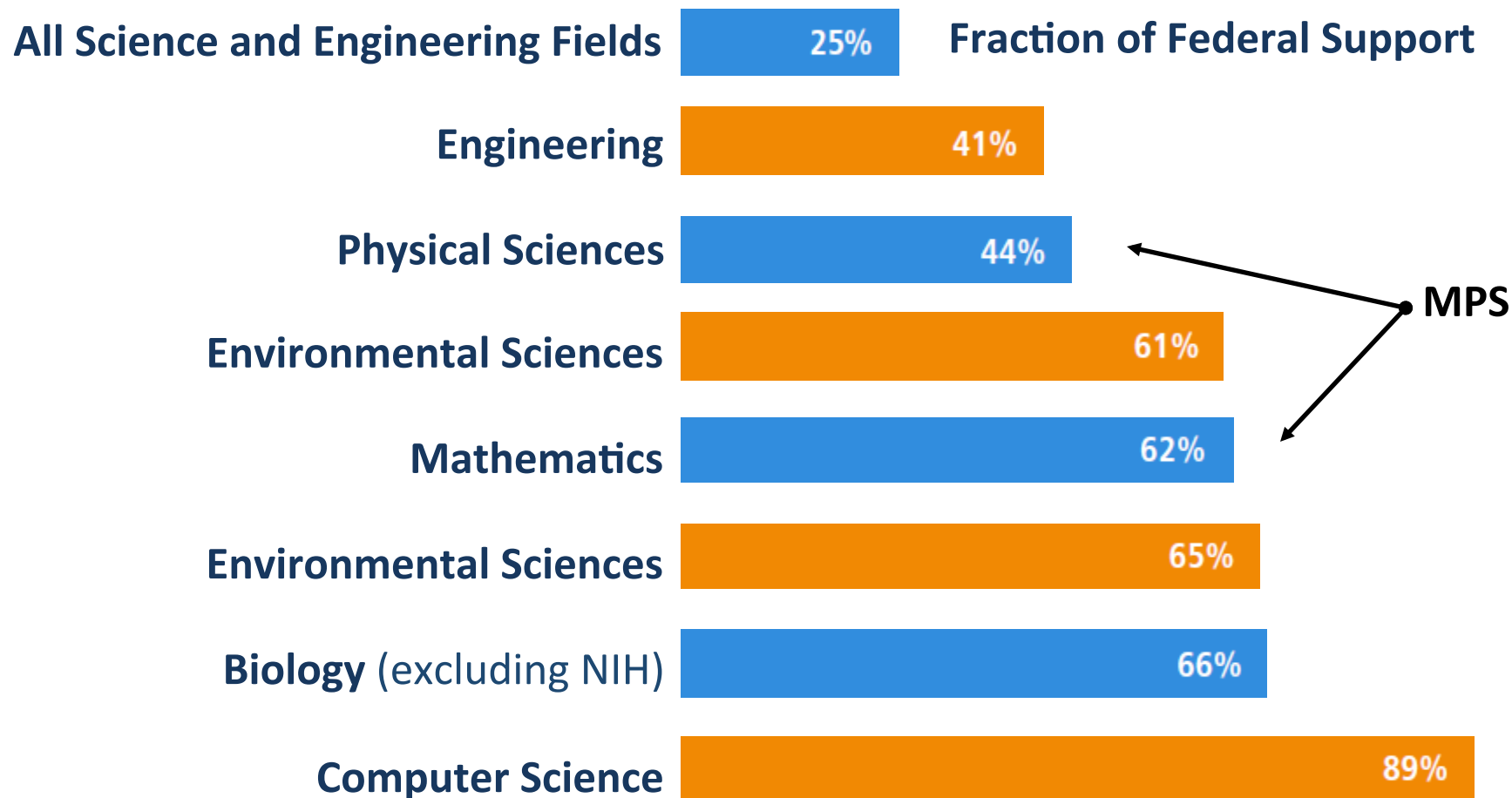


Mid-scale Instrumentation
Comments on Long Range Plan



Mathematical and Physical Sciences

NSF Supports Academic Basic Research

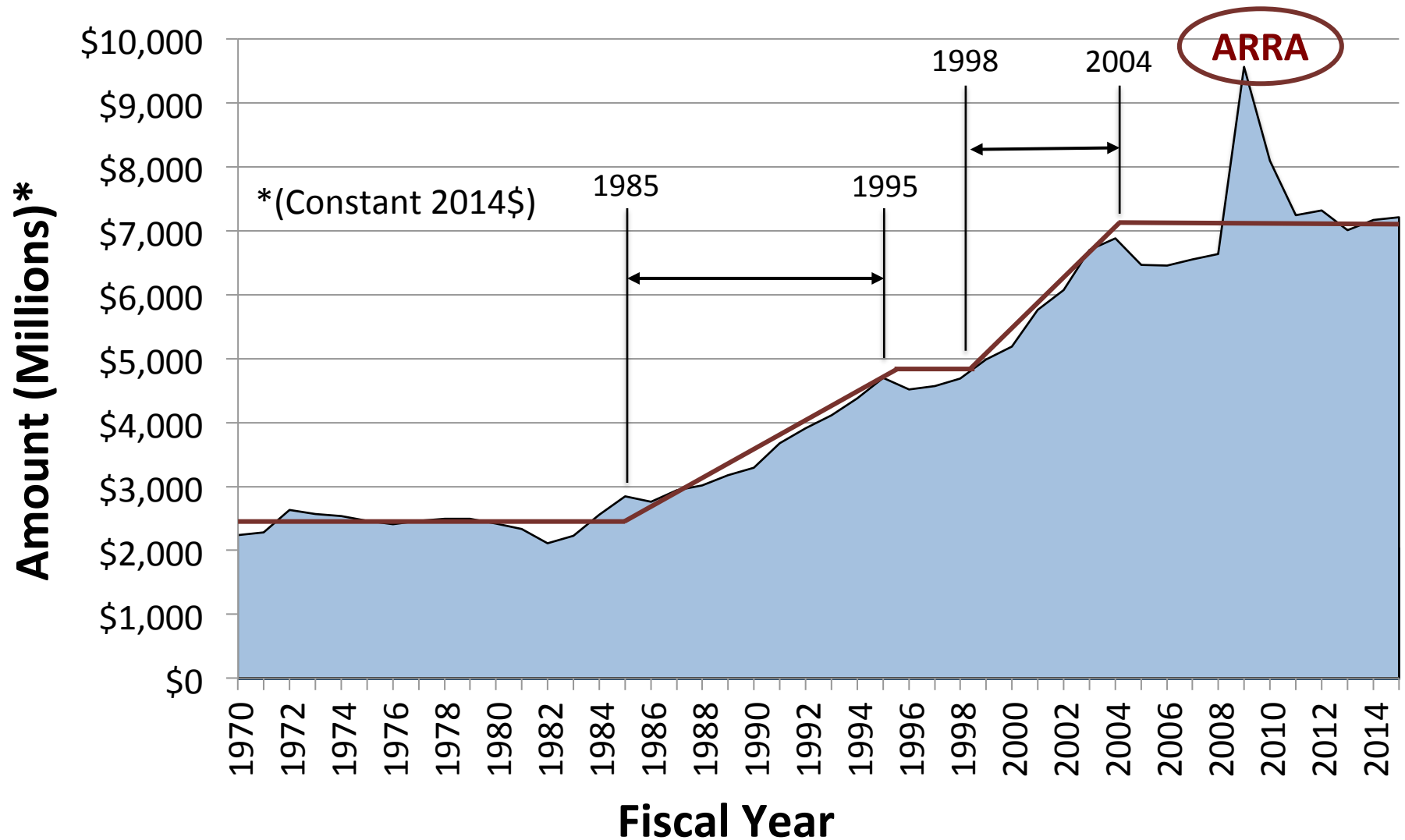


Source: NSF/ Center for National Science and Engineering Statistics, FY 2013



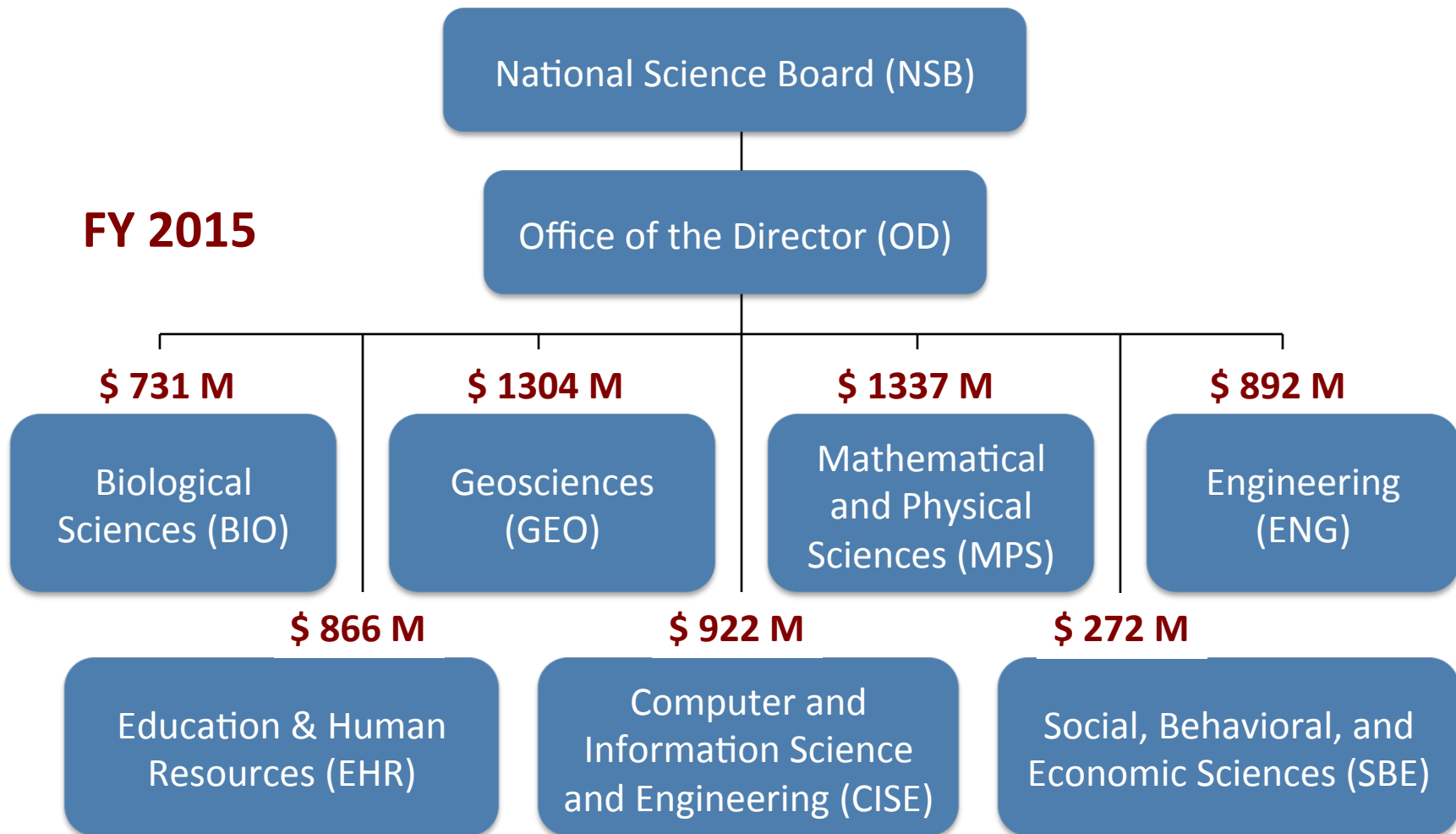
Mathematical and Physical Sciences

NSF Funding History



Mathematical and Physical Sciences

The National Science Foundation



Mathematical and Physical Sciences

UNITED STATES
National Science Foundation

	FY 2015	FY 2016 (request)	
NSF	\$ 7344 M	\$ 7724 M	5.2%
R&RA	\$ 5934 M	\$ 6186 M	4.2%

FY 2016

BUDGET REQUEST TO CONGRESS

UNITED STATES
National Science Foundation

FY 2016
BUDGET REQUEST TO CONGRESS

MISSION: To promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense.

—From the National Science Foundation (NSF) Act of 1950 (PL. 81-507)

VISION: A Nation that creates and exploits new concepts in science and engineering and provides global leadership in research and education.

—From "Investing in Science, Engineering, and Education for the Nation's Future" NSF Strategic Plan for 2014-2018



Mathematical and Physical Sciences

FY 2016 Budget Request

NSF Budget by Appropriation

(\$ in millions)

	FY 2015	FY 2016 Request	Change
Research & Related Activities	\$ 5934	\$ 6186	4%
Education & Human Resources	866	963	11%
Major Research Equipment & Facilities Construction	201	200	-0.2%
Agency Operations & Award Management	325	355	9%
National Science Board	4	4	--
Office of Inspector General	14	15	5%
Total NSF	\$ 7344	\$ 7724	5%

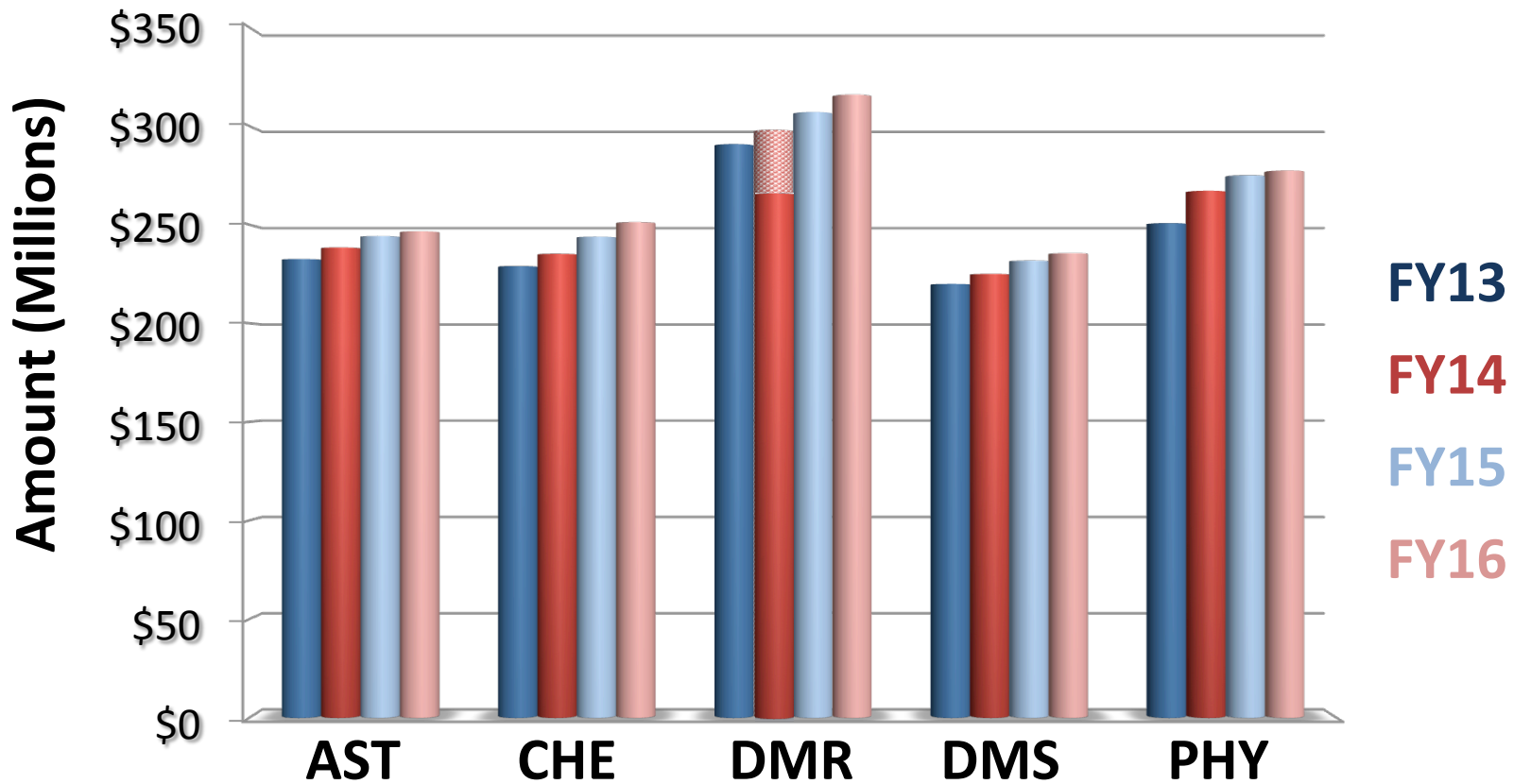
BUDGET REQUEST TO CONGRESS

—From "Investing in Science, Engineering, and Education for the Nation's Future" NSF Strategic Plan for 2014-2018

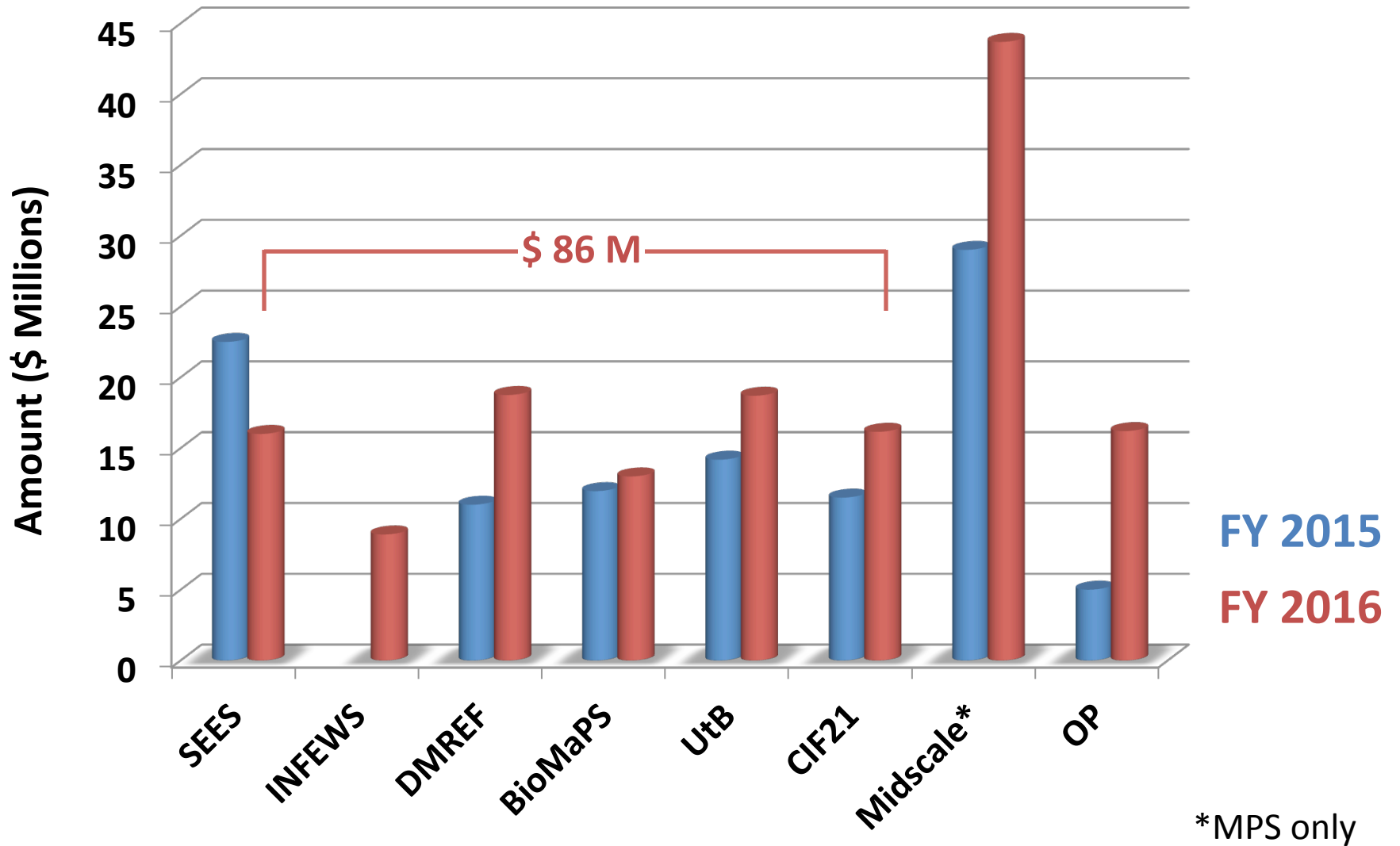


MPS Budgets

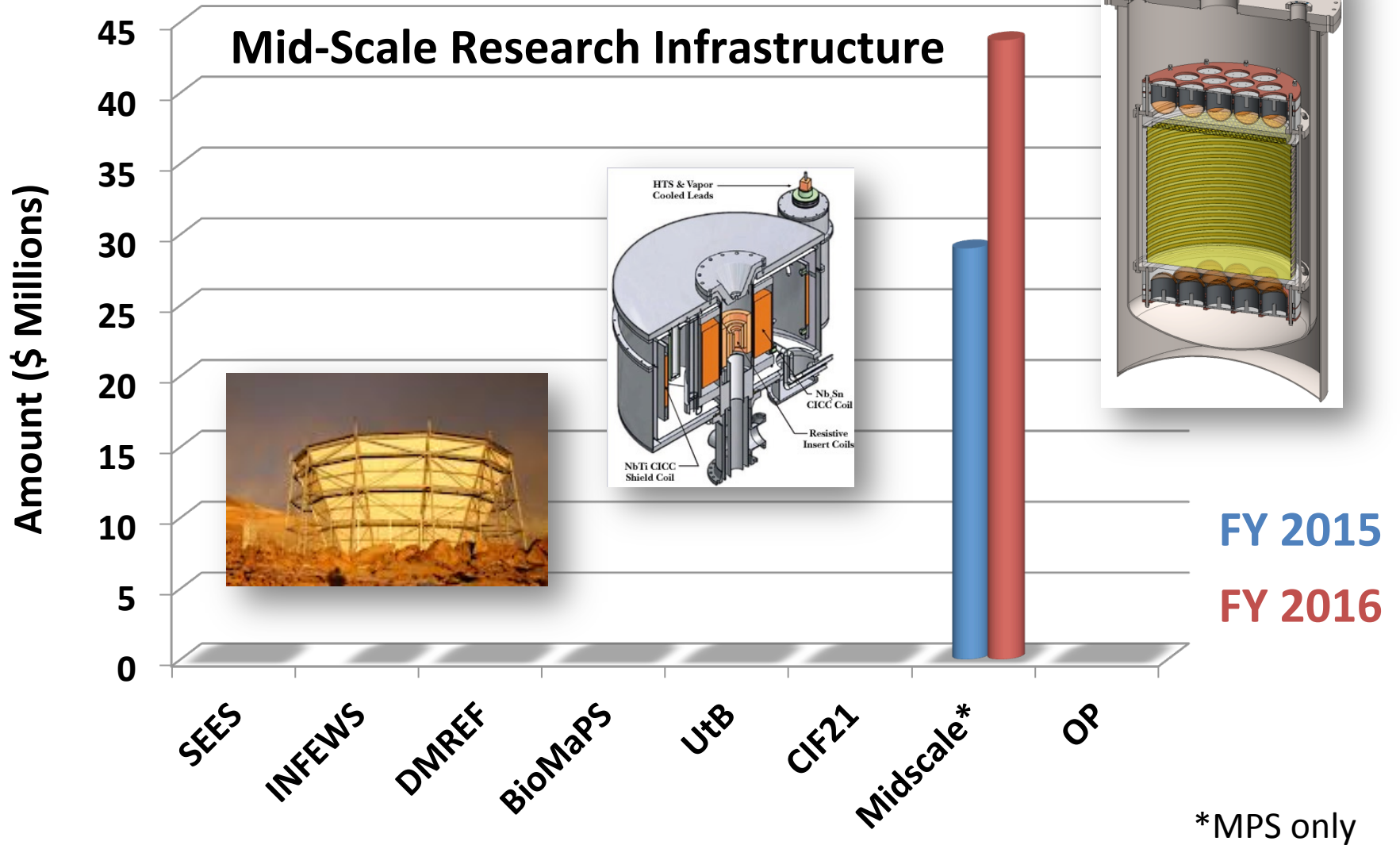
FY 2013 \$ 1250 M $\xrightarrow{+4.0\%}$ FY 2014 \$ 1300 M $\xrightarrow{+2.8\%}$ FY 2015 \$ 1337 M $\xrightarrow{+2.2\%}$ FY 2016 \$ 1366 M (request)



Selected MPS Major Investments



Selected MPS Major Investments



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Long Range Plan



Mathematical and Physical Sciences

Examples of Community Calls

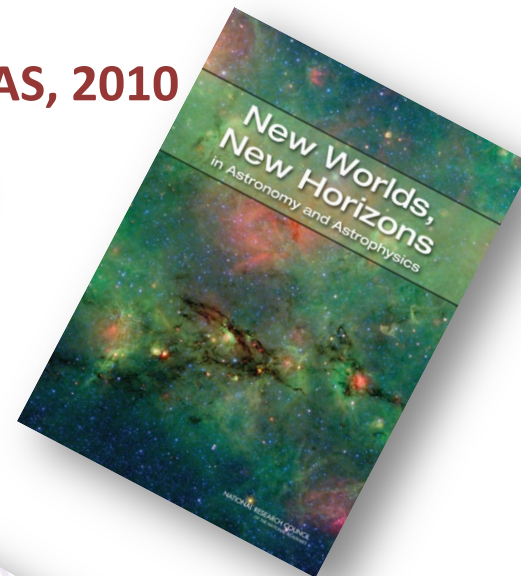
NSB, 2002



NAS, 2006



NAS, 2010



HEPAP, 2014



NSAC, 2014



Mathematical and Physical Sciences

Mid-Scale Infrastructure

Projects larger than the Major Research Instrumentation (MRI) limit of \$4M and smaller than the MREFC threshold (10% of a Directorate's budget)



Mid-Scale Infrastructure

Projects larger than the Major Research Instrumentation (MRI) limit of \$4M and smaller than the MREFC threshold (10% of a Directorate's budget)



PHY Mid-Scale Infrastructure Approach and Examples

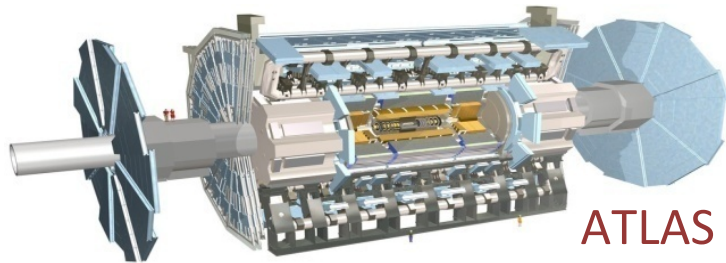
Selection: Merit review, great opportunity, community priorities

Cost: Up to \$15M over several years (see NSF 14-116)

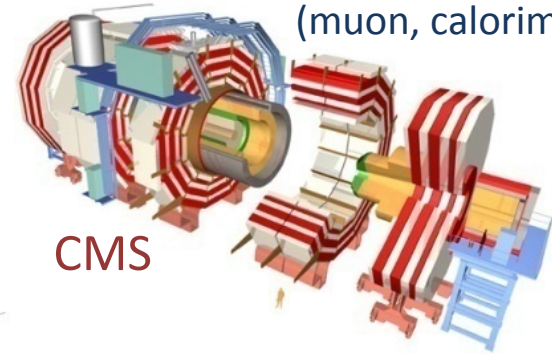
Currently: Five projects receiving about \$ 2M/yr

Phase 1 LHC Upgrades

Liquid Ar Calorimeter Trigger

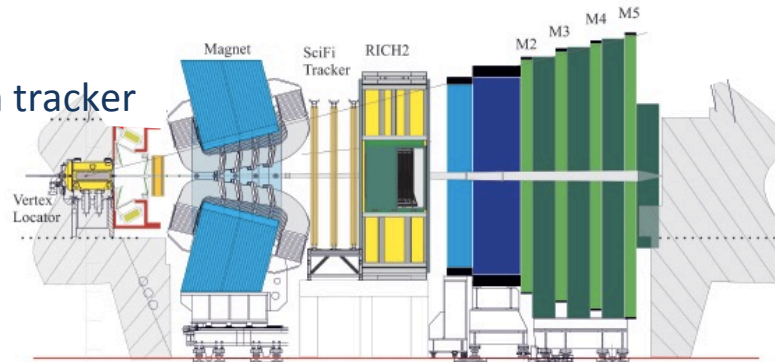


L1 Trigger
(muon, calorimeter)



Upstream tracker

LHCb



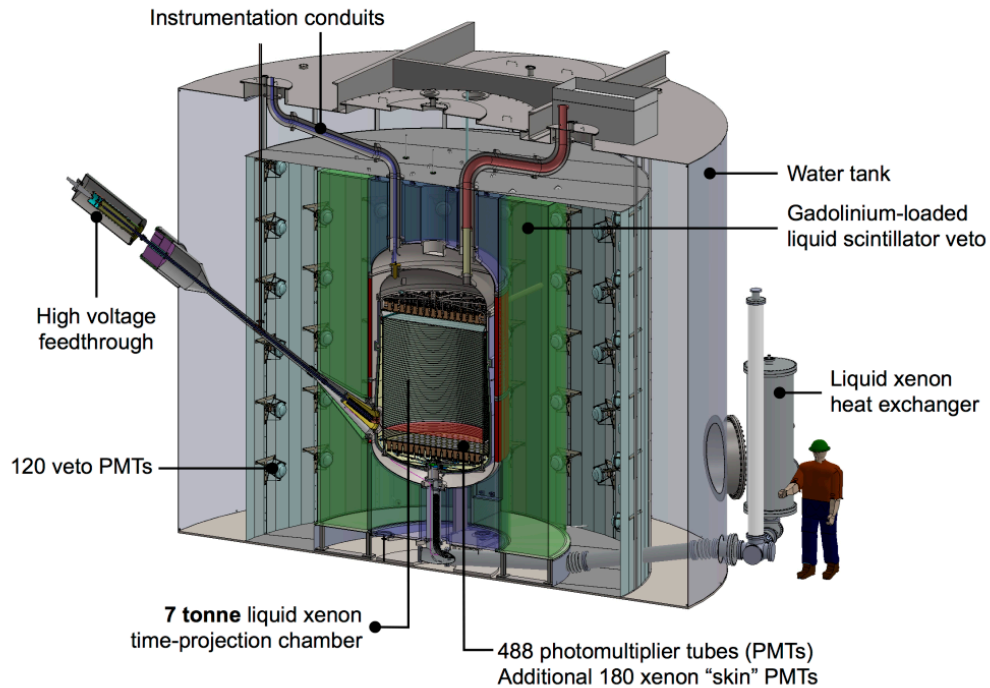
HCAL (muon, calorimeter)
FPIX



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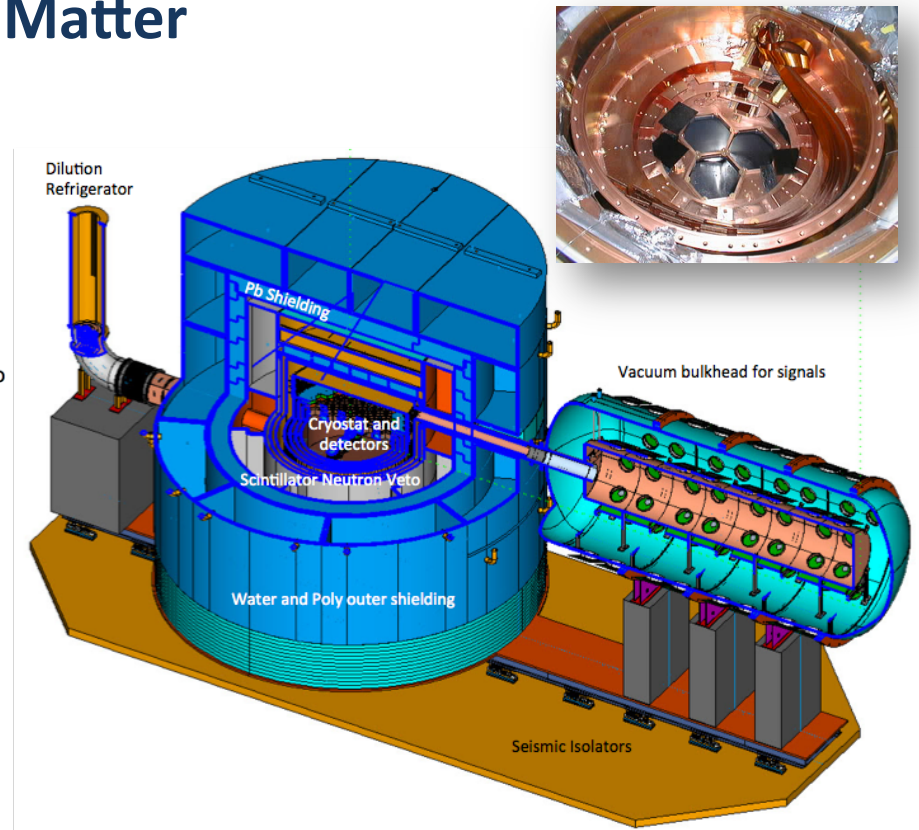
PHY Mid-Scale Infrastructure

G2 Dark Matter



Large Underground Xenon – Zeplin
(LZ)

www.lbnl.gov



Super Cryogenic Dark Matter Search
(Super CDMS)

<http://cdms.berkeley.edu/scdmsslolab.html>

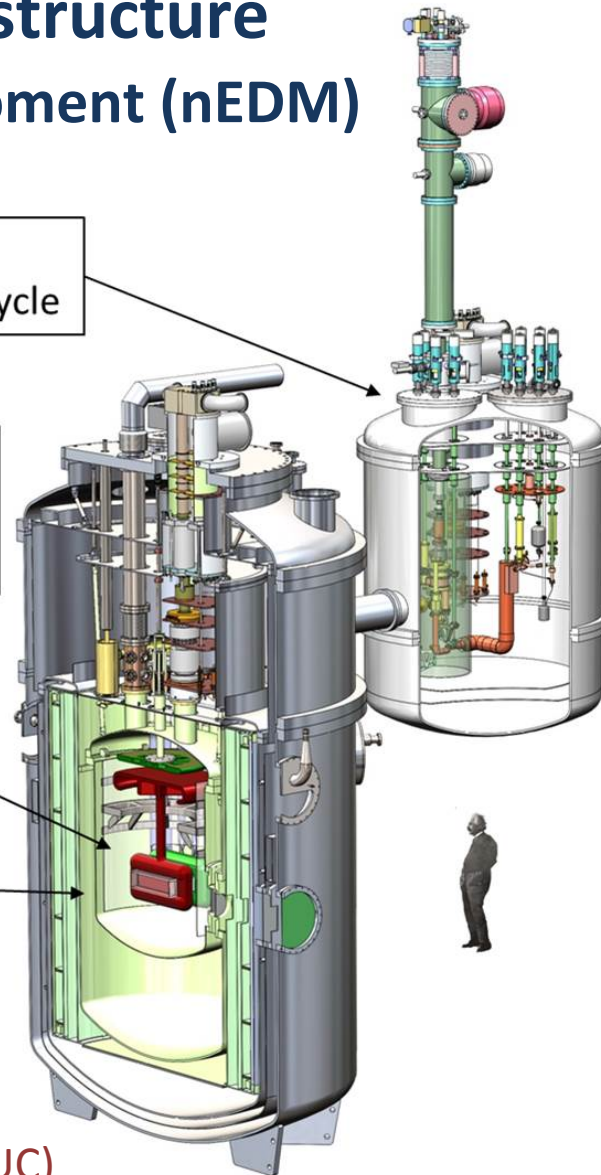


PHY Mid-Scale Infrastructure Neutron Electric Dipole Moment (nEDM)

- Prepare polarized ^3He
- Isotopically purify ^4He each measurement cycle

- Generate electric field
- Store ^3He , neutrons
- Monitor ^3He , neutron precession frequencies

- Generate uniform B-field



Brad Filippone (Caltech) and Doug Beck (UIUC)



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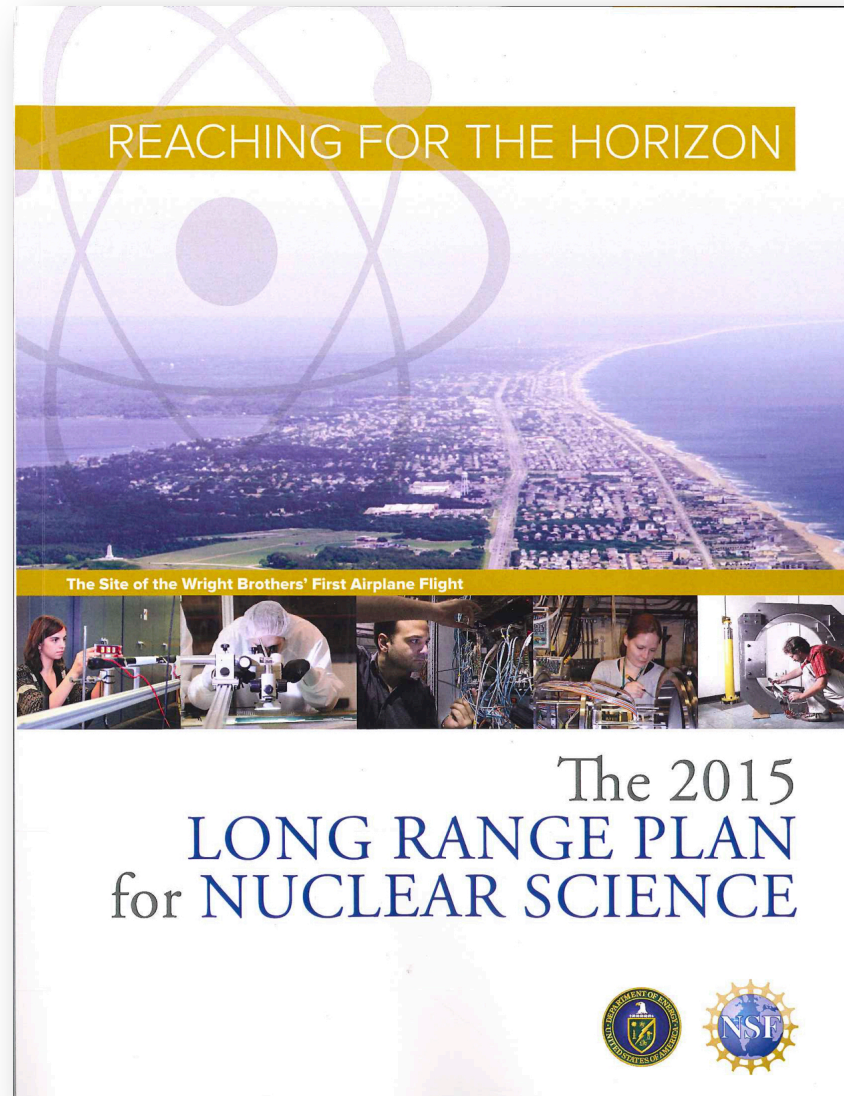
Mid-scale Instrumentation

Long Range Plan



Mathematical and Physical Sciences

Long Range Plan



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Long Range Plan

Recommendation I: Capitalize on investments of 2007 plan
CEBAF upgrade, FRIB, fundamental symmetries, neutrinos, RHIC
MPS supports through IIA, MRI, midscale

Recommendation II: Ton-scale neutrinoless $\beta\beta$ decay
NSAC subcommittee report at this meeting

Recommendation III: Polarized electron-ion collider after FRIB
JLab and RHIC planning

Recommendation IV: Small-scale and mid-scale projects
MPS priority – budget constraints



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