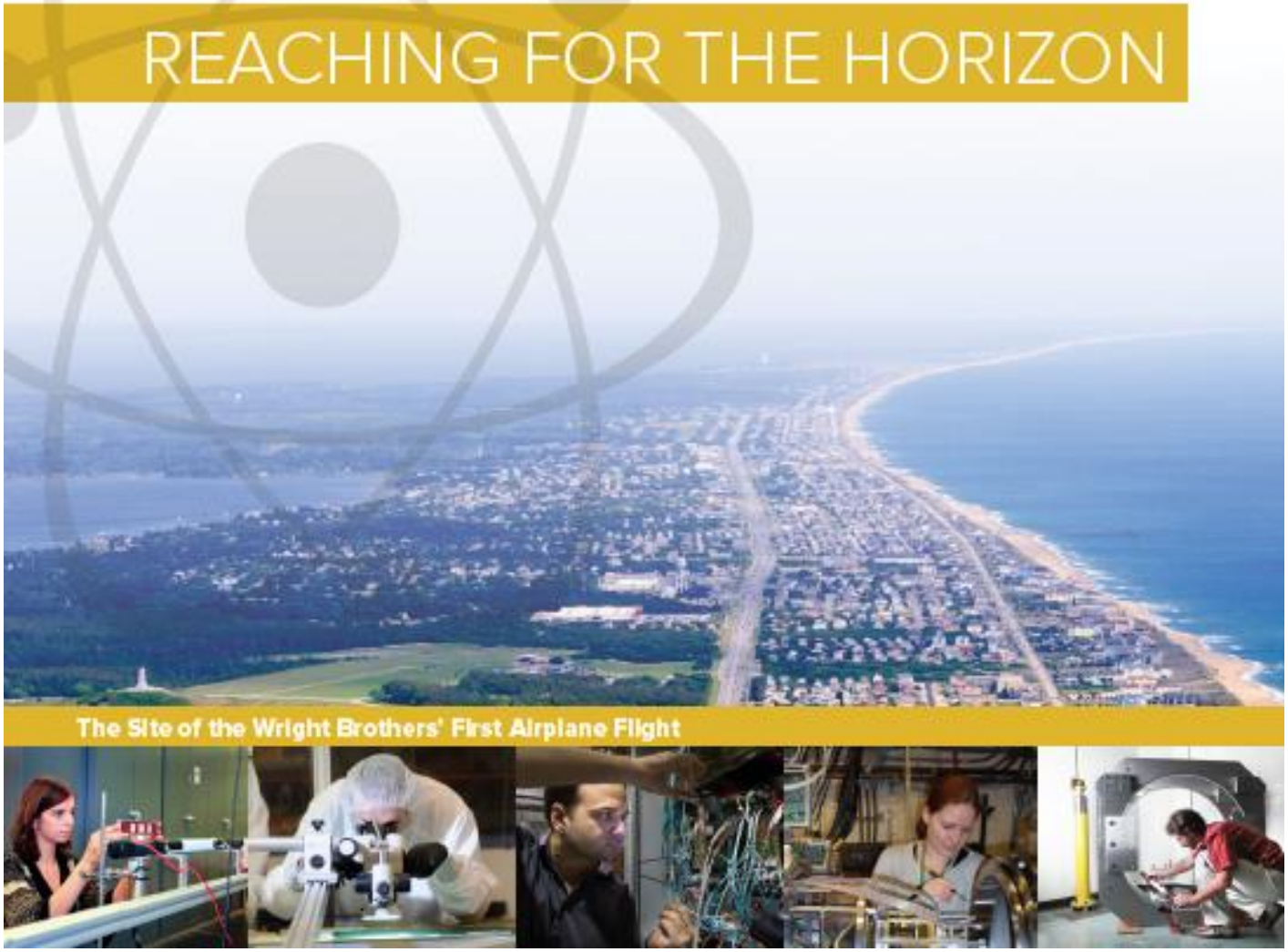
The Nuclear Physics Long Range Plan Process
NSAC Meeting, 16 November 2021

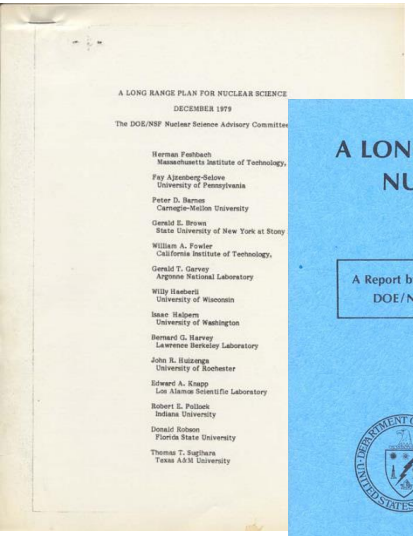


The 2015
LONG RANGE PLAN
for NUCLEAR SCIENCE

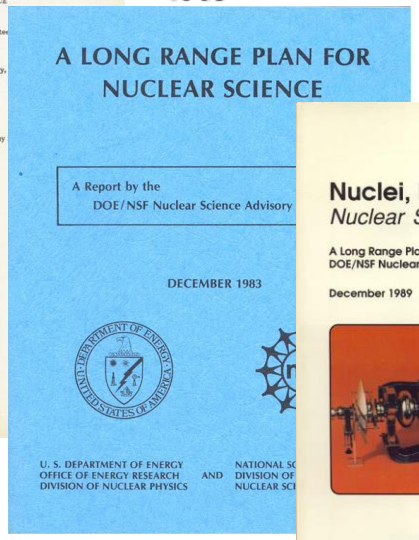
Nuclear Science in the U.S. has been guided by the NSAC Long Range Plans

For large projects ~15 years between recommendation and first operation

1979



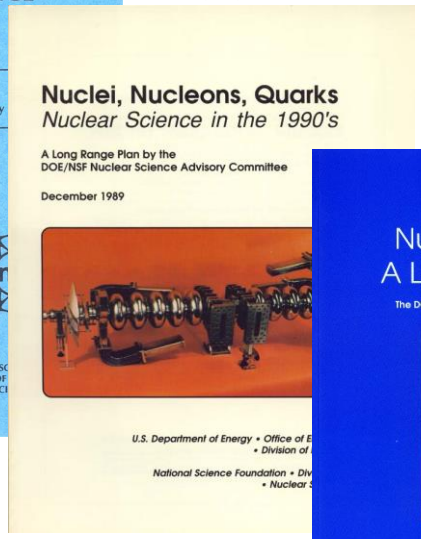
1983



CW Electron Accelerator

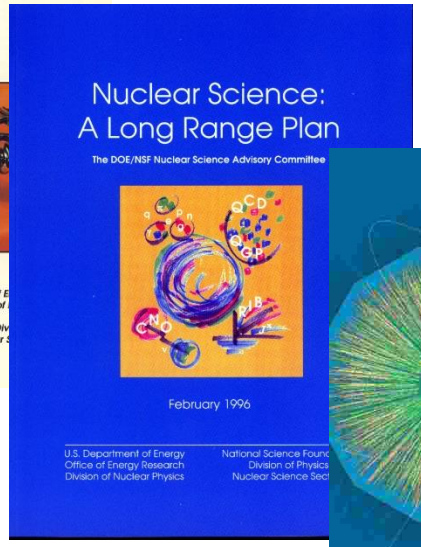
RHIC

1989



Two Rare Isotope Facilities –in-flight, ISOL

1996

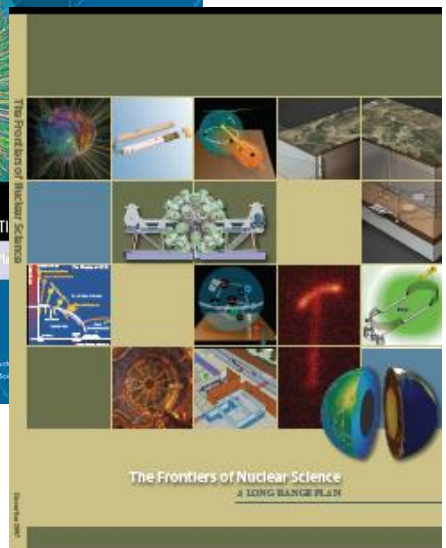


RIA (Descoped)
JLAB 12 GeV

2002

FRIB
RHIC Upgrade

2007



Recommendations that did not happen, typically recommendation #3-4, but one was #1

10% budget increase

KAON

LISS

DUSEL

Our Charges are from Two Funding Agencies

Department of Energy
Office of Science
Nuclear Physics

National Science Foundation
Mathematical and Physical Sciences Directorate
Division of Physics

In 1979 ratio of NSF to DOE funding was 1 : 2
In 2015 it was 1 : 12

The process has evolved

- NSAC was formed in 1977

1979- Feshbach: NSAC smoke filled room

1983- Schiffer: Working group of ~50 members including younger scientists. I was a member at age 33.

1989- Paul: NSAC organized community town meetings

1995- Moniz: NSAC and DNP together organized community meetings

2001- Symons: DNP by itself organized community town meetings

2007- Tribble:

2015- Geesaman:

Fundamentals- Trust

- We can see the the program office has listened to the Long Range Plans and helped deliver major initiatives.
- The fundamental recommendations are about capabilities to do science, not a particular machine or experiment. This differs from the HEP P5 charge. We trust the DOE and NSF to optimize the science delivery.
- Under budget pressures, the scope that can go forward may be reduced, if the science still can be done.
- To be effective the entire community must support the plan. **We cannot circle the wagons and shoot inward.**
- If we start something**, finishing it is a priority**.
- Budget constraints are real. **This means low-ball estimates of project costs are dangerous**.
- It must address the international context.
- **Obviously great care must be taken in selection of the subcommittee members to provide the best advice and to avoid the perception of bias.**

Charge to NSAC to Develop a New Long Range Plan

"a framework of coordinated advancement of the Nation's nuclear science research programs over the next decade"

"articulate the scope and scientific challenges"

"what progress has been made and the impact of these accomplishments both within and outside the field"

"identify and prioritize the most compelling scientific opportunities"

"coordinated strategy for the use of existing and planned capabilities, both domestic and foreign"

"what resources and funding levels would be required … to maintain a world-leadership position in nuclear physics research"

"what the impacts are and priorities should be if funding provides for constant level of effort."

"key element should be the Program's sustainability under the budget scenarios considered"

LRP Schedule

- ✓ Charge delivered at 24 April 2014 NSAC Meeting
- ✓ LRP Working Group formed in early June ~ 60 members
  - Observers from nuclear physics associations in Europe and Asia
- ✓ DNP and Community organization summer 2014
- ✓ I set up a web site set up to distribute information and white papers.
- ✓ DNP town meetings in the July/September 2014
- ✓ Joint APS-DNP-Japanese Physical Society Meeting Oct 7-11, 2014
- ✓ Working Group organizational meeting Nov 16, 2014
- ✓ White papers submitted by end of January
- ✓ Cost review of EIC – Report at the April 3 NSAC meeting
- ✓ Most of text of report assembled by April 10
- ✓ Resolution meeting of Long Range Plan working group April 16-20, 2015 in Kitty Hawk, NC. **The wordings of the recommendations were frozen.**
- ✓ Second draft of full report by May 18
- ✓ Draft report reviewed by external wise women and men
  - Balantekin, Jacak, Redwine, Seestrom, Symons, Tribble,
- ✓ LRP final report October 2015 – NSAC Meeting and Public Presentation

18 months in 2014-15. Some were done in 6 months.

Obviously, some areas are dominated by big facilities with significant resources, developed lab plans and user bases

- RHIC, JLAB, FRIB
- Other communities such as fundamental symmetries, astrophysics and theory are more diffuse. It can be more difficult to build consensus.
- Need to weight the science and the community served – this is also a workforce development issue.
- Should there be a dedicated theory town meeting? Both approaches have been tried.

Special Thanks to the Organizers and Participants in the 2014 Town Meetings

Education and Innovation: Michael Thoennessen and Graham Peaslee

Nuclear Structure: Mark Riley and Charlotte Elster

Nuclear Astrophysics: Hendrik Schatz and Michael Wiescher

Hadron QCD: Haiyan Gao and Craig Roberts

Heavy Ion QCD: Paul Sorensen and Ulrich Heinz

Fundamental Symmetries, Neutrinos and the Relevant Nuclear Astrophysics: Hamish Robertson and Michael Ramsey-Musolf

High Performance Computing: A. Burrows, J Carlson, W. Detmold, R. Edwards, R, Furnstahl, W, Haxton, W, Hix, F. Karsch, W. Nazarewicz, P. Petreczky, D, Richards and M. Savage. This was an ad-hoc meeting.

Town Meetings

- I gave no direction to DNP or the town meeting organizers because the process was similar to previous LRP's.
- One major goal is to help make the physics case. Text from the white papers of the town meetings were freely adapted for the science discussion in the LRP.
- It is difficult for an open community without realistic budget constraints to set priorities. If they can, that is great and has an impact with the LRP working group. If not, that is also useful information.
- Ad hoc town meetings that do not spring from the DNP organization can also be useful. They need to be open to the broad community and let everyone have a chance to speak.
- Listing every project as a separate recommendation is not particularly useful. Specific Project vs Science Goal!

White Papers

These were public documents from the community

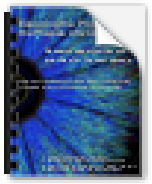

compnuc2014.pdf

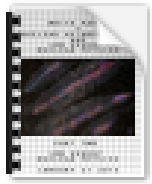

EducationInnovation2015.pdf


EICWhitePaper1212.1701v3.pdf


FSNu_WP_Master_v4.pdf


GRETA_WP_LE_TM_Full.pdf


HotQCD_TM_2014_Summary.pdf


LENP_White_Paper_Jan_2015.pdf


NAP_White_Paper_Jan_2015.pdf


NAP_White_Paper.pdf

QCDHadronWP(3).docx


QCDHadronWP(3).pdf

White paper Isla recoil co...lete.pdf

7 from town meetings
1 from proposed major facility
2 major instrumentation projects

2 copies in other formats

Important to understand if past LRP Recommendations and responses to NSAC charges were being implemented and why they were made! From 2007 LRP they were being followed.

- Complete JLAB 12 GeV - almost complete in FY15
- Build FRIB - now well underway
- Targeted program in fundamental symmetries - underway
- Upgrade RHIC - completed at 1/7 the anticipated cost

- Resources for R&D for EIC – steps forward

- Initiatives in theory, gamma-ray tracking and Accelerator R&D - major progress, theory topical collaborations, GRETINA

2015 Recommendations from the Town Meetings

These flow into LRP recommendations

Not Priority Ordered Here!

Run JLAB12
Run RHIC RHI
Run RHIC Spin
and other existing facilities
Run ATLAS and NSCL
Participation in LHC

Finish and run FRIB

Recommendation of both low energy and astrophysics meetings

Lead NLDBD → $250M

Recommendation of both hadron and hot qcd meetings

Build EIC → <$1500M

Increase Instrumentation and MIE →

Requests	
JLAB	$75M
LE	$116M
RHI	$31M
ASTRO	$25M
OTHER FS&N	$116M
TOTAL	$363M

Increase theory and theory computing

Increase experimental research in Astro, FS&N

How were recommendations and priorities set in the Long Range Plan?

The recommendations were developed by consensus in the context of illustrative budget scenarios. Having sample budgets to work through was very important. It was understood that hard choices had to be made or the budgets would be completely unrealistic. The only votes were on details of word choice.

In earlier LRP there have been working group votes on relative priorities of different initiatives.

The Role of the NSAC Long Range Plan in Projects

NSAC is asked to identify scientific opportunities and a level of resources necessary to achieve these. The recommendations express priorities. But, except for the largest-scale facilities, projects named in this report are given as examples to carry out the science. The funding agencies have well-established procedures to evaluate the scientific value and the cost and technical effectiveness of individual projects. There is a long-standing basis of trust that if NSAC identifies the opportunities, the agencies will do their best to address these, even under the constraints of budget challenges.

In this way our charge is different than that of the HEP Particle Physics Prioritization Panel which considers individual projects.

International Context- We rely on off-shore facilities

- Higher energy relativistic heavy ions – LHC
- Multi-GeV energy hadron beams – J-PARC, FAIR, CERN
- Higher energy radioactive beams – RIBF, GSI, FAIR
- ISOL radioactive beams – TRIUMF, ISOLDE
- To a large part, neutrons and neutrinos from reactors
- Lower energy electron beams – Mainz
- High resolution transfer reactions with stable beams - RCNP

In some cases, U.S. scientists are users of these facilities. In others, we count on experiments at these facilities to provide complementary information.

Budgets

It is well recognized that resources are always limited, and hard choices have been made concerning parts of the program that could not go forward in a realistic budget scenario. For example, the 2013 NSAC report *Implementing the 2007 Long Range Plan* responded to a more constrained budget picture than was originally expected. The resulting focused plan has been widely supported by the community, the Administration and the Congress. The 2015 Long Range Plan also involved hard choices to go forward with constrained budget scenarios.

Project Sequencing

- FY15-18 as in 2013 Implementation Plan and consistent with the FY16 President's budget request
- Ton-scale neutrinoless double beta decay starts near end of the decade after FRIB peak.
  - Need for demonstration projects to show what they can do and need for more R&D
  - A standing NSAC subcommittee is providing advice.
- EIC construction after completion of FRIB construction.
  - Time scale set, in part, by exciting physics at current facilities, by R&D required, and, in part, to avoid the need for large sudden budget increase.
  - Significant redirection from existing facilities when construction begins

Other Budget Priorities

- Increased small-scale and mid-scale projects including theory computing. This was temporarily sacrificed in 2013 implementation plan to start construction program.

- Increased research funding. It has fallen over the past few years to less than 30% of total in 2015 in DOE-NP.

Major NP Facilities Have Been Closed

- Bevalac
- LAMPF
- M.I.T. Bates Electron Accelerator
- Holifield Radioactive Ion Beam Facility

but so far no long range plan has recommended this. Ad-hoc NSAC subcommittees responding to specific charges have recommended closures under speciifc budget guidance.

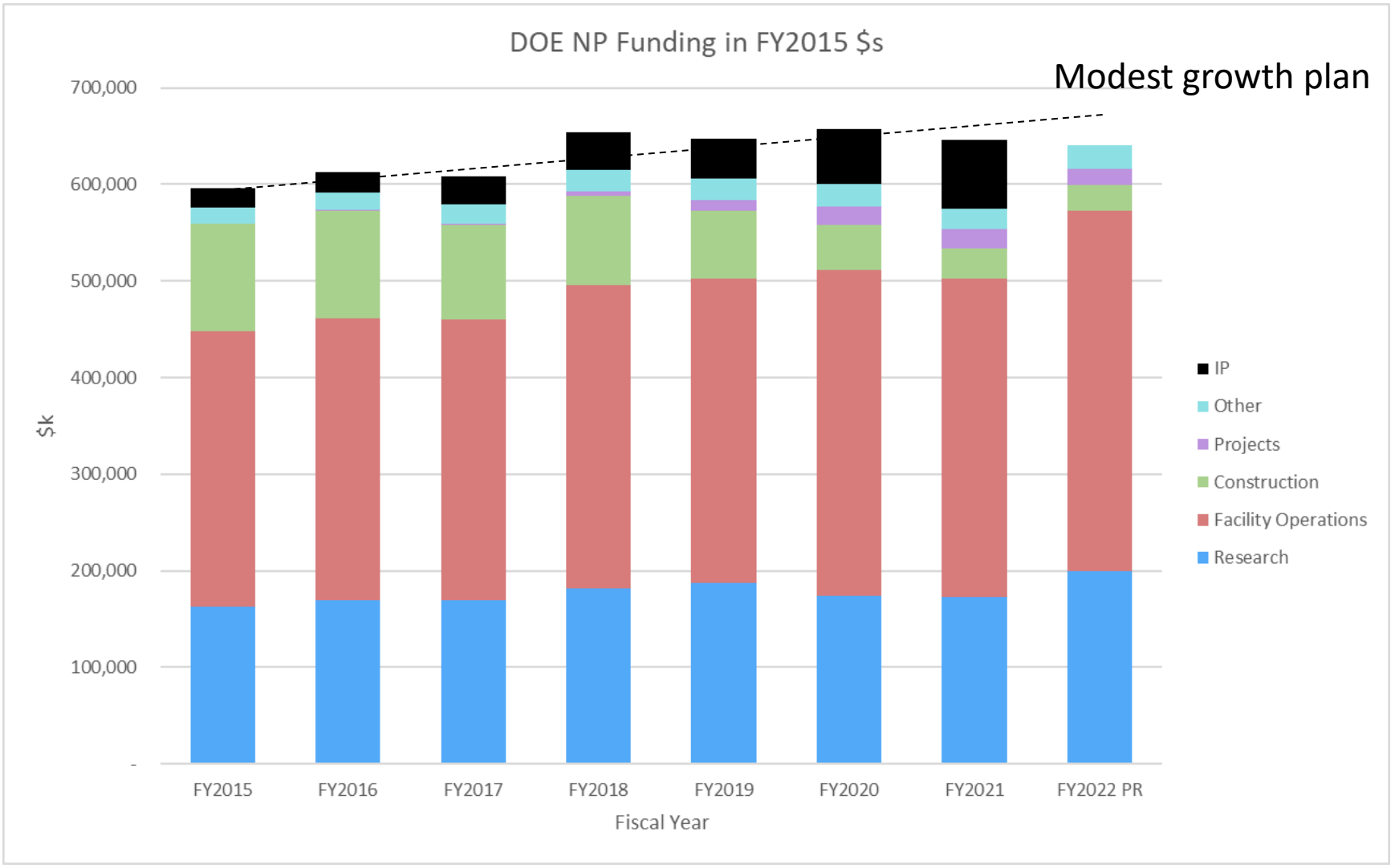
NSF Nuclear Physics Budget

- FRIB begins operation at the mid-point of this LRP and NSCL transitions from NSF stewardship. Before the transition , NSCL will remain the premier national user facility for rare isotope research in the U.S., with unique rare isotope reacceleration capabilities following fast beam fragmentation.

- We project increasing mid-scale funding at NSF and believe NP can compete well across the Physics Division for new initiatives. This is essential to ensure NSF-supported scientists have the resources to lead significant initiatives. We did not specifically associate any one initiative with NSF except as significant partners/leaders in neutrinoless double beta decay and neutron EDM where they already play important roles.

- We project a total NSF nuclear physics funding increasing slightly each year in line with the modest growth scenario.

DOE NP Funding in FY2015 $



Thoughts from afar on P5

- HEP does an even more comprehensive job now than NP in organizing the community to contribute to the planning process.
- Previous HEPAP LRP's suffered from the focus on the elephant in the room, the ILC. They required huge budget increases to implement recommendations. (ghost of the SSC). The 2014 P5 report responded to budget scenarios..
- P5 dealt with concrete projects.
- How do you build the trust in each other and the funding agencies?

- HEP is facing a problem now with underestimation of major project costs

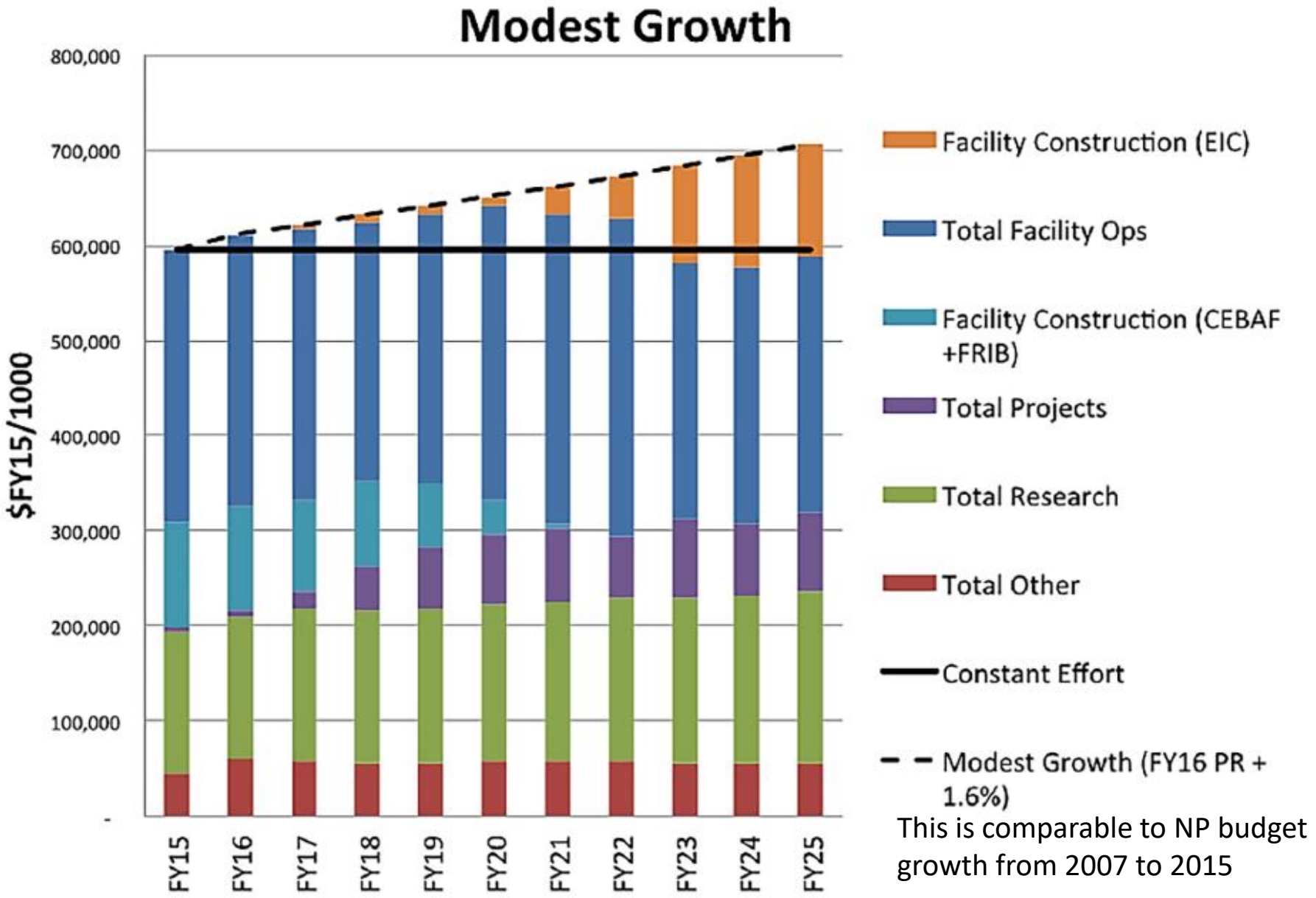
NSAC LRP and NAS Decadal Survey

- In NP, the LRP is accepted as the base planning document.
- If the LRP and Decadal Surveys offer differing priorities, I don’t know how you convince Congress to move forward.

Summary

- **The NSAC LRP process has produced an exciting and sustainable world-leading science program for four decades.**
- New powerful world leading tools are coming on-line and being constructed.
- We see important major initiatives for the future.
- The recommendations were developed by consensus. There was unanimous agreement among the working group for the recommendations and the report**. The community did unite to support this vision of the future.**
- **It is built on trust within the community and with the funding agencies.**

2015 LRP DOE Budget Projections



This is comparable to NP budget growth from 2007 to 2015

Is This Realistic?
DOE NP Budget history Since the 2007 LRP