



NSF/AST

Current & Future Activities

CAA

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March 7, 2013

Outline

- Science and Telescope News
- Budget Trends and Outlook
- Portfolio Review & Division Response
- Decadal Survey Progress and Plans
- O/IR System



Science and Telescope News



ALMA Status

- 112 early-science projects selected from ~900 Cycle 0 proposals; 90% of observations completed
- 196 high-priority projects selected from 1133 Cycle 1 proposals
- All 66 antennas in Chile; 59 accepted
- Inauguration on March 13, 2013

Last of 25 NA antennas accepted

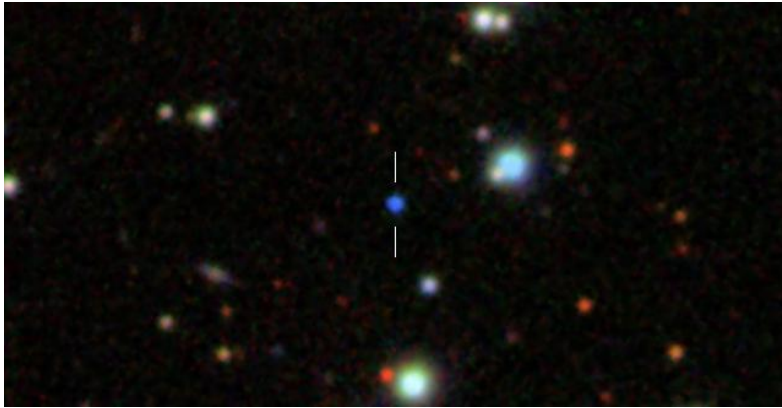


Gas spiral around R Sculptoris caused by interplay between AGB star thermal pulses and stellar companion

Maercker et al. 2012, Nature, 490, 232



First visible-light evidence for gravitational waves from white-dwarf binary

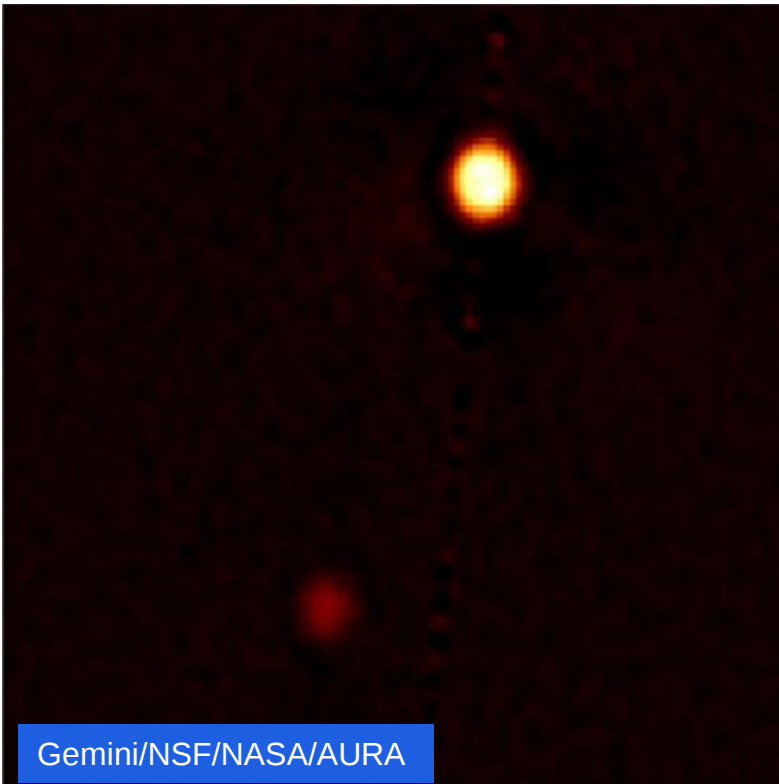


The white-dwarf binary SDSS J0651+2844. Image credit: The Sloan Digital Sky survey. Hermes et al. 2012, ApJ, 761, L1-L15.

- WD binary has 13-minute orbit
- General Relativity predicts gravitational waves to radiate energy from system, causing stars' orbits to shrink.
- Team measured this effect, with eclipses happening 6 seconds sooner than expected in one year.
- Binary system will be useful for future searches of gravitational waves, and exploring tidal heating effects on compact objects and planetary systems.
- Observations made by McDonald, Gemini-N and MMT Observatories.
- Supported by AST-0909107/Montgomery and AST-1008734/Szkody (SAA).

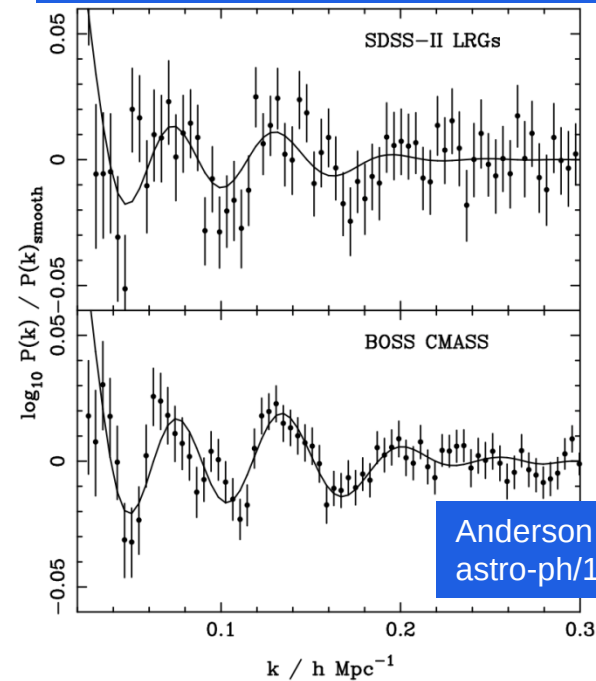
More Recent Results

Pluto-Charon image with Gemini-N; highest resolution ground-based image of system (Howell et al. 2012, PASP, 124, 920)



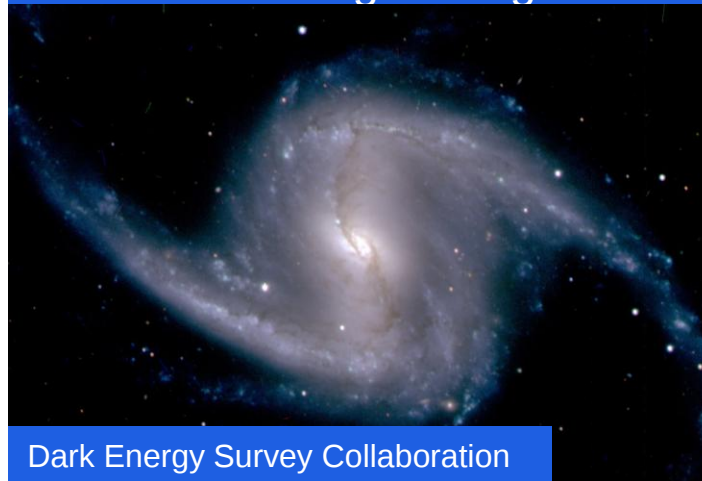
Gemini/NSF/NASA/AURA

BAO measured with SDSS-III BOSS



Anderson et al. 2012,
astro-ph/1203.6594

DECam First Light image



Dark Energy Survey Collaboration

Budget Trends and Outlook

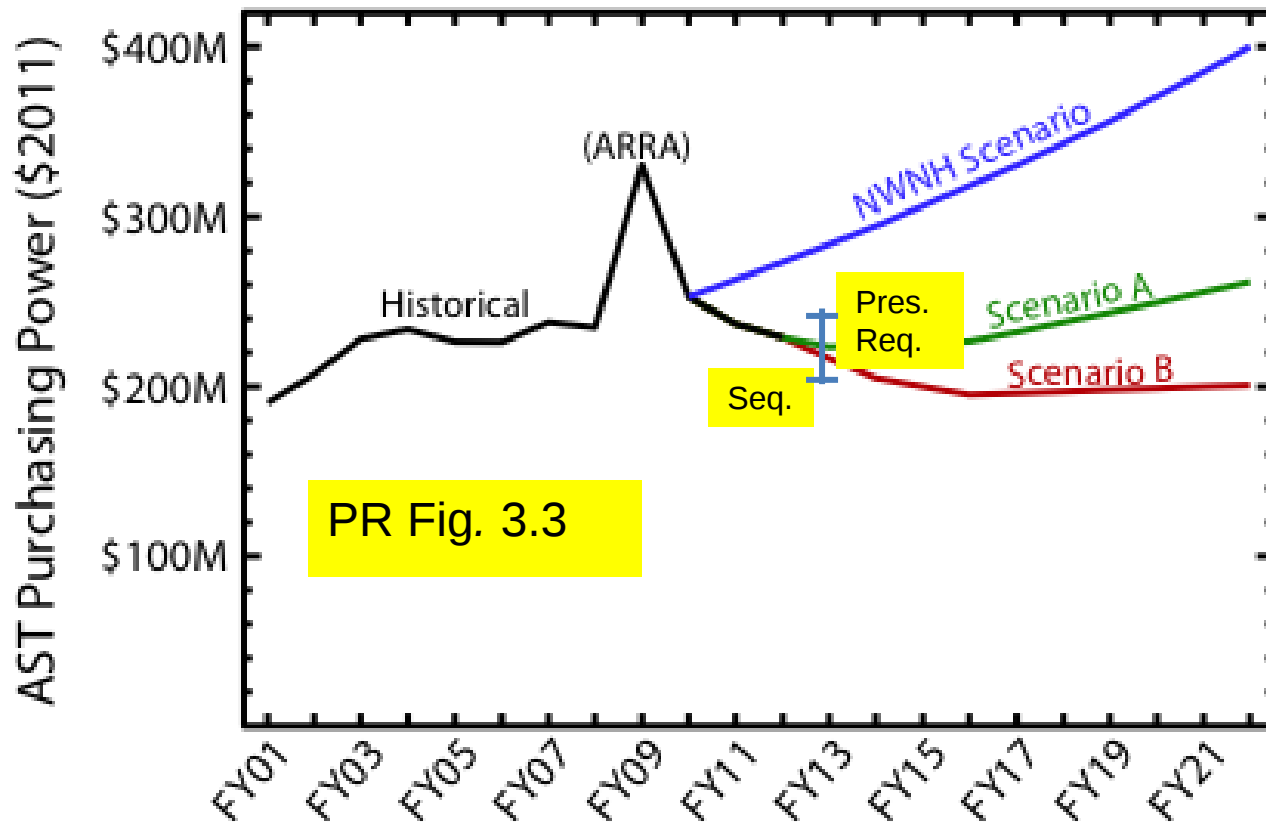


Sequester Outlook for the NSF

- Community members ask about the impact to NSF research programs, facilities, etc.
 - “I don’t think anyone quite understands how the sequester is really going to work.” (Speaker Boehner on NBC Meet the Press, March 3, 2013)
- NSF Director has written that NSF will rely on 3 major principles:
 - Protect commitments to NSF’s core mission and maintain existing awards
 - Current and future years of existing awards will be honored
 - Protect the NSF workforce
 - NSF internal costs are only ~6% of total NSF budget, so furloughs are unlikely to be necessary
 - Protect STEM human capital development programs
 - CAREER, Graduate Research Fellowship, postdoctoral programs, and Research Experiences for Undergraduates have high priority



Portfolio Review Budget Scenarios



- Committee Figure 3.3 is annotated here by budget ranges for FY13, ranging from the President's Request level to a 5% across-the-board sequestration

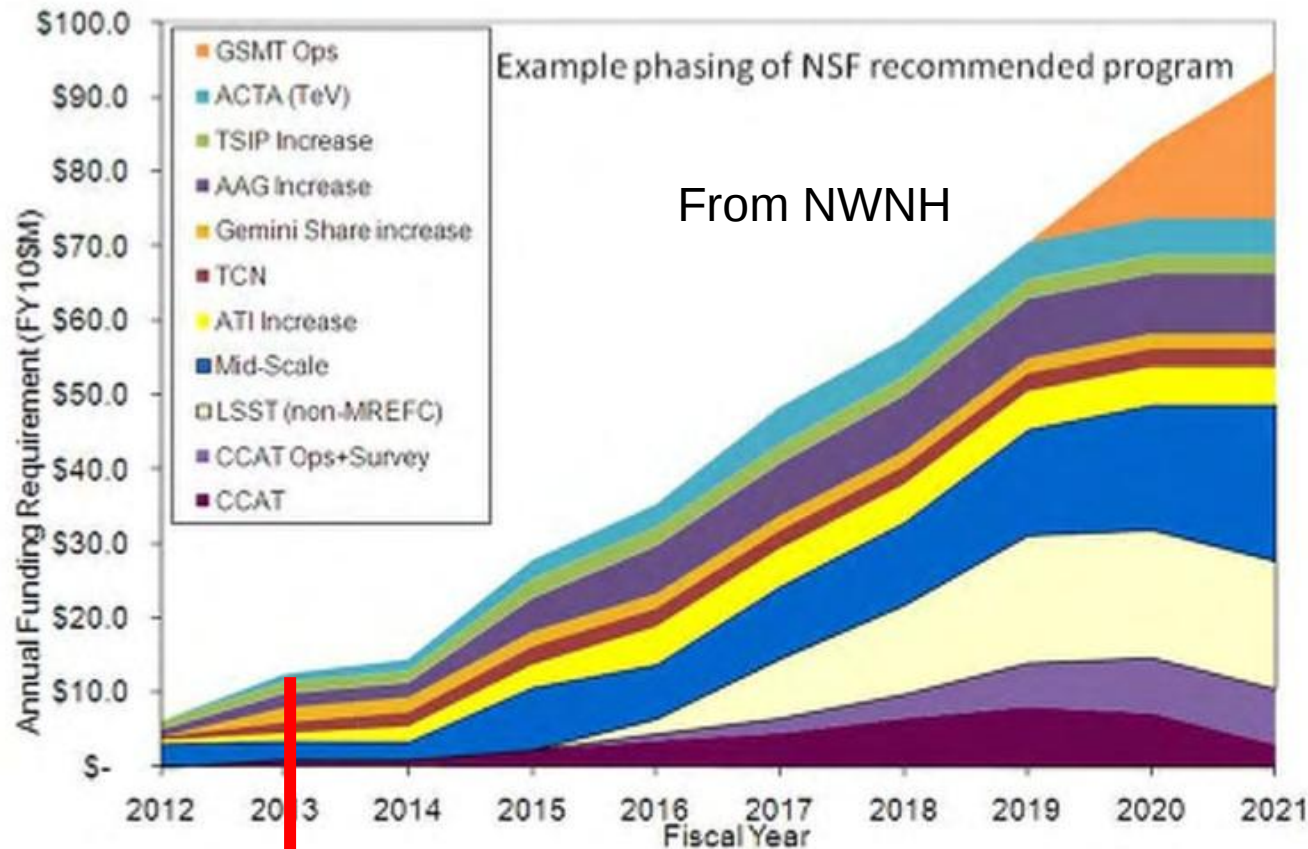
Recent AST budget requests and appropriations:

Year	FY11	FY12	FY13
Request	\$251.8M	\$249.1M	\$244.6M
Approp.	\$236.8M	\$234.6M	-5%=\$222M

NWNH≈\$298M in FY13\$



Astro2010 Ramp + Budget Scenarios



 **FY 2013 budget request**

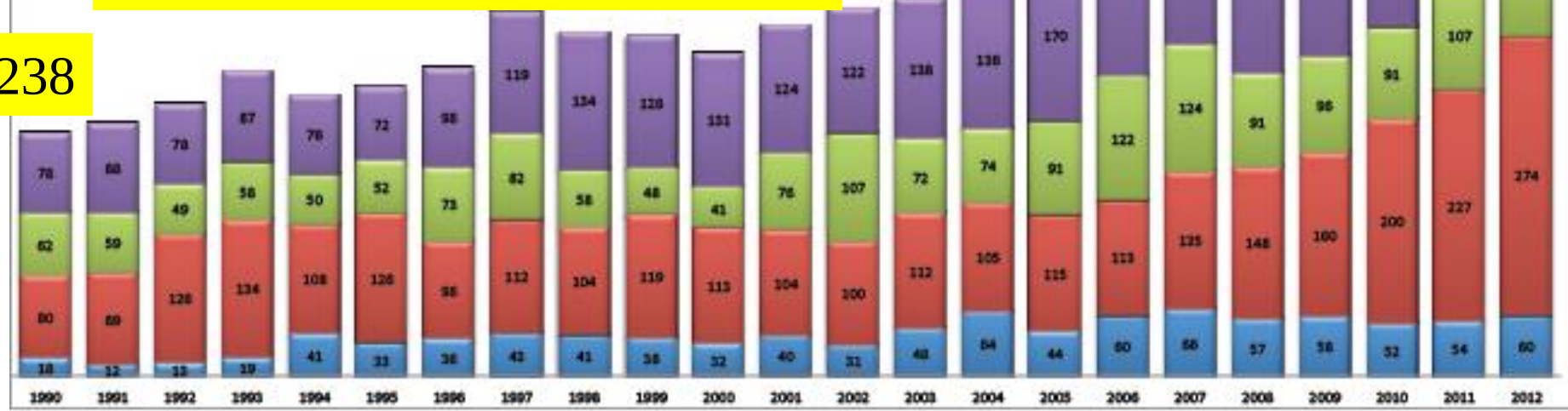
Proposals Reviewed in AAG

PLA SAA
GAL EXC

\$283M requested in FY 2013
compared to TOTAL AST budget
request of \$244.6M

716

238

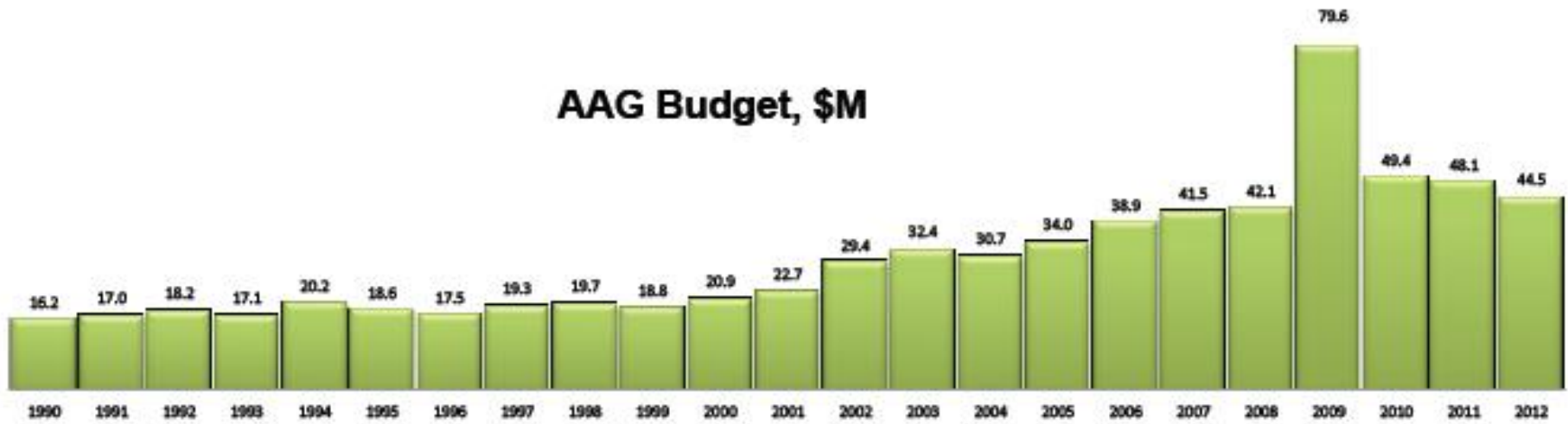


1990

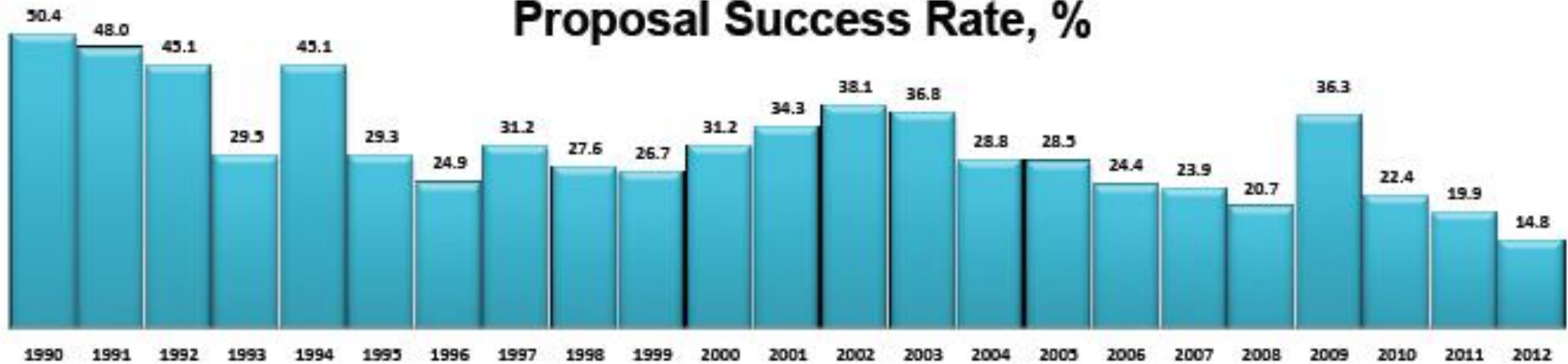
2012



AAG Budget, \$M



Proposal Success Rate, %



AAG Proposal Requests—FY12

Item	Budget Percentage
Senior Personnel	17%
Grad Students	13%
Postdocs	8%
Undergrads	2%
Fringe Benefits	9%
Travel	6%
Other Direct Costs (incl. tuition)	6%
Indirect Costs	31%
Misc (professionals, publications, equipment, etc.)	8%

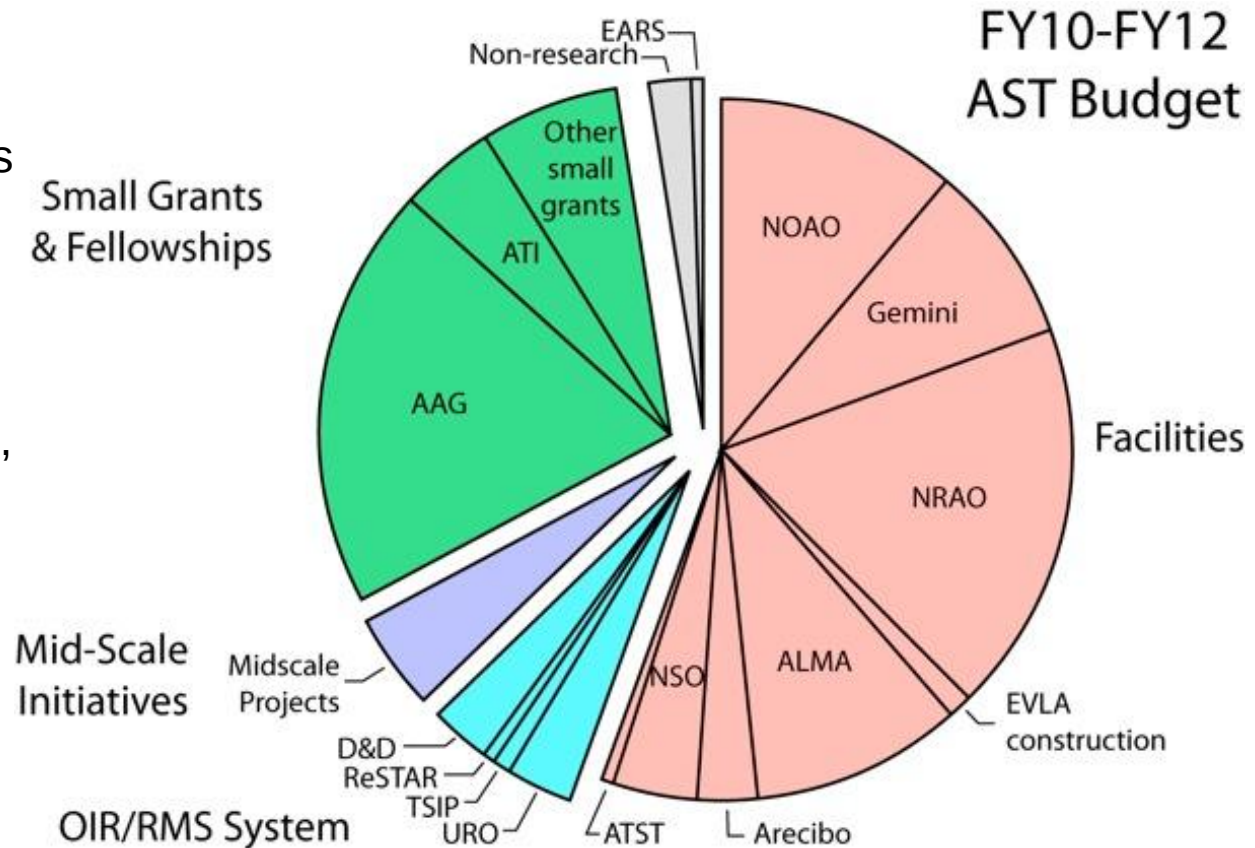


Portfolio Review



An Overview of the AST Portfolio

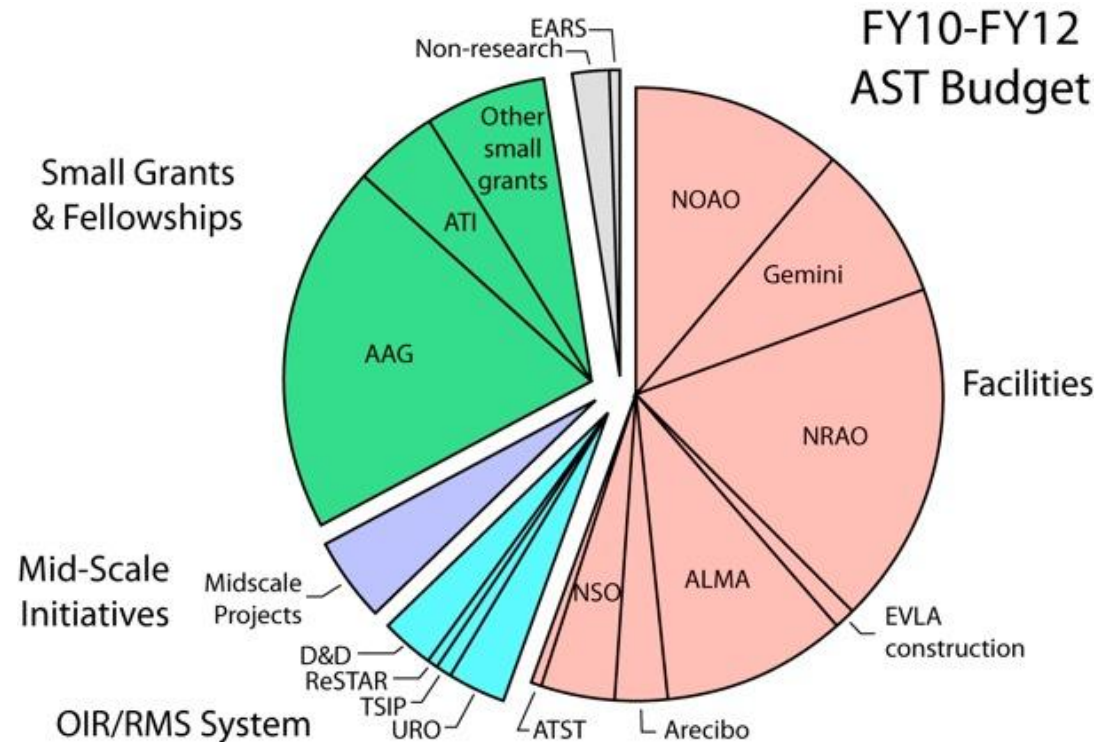
- AST supports a wide variety of activity.
 - State-of-the-art facilities in optical, radio, and solar astronomy.
 - Small-grants programs to support individual researchers.
 - Mid-scale projects, e.g., surveys & instrumentation.
 - Support of instrumentation and operations at non-NSF facilities.
- All of these are important!



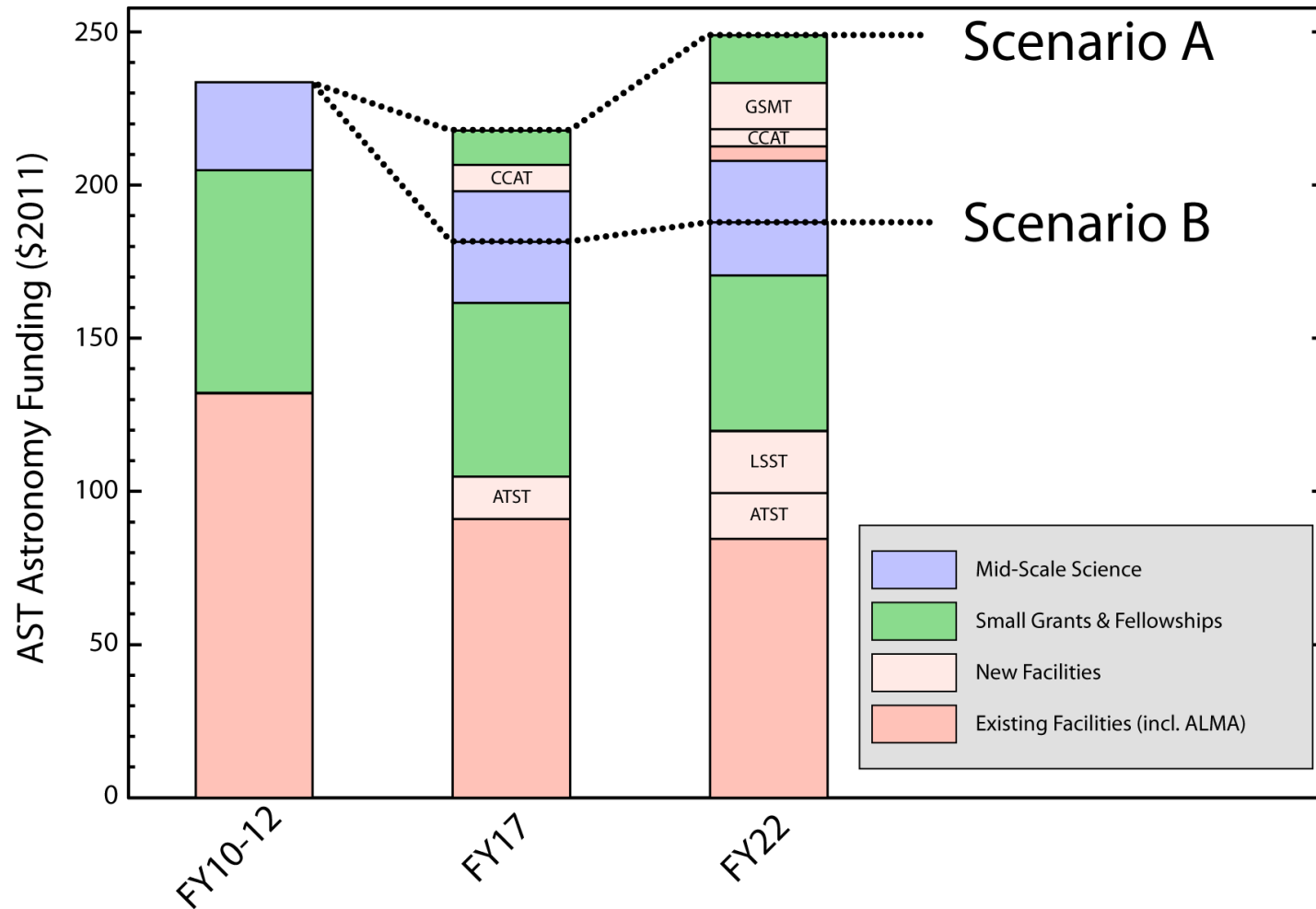
PR Report adopted the average of FY10, FY11, and FY12 as today's baseline.

AST Budget Challenge

- Major new facilities are under construction.
- ALMA operations are ramping up to a U.S. share of about \$40M/year (up from \$23M in this chart).
- ATST operations later in the decade will ramp up to nearly \$20M/year.
- Relative to this pie chart, the added cost is 15%.
- Unless the overall budget increases, this must displace something else.

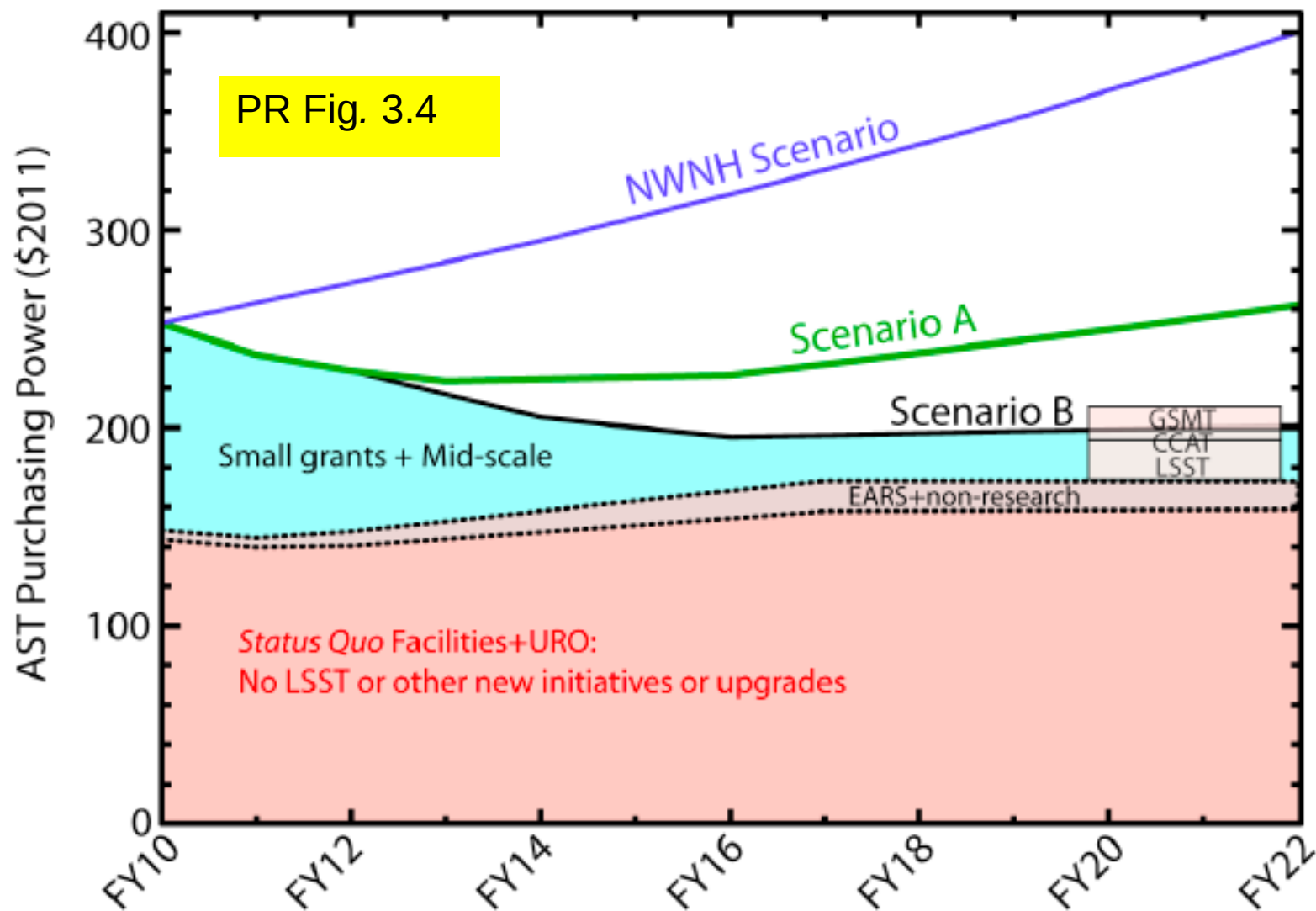


Recommended Portfolios



- Inflation-adjusted graph of the major portfolio components.

Impact of Maintaining Status Quo



NSF Response to PR Report

- NSF response document issued on August 31.
- NSF must decide on nature of divestments near the end of CY 2013 in order to realize significant savings by FY 2017.
 - No decisions have been made by NSF to date.
 - Divesting a telescope does not need to imply closing a site.
 - Emphasize principle of divestment in a responsible manner.
 - Partial divestments/partnerships of various sorts are under active consideration.
 - Intersection with management competitions?
- Agree with Committee assessment that failure to act on their recommendations will reduce grants program four-fold in Scenario B
 - Resulting grants funding rate would be in 3%-4% range.
- Decisions and response are not up to AST alone, but are decisions of AST and the executive branch, with Congressional input as part of the budget process.



What Has AST Done Since August 2012?

- Exploring various partnership models for major facilities that were recommended for divestment
 - Working with DOE as they analyze alternatives for their Mid-Scale Dark Energy Spectroscopic Instrument (MS-DESI).
 - Meeting with managing organizations and potential partners regarding facilities given lower priority by PR Committee.
 - Will meet with representatives of telescopes hosted on Kitt Peak to understand their infrastructure requirements.
- Proceeding on competitions for management of NOAO, NRAO, and Gemini, all to be decided in 2015
 - Solicitations out this summer will describe scope of work.
 - Announced at National Science Board that Green Bank Telescope and Very Long Baseline Array will be partitioned from NRAO management competition.
 - Provides opportunity to engage potential operators and partners who may be interested in individual telescopes.



Decadal Survey Response

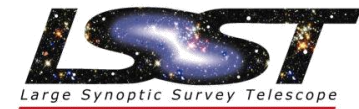


NWNH Actions—Large Programs

- Continuing LSST D&D funding, aiming for possibility of MREFC start in FY 2014 or later (see later slides)
- Mid-Scale Innovations Program (MSIP), \$4M-\$120M
 - Difficult to find a budget wedge in current climate
 - Portfolio review committee recommended combining with other similar-size programs, such as University Radio Observatories and Telescope Systems Instrumentation Program
 - Maximum project size will be well below \$120M
- GSMT partnership planning solicitation issued
 - Condition: No construction funding before 2020
 - Preparing to make award at \$250K/yr level
- ACTA: No wedge visible, could propose to MSIP



Now in *Large Facilities Manual* Final Design Phase



Large Synoptic Survey Telescope

Total Project Cost ~\$665 million; Total NSF Cost \$466 million (+operations)

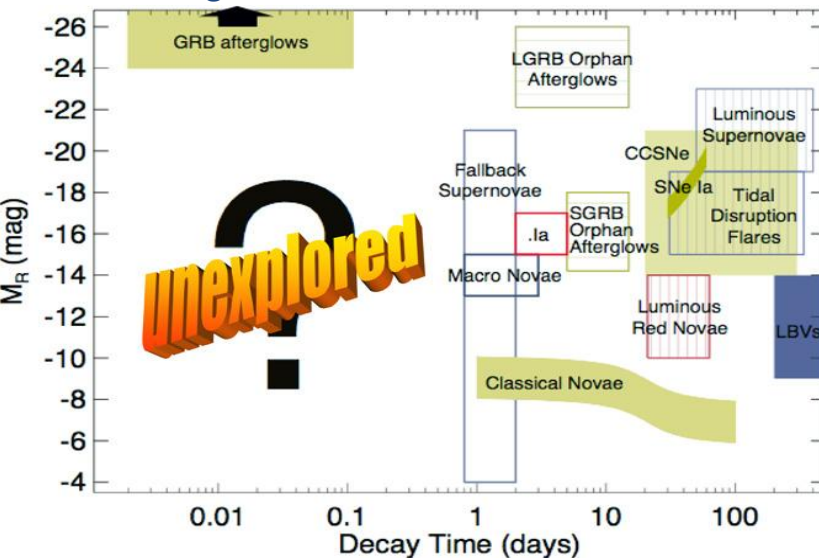
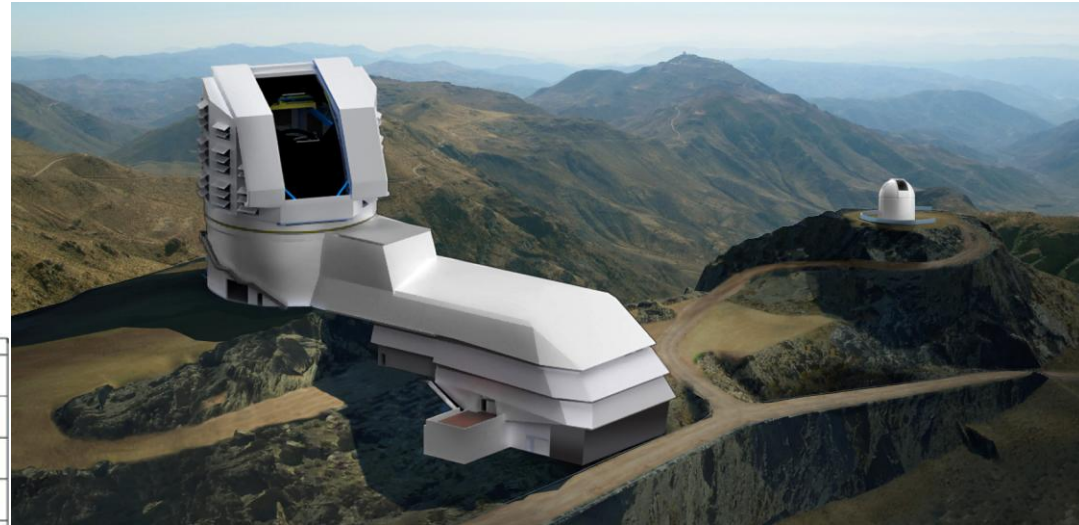
Massively parallel astrophysics - data enabled science
very large datasets allow for precision statistical analysis
and an automated search for very rare events

***A survey of 20 billion
objects in space & time***

High dimensionality data exploration
automated discovery
automated data quality assessment

A new window on the Universe
expect the unexpected

Transformative impact of sky surveys
change in astronomical culture

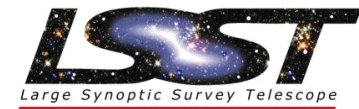


- *Probing dark matter and dark energy*
 - *Order of magnitude improvement*
- *Mapping the Milky Way*
 - *Formation and structure*
- *An Inventory of the Solar System*
 - *Potentially hazardous asteroids*
- *The Transient Optical Sky*
 - *Opening the Time Domain*

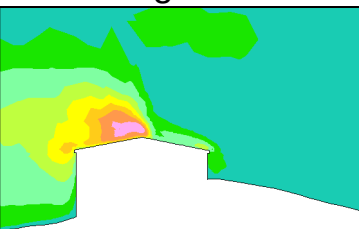


Large Synoptic Survey Telescope

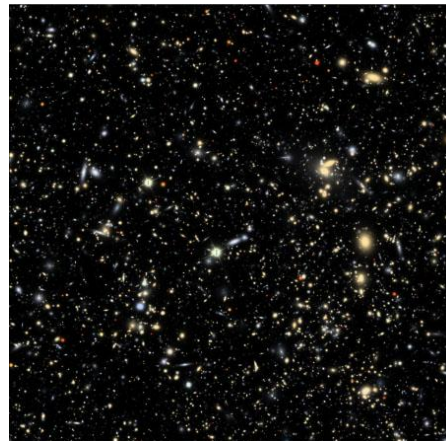
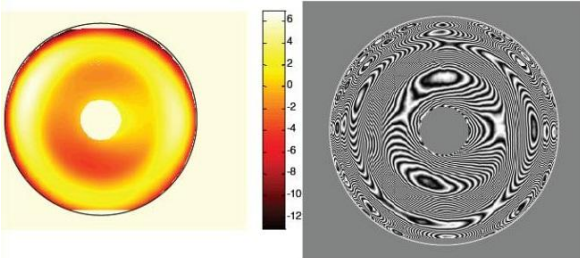
Current status, recent activities



Building air flow



Final polishing of M1/M3 mirror started



End to end image simulation
fully functional - ray-traces
individual photons



Initial site excavation has created level
platforms for the main LSST telescope (L) and
calibration telescope (R), while also verifying
the required high structural strength of the rock.

NSF PDR and DOE CD-1 camera review, Fall 2011.
Interface and Cost Estimation reviews, May 2012.
NSB approval granted in July 2012 for LSST to be
included in a future budget request.

*Deputy Project Manager steps up to Project Manager;
Senior Systems Engineer added to team; new Project
Director selection near completion*



Plant propagation
(environmental
mitigation) under
way at leveled
telescope site



Fully functional prototype sensors for camera

Vendor selected for M2 polishing and
support cell



Operations Simulator models site
and telescope to optimize scheduling
and maximize science.

LSST

- Passed Preliminary Design Review in Sept. 2011
- NSF/DOE Memorandum of Understanding signed, outlining agency scopes and areas of responsibility
- Advanced to MREFC Readiness stage in July 2012, by action of the National Science Board
 - NSF Director may include LSST construction in a future budget request, at his discretion
- If construction is started in FY 2014, planned date for beginning of operations is October 2021, assuming a funding profile that meets a technically driven schedule



NWNH Plans—Medium

- CCAT Design and Development proposal funded
 - No apparent construction wedge in 2014/2015
 - Could compete for funds in MSIP, if AST is able to fund that line.



“Small”/Other Recommendations

- Increases in general (AAG) and instrumentation (ATI) grants programs not possible without substantial facility divestment and improved budget outlook
- TSIP: see response to MSIP
- Gemini: \$2M increase in FY 2012 mandated by Congress; extra funds in future years are unlikely
- Theoretical & Computational Astrophysics Network: NSF/NASA solicitation, \$1.5M/yr from NSF for 3 yr
- Gemini/NOAO consolidation: unlikely due to difficulty of combining national and international observatories
- CAA/DSIAC: this body



Other Decadal Surveys

- Vision and Voyages (no NSF budget targets employed)
 - Multidisciplinary, balanced solar program
 - Support all NSF ground-based facilities
 - Timely LSST completion
 - Echoes NWNH GSMT recommendation
 - More laboratory support for planetary science
- Solar & Space Physics (no AST budget targets employed)
 - DRIVE initiative: mid-scale NSF projects; vigorous ATST and synoptic program support; science centers and grant programs; instrument development



Giant Segmented Mirror Telescope

- Solicitation issued December 30, 2011, entitled “Partnership Planning for a Giant Segmented Mirror Telescope”
 - \$0.25M/yr for 5 yr, for planning for the possibility of an eventual public/private GSMT partnership
 - Included constraint that no federal funding for construction or operations is possible until after 2020
 - No commitment to eventual funding is made or implied by this solicitation, and explicit acknowledgement of the Astro2010 priorities is included



O/IR System



O/IR “System” History

- Multiple “system roadmap” reports commissioned by NOAO and/or AURA
 - E.g., ALTAIR report, ReSTAR report, recent input to AST Portfolio Review
 - These tend to come from a particular perspective, and do not have a charge to balance the entire portfolio of ground-based astronomy within a constrained budget
- CAA study, 1995: “A Strategy for Ground-Based Optical and Infrared Astronomy”
 - Should strategic balance of support by NSF for O/IR astronomy be adjusted as Gemini telescopes come on line?
 - Articulate a new mission for NOAO

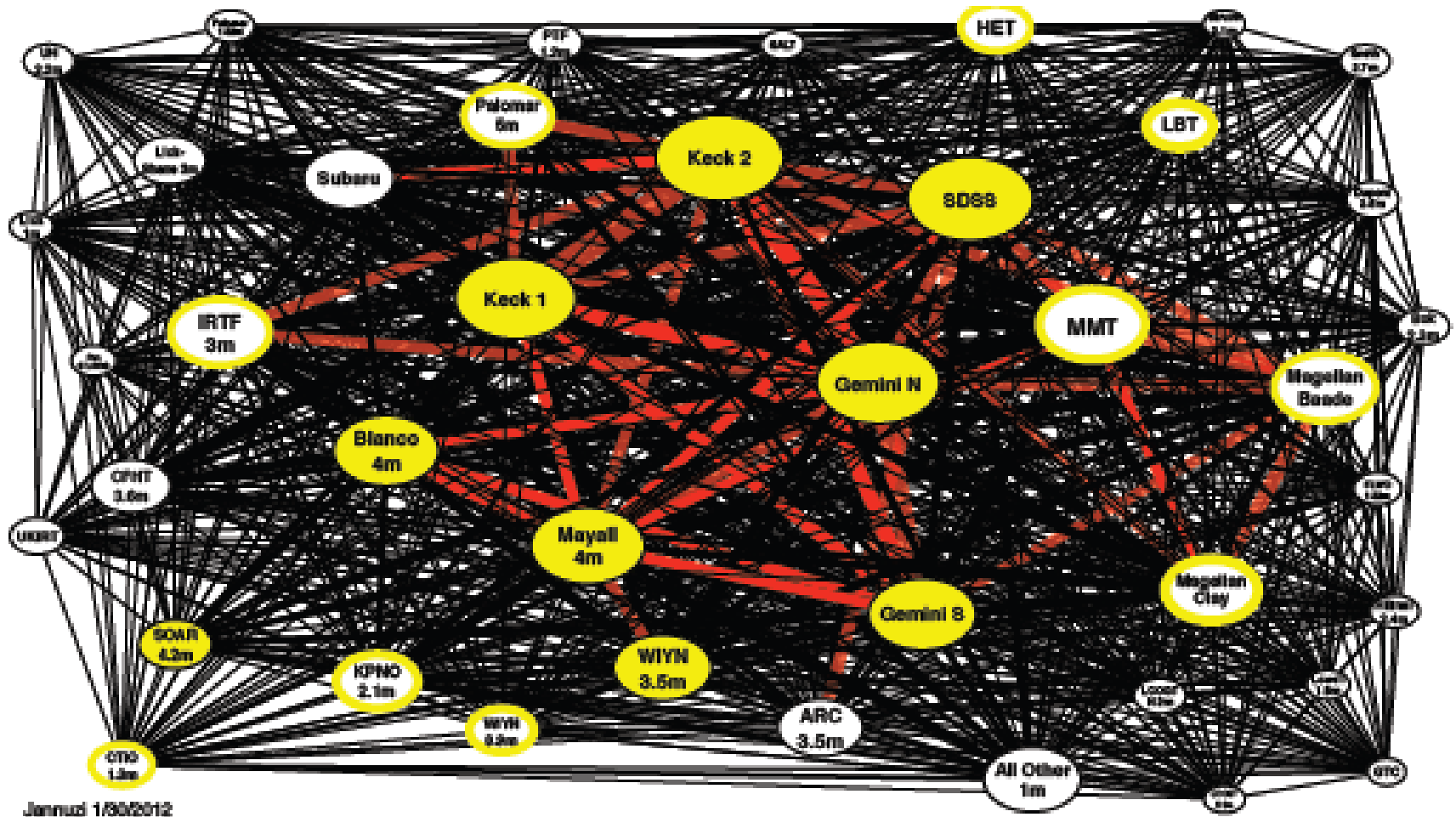


O/IR System Definition (December 2012 to AAAC)

- Long-term directions inferred from Portfolio Review Report
 - LSST should be at heart of OIR system
 - OIR system should center on >4m telescopes, with 4m telescopes being used primarily as supporting capabilities or survey capabilities
- This leads to many questions
 - What does the post-2021 system look like, as a whole?
 - How do you make a transition to that system, and make the transition while continuing to deliver science capabilities along the way?
 - What are the opportunities to motivate private telescope operators to participate in an integrated system?
 - How much of the system is defined top-down vs. on a more ad-hoc bottom-up basis?
 - How is the system coordinated and managed?
 - How do Gemini and NOAO change over the next decade?



A Snapshot of the O/IR “System”



- From OIR System Roadmap Community Survey, 2012 (Jannuzi et al.)

Toward the O/IR System With LSST

- Community self-organizing in workshops and other venues to determine best methods of doing LSST science
- NSF and DOE discussing how DOE mission goals might be achieved using telescopes in the NSF part of the system
 - Given “Rocky-III” report, DOE has an idea of where the gaps are in their integrated program
- Need community-led assessment of what we really want the system to look like post-2020 to deliver both NSF investigator science and DOE mission science “in the LSST era”
 - Which telescopes, instruments, and observing methods best deliver the overall science capabilities and return?



Possible CAA Study

- “A Strategy for Optimizing the U.S. O/IR System in the Era of LSST”
 - Goal 1: Position the observational, instrumentation, and support capabilities in U.S. O/IR astronomy to complement LSST for addressing decadal survey science questions
 - Goal 2: Achieve the best science from the NSF investment in O/IR astronomy
- Some guiding principles
 - Maximize access to system resources by the astronomy community at large, whenever possible
 - Use decadal surveys for science questions, Portfolio Review for mapping these questions to O/IR capabilities; no need to revisit
 - Make use of already-planned community workshops for maximizing science return related to LSST



Possible Outcomes of CAA Study

- Inventory of capabilities that are, or may be, available in the U.S. system, including federal and non-federal telescopes
- Identify system capabilities (e.g., instrumentation) needed to optimally exploit LSST
- Need for dedicated resources vs. open-access resources
- Identify priorities for needed system capabilities, based on scientific arguments
- Focus on science priorities and capabilities, not implementation or organizational structures
- Suggest and evaluate alternative strategies to optimize progress, considering severely constrained NSF resources
 - National strategy for O/IR system instrumentation
 - National strategy for O/IR data management, processing, mining

