



# NSF Town Hall

January 7, 2016

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*@UlvestadNSF*

*Patricia Knezek, Deputy Division Director, AST*



# High-Level Summary

- Outstanding science opportunities offered/developed
  - ALMA, EVLA, Dark Energy Camera, GPI, DKIST, LSST
  - ~110 research awards/yr in AAG, plus MSIP, ATI, AAPF, REU, PAARE
  - Interagency: DES, DESI, NN-EXPLORE (plus LSST, of course)
  - Beyond AST budget, NSF spent over \$100 million on construction of AST facilities in FY 2015
- No expectation for significant budget increases this decade
- Partnerships with NASA and DOE have strengthened
- Data-enabled science continues to grow in importance
- Challenges are many, but our community continues to make progress at the science frontiers



# Outline

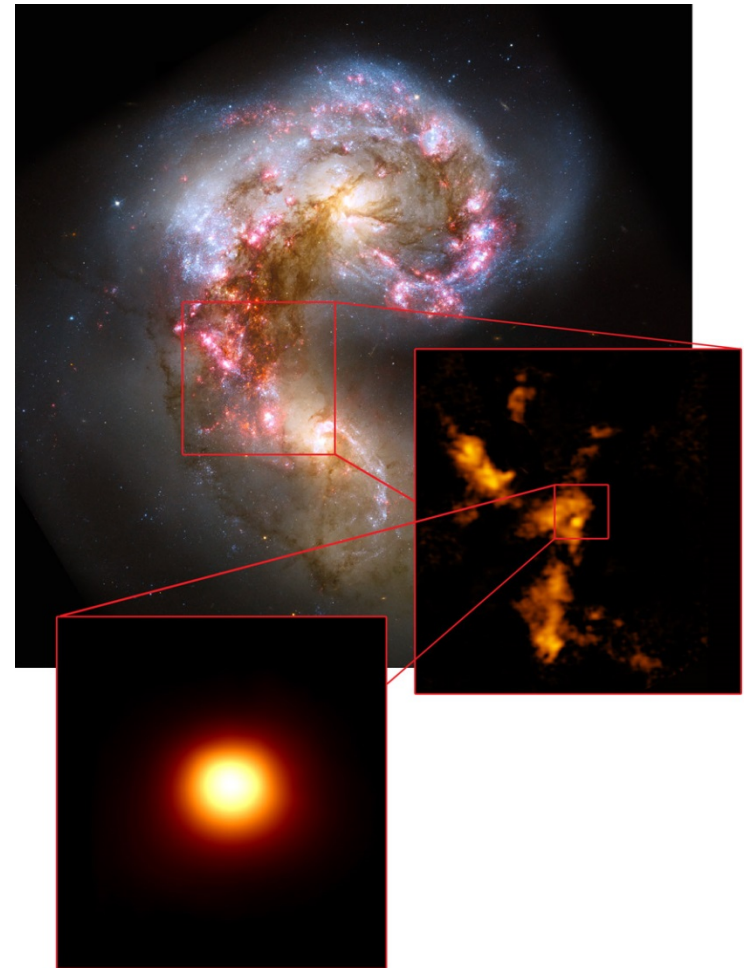
- Recent Highlights
- Budget Status and Outlook
- Decadal Survey Status
- Portfolio Review Status
- Summary



# Recent Highlights

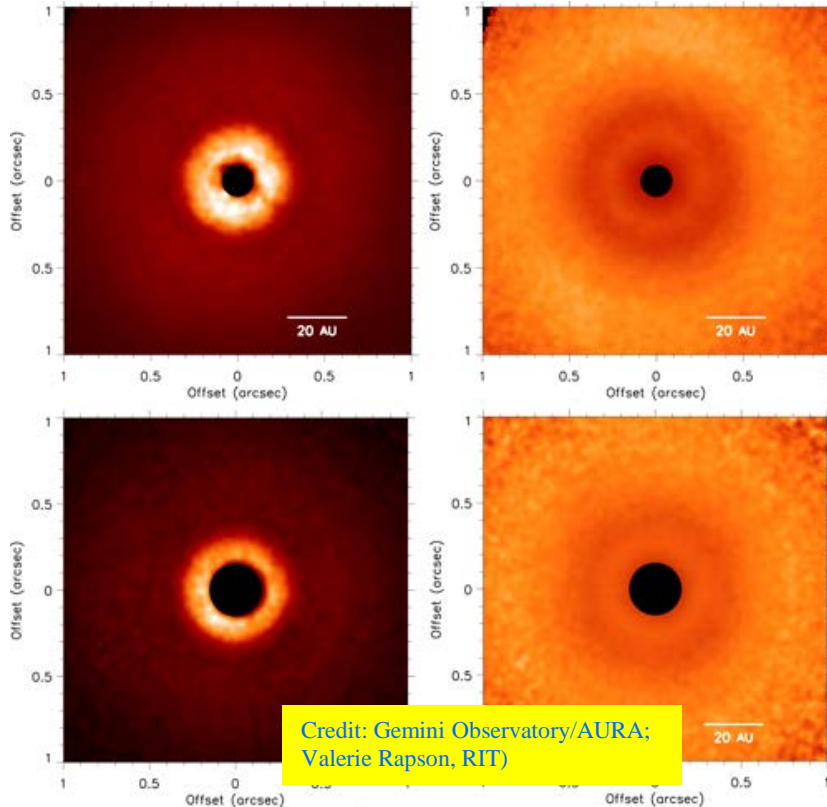
# Atacama Large Millimeter/Submm Array (ALMA)

- Construction of ALMA was officially completed in 2015.
- ALMA is a joint project of North America (led by NSF), the European Southern Observatory, and East Asia, with a total construction cost of \$1.4 billion.
- At upper right, an optical image of the merging “Antennae” galaxies is shown, progressively zoomed into a compact but intense source of millimeter radiation imaged with ALMA. This massive, dense, star-free cloud may be the first known example of a globular star cluster about to be born.



Credit: B. Saxton (NRAO/AUI/NSF); Images from NASA/ESA Hubble, B. Whitmore (STScI); K Johnson (U.Va.); ALMA (NRAO/ESO/NAOJ). (ApJ, 2015, 806, 35)

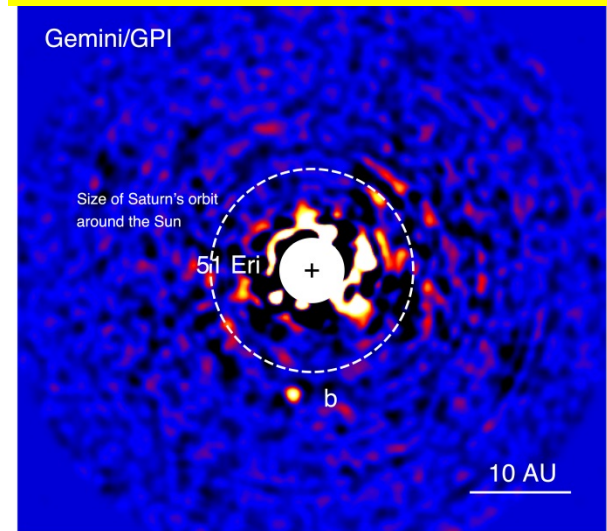
# Gemini: GPI Results



The images to the left show the T Tauri star TW Hya, imaged polarimetrically at J and K bands (intensities in right-hand panels scaled by  $r^2$ ), illustrating a 50% diminution in intensity at  $r \sim 23$  AU. Modeling indicates at least one  $0.2M_J$  planet (Rapson et al. 2015, ApJL, 815, L26)

- The image to the right shows the exoplanet 51 Eridani b (bottom of frame); this object is the most similar to our Solar System's gas giants of any known exoplanet (Macintosh et al., Science, August 13, 2015).

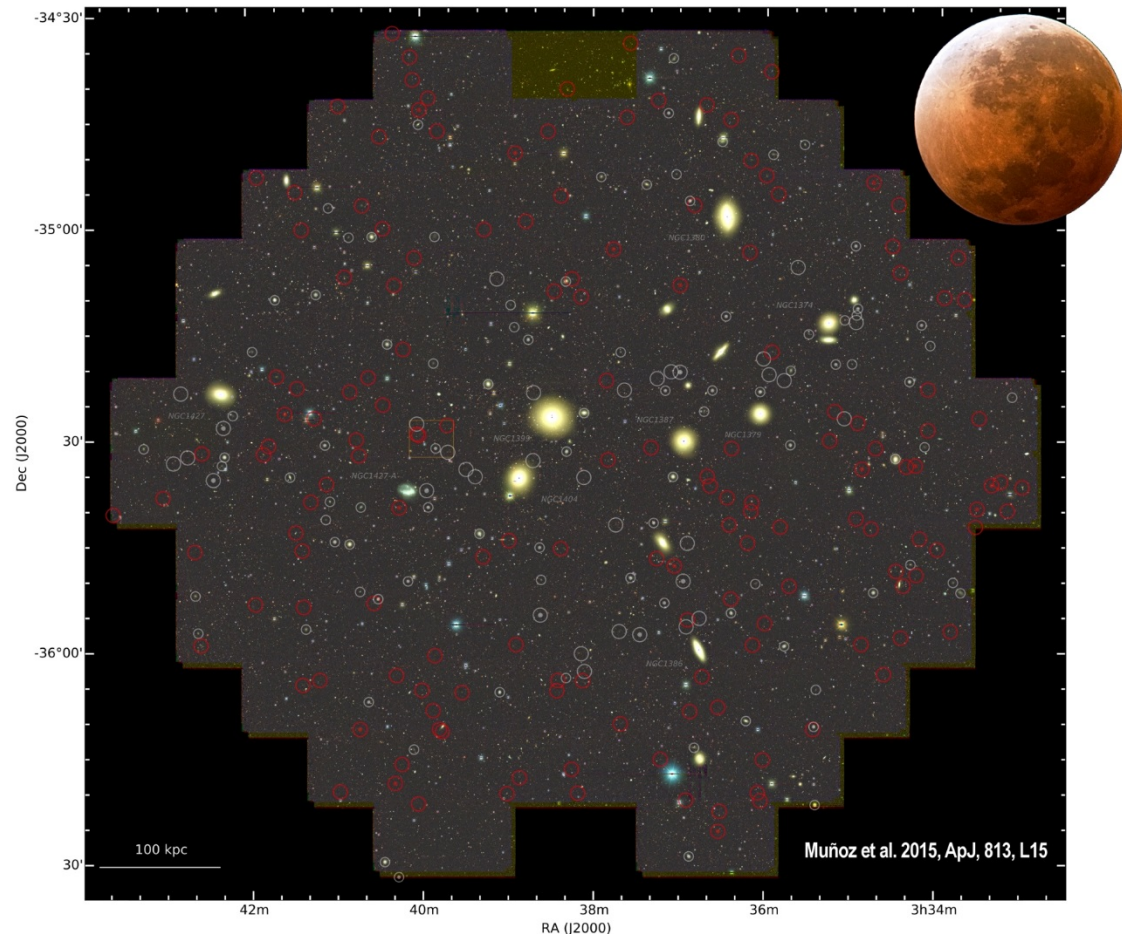
Credit: J. Rameau (UdeM) and C. Marois (NRC Herzberg)



# Next Generation Fornax Survey

- Dark Energy Camera on the CTIO 4-m telescope reveals numerous “new” (red circles in the 3-deg<sup>2</sup> field at right) dwarf galaxies in the Fornax cluster (Muñoz et al. 2015, ApJL, 813, L15)
- Total of 30 deg<sup>2</sup> being studied
- Possible solution to the “missing” dwarf galaxies predicted by cosmological simulations

## The Next Generation Fornax Cluster Survey (NGFS)

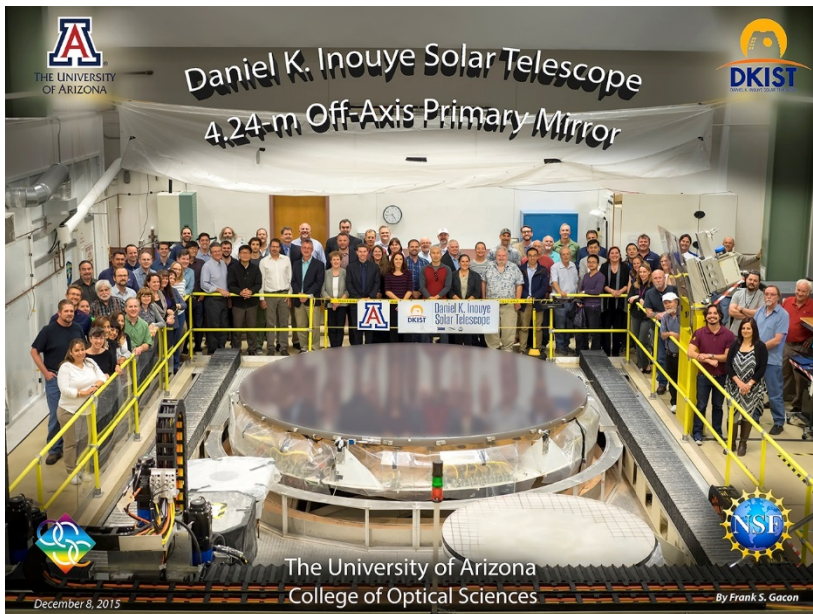




# Daniel K. Inouye Solar Telescope



- Excellent construction progress, with some delays on site work because of poor weather in Hawaii
  - Scheduled for completion in 2019
- Data rate  $\approx$  LSST data rate, but three years earlier!



Telescope enclosure assembly underway at the DKIST site on Haleakala, Maui, HI, November 2015. [Credit: DKIST project web camera.](#)



# Management Competitions

- NOAO competition concluded. AURA selected. New 5-yr cooperative agreement began on October 1, 2015
- NRAO competition concluded. AUI selected. New 10-yr cooperative agreement to begin on October 1, 2016
  - ALMA + VLA + Central Development Laboratory + associated administration
- Gemini competition nearing completion, for 6-yr cooperative agreement to begin on January 1, 2017
  
- Also, non-competitive 10-yr award has been made to AURA for NSO (including DKIST), and will run through September 30, 2024



# AST Scientific Staff Changes Since Jan. 2015

- Retirements: Craig Foltz: (DKIST/NSO); Gary Schmidt (Gemini); Eric Bloemhof (Arecibo/ATI)
- Departures: Dana Lehr: (NRAO, to AURA); Joan Schmelz (IPA, AAPF, to Arecibo); Dan Evans (IPA, ESP + AAG + Gemini, to NASA); Maria Womack (AAG PLA, end of IPA); Sandra Cruz-Pol (Spectrum Management, end of VSEE)
- Arrive/Depart: Claire Cramer (Gemini, detail from NIST); Greg Mack (MSIP, AAAS Fellow→Expert→APS)
- Arrivals: Chris Davis (Gemini, from Liverpool); Joan Wrobel (IPA, CAREER and AAG); Harshal Gupta (2-yr appt, AAPF); Faith Vilas (VSEE, AAG PLA); Tom Wilson (VSEE, Spectrum Management); Hugh Van Horn (Fed Temp, arrives January 10, AAG); Ed Ajhar (arrives late January, LSST and DKIST)



# Division of Astronomical Sciences (AST)

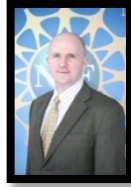
## Office of the Division Director



James Ulvestad  
Division Director



Patricia Knezek  
Deputy Division  
Director



Craig McClure  
Program Support  
Manager



Donna O'Malley  
Operations  
Specialist



Vernon Pankonin  
Senior Advisor



Elizabeth Pentecost  
Project  
Administrator



Gregory Mack  
Expert

## Administration



Diana Phan  
Program  
Analyst



Matthew Viau  
Program  
Specialist

## Individual Investigator Programs and Astronomy & Astrophysics Research Grants



James Neff  
IIP Coordinator;  
Stellar Astronomy  
& Astrophysics



Richard Barvainis  
Extragalactic  
Astronomy &  
Cosmology



Glen Langston  
Galactic  
Astronomy



Harshal Gupta  
Astronomy &  
Astrophysics  
Postdoctoral  
Fellowships



Joan Wrobel  
CAREER;  
Extragalactic  
Astronomy &  
Cosmology



Faith Vilas  
Planetary  
Astronomy

Glen Langston  
Enhancing  
Access to the  
Radio Spectrum

James Neff  
Education &  
Special  
Programs  
(REU, PAARE)

Major Research  
Instrumentation

Ralph Gaume  
Advanced  
Technologies &  
Instrumentation

David Boboltz  
Theoretical and  
Computational  
Astrophysics  
Networks

Vacant  
Program Assistant

Vacant  
Student  
Trainee –  
Administrative

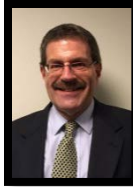
## Facilities, Mid-Scale, & MREFC Projects



Christopher Davis  
Gemini  
Observatory



Philip Puxley  
National Radio  
Astronomy  
Observatory  
/ALMA



Ralph Gaume  
Arecibo  
Observatory



Nigel Sharp  
Large  
Synoptic  
Survey  
Telescope



David Boboltz  
Daniel K.  
Inouye Solar  
Telescope

Vernon Pankonin  
National  
Optical  
Astronomy  
Observatory

Richard Barvainis  
Mid-Scale  
Innovations  
Program

David Boboltz  
National  
Solar  
Observatory



Mangala Sharma  
Electromagnetic  
Spectrum  
Management

Tom Wilson  
Electromagnetic  
Spectrum  
Management



# IPA Program Officers Needed

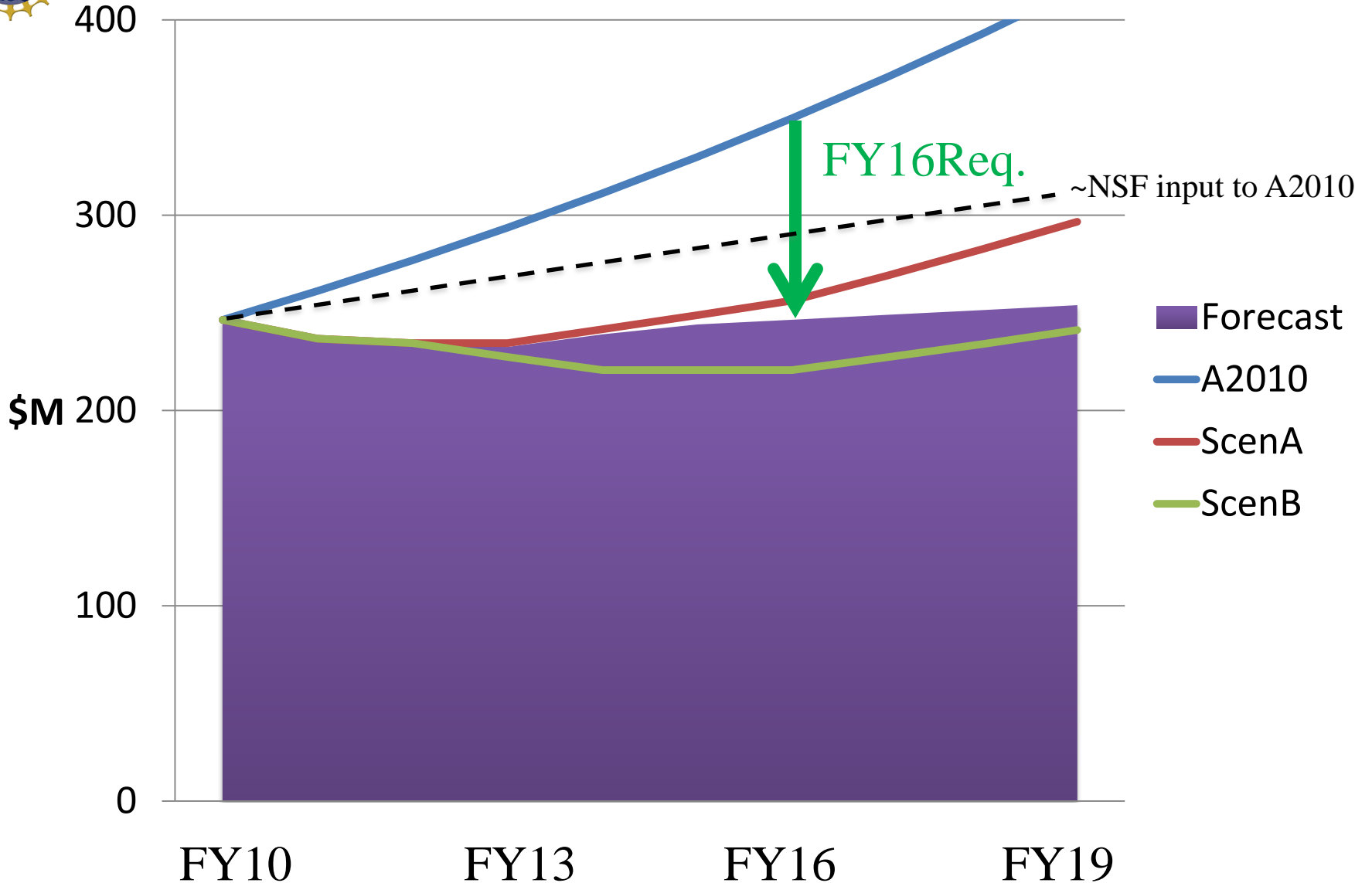
- AST has 2-3 openings for rotators under Intergovernmental Personnel Act (IPA), with a new ad soon to be posted
  - Typically 2-3 years at NSF, while maintaining employment status at home institution
  - Per diem of \$22,500; up to 50 days of research time
- IPAs bring a different and important university perspective to the federal government, and can help translate federal requirements to the scientific community
  - As a default, IPAs return to their home institutions
  - Some come back to the federal government or leverage their experience for other positions
- At present, AST has only two IPAs on staff
- Potential candidates urgently needed!



# Budget Status and Outlook



# NWNH Budget vs. Actual AST Budget





# FY 2016 Budget Status

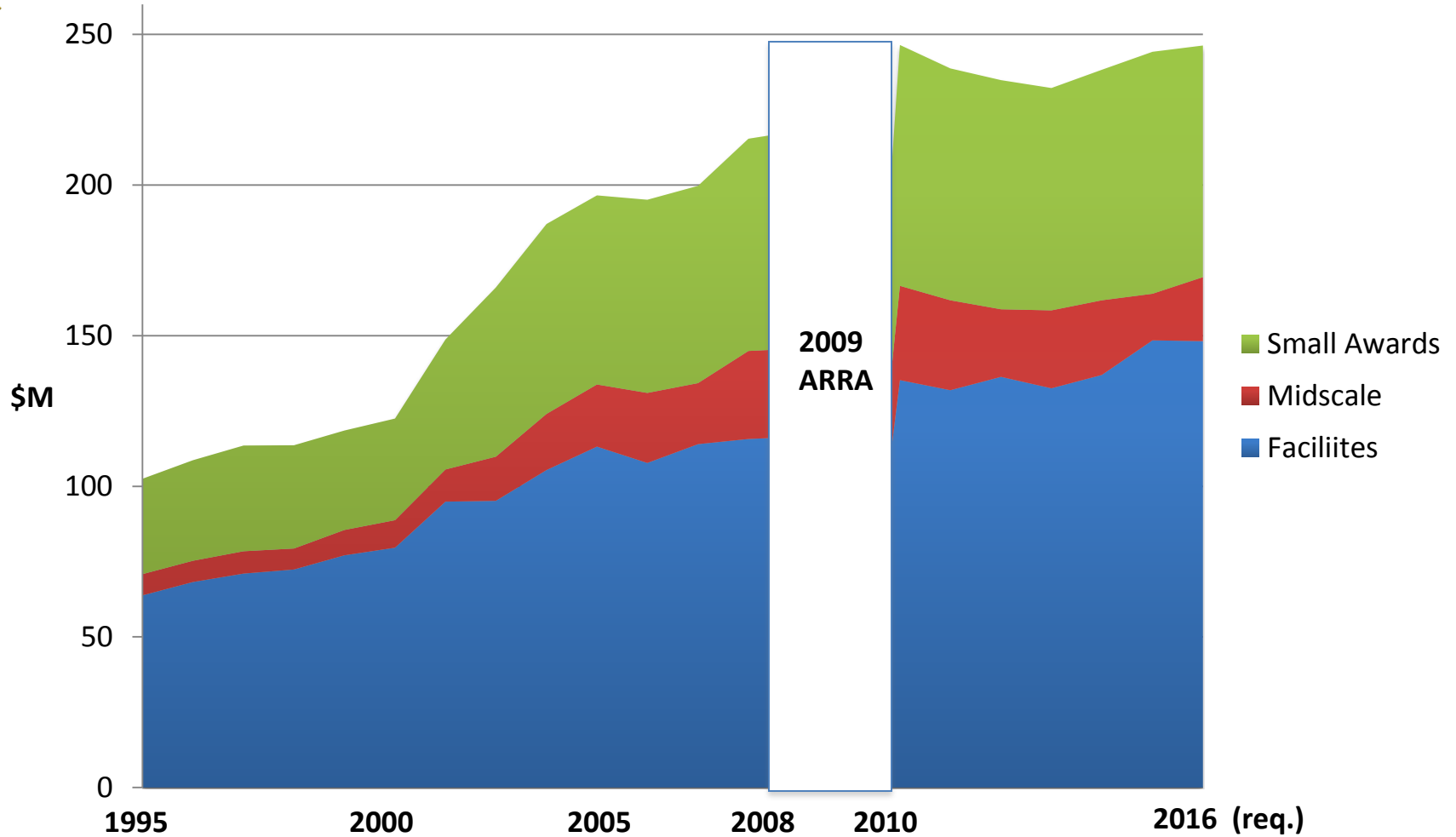
- Omnibus funding bill for FY 2016 passed in December

\$M	FY14 Actual	FY15 Actual	FY16 Request	FY16 Omnibus
NSF Total	7131	7344	7724	7464
NSF R&RA	5775	5934	6186	6034
MPS	1268	1337	1366	??
AST	238.4	244.2	246.5	??
MREFC	200.0	200.8	200.3	200.3

- Since NSF received less than the President's Request Budget, MPS and AST are unlikely to receive more!
- NSF Current Plan for FY 2016 is in preparation for submission to Congress, and subsequent approval
- FY 2017 President's Request will be out in early February, and probably will contain FY 2016 Estimated Budget



# AST Budget Breakdown, 1995-2016



- Facility fraction was 63%-65% in late 1990s, decreased to 53% in 2008, then rose back to 60% in FY 2016 request





# Status of Decadal Survey Response, and Follow-on Reports



# High-Level Look at the Decade So Far

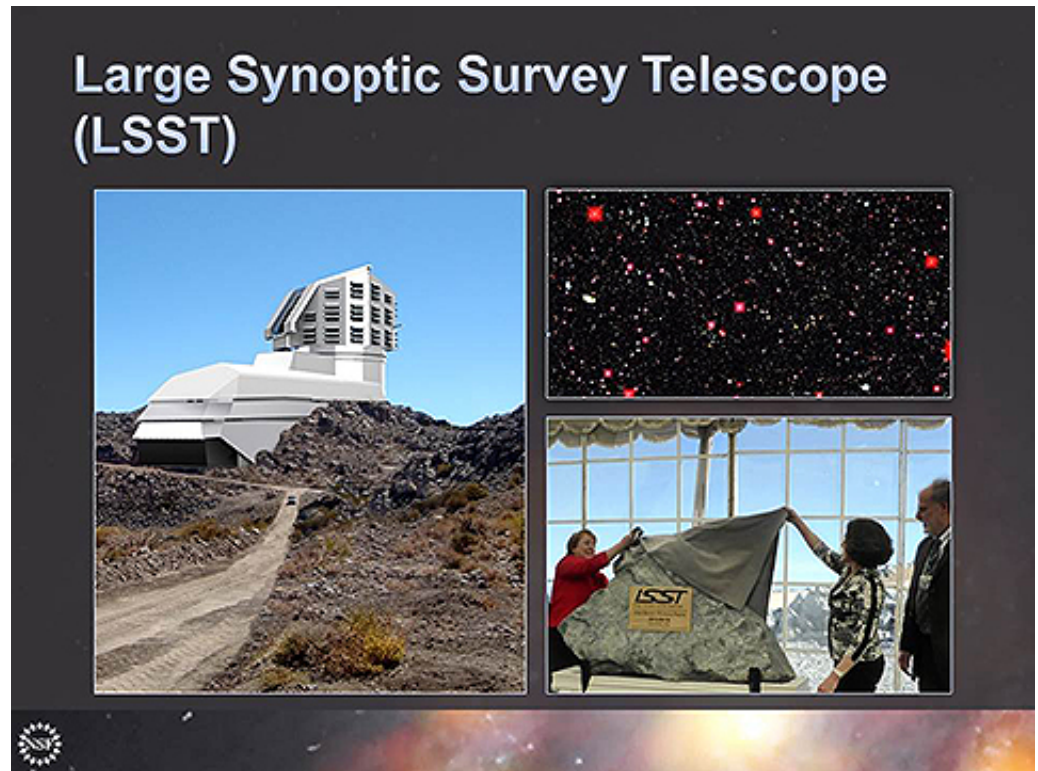
- NSF has successfully started the two highest priority “Large Ground-Based Projects” from *New Worlds, New Horizons*,
  - Large Synoptic Survey Telescope: under construction in Chile
  - Mid-Scale Innovations Program: full proposals invited from second solicitation
    - Plenary talks at this meeting on two projects awarded in the first MSIP round (Event Horizon Telescope; Zwicky Transient Facility)
- Realized budgets have precluded additional large actions
- Complete summary of NSF response to *NWNH* is in a Dear Colleague Letter (DCL), NSF 15-044, available at

[http://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=nsf15044](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf15044)



# Large Synoptic Survey Telescope

- NSF construction award made in August 2014
- Strong NSF/DOE partnership in construction and operations
- NRC committee studied OIR system in LSST era (more later)

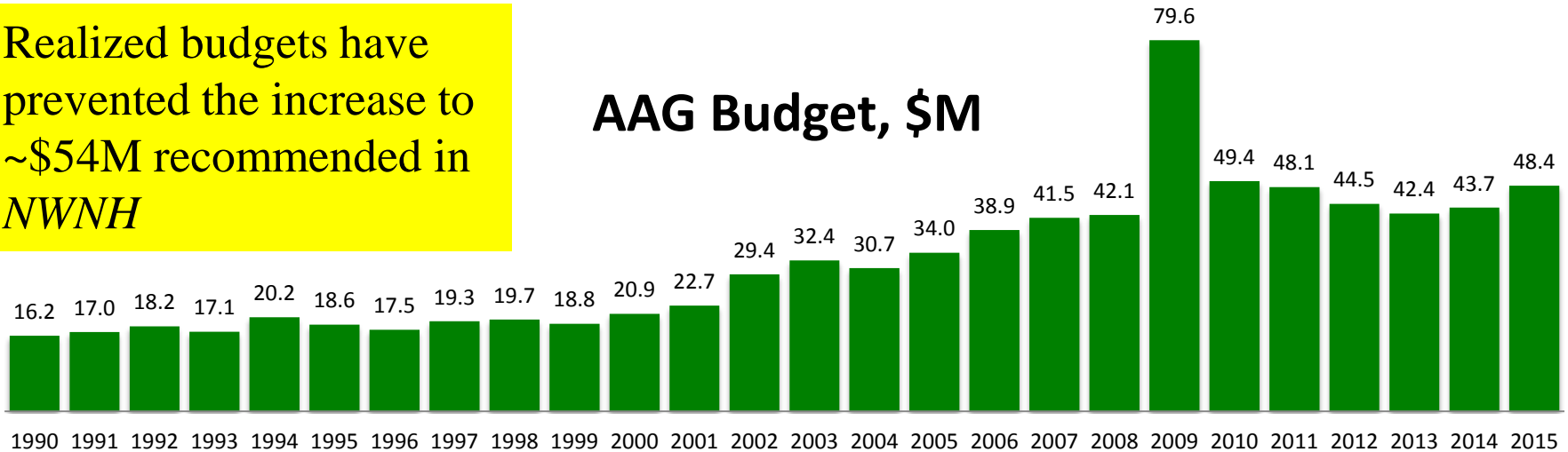




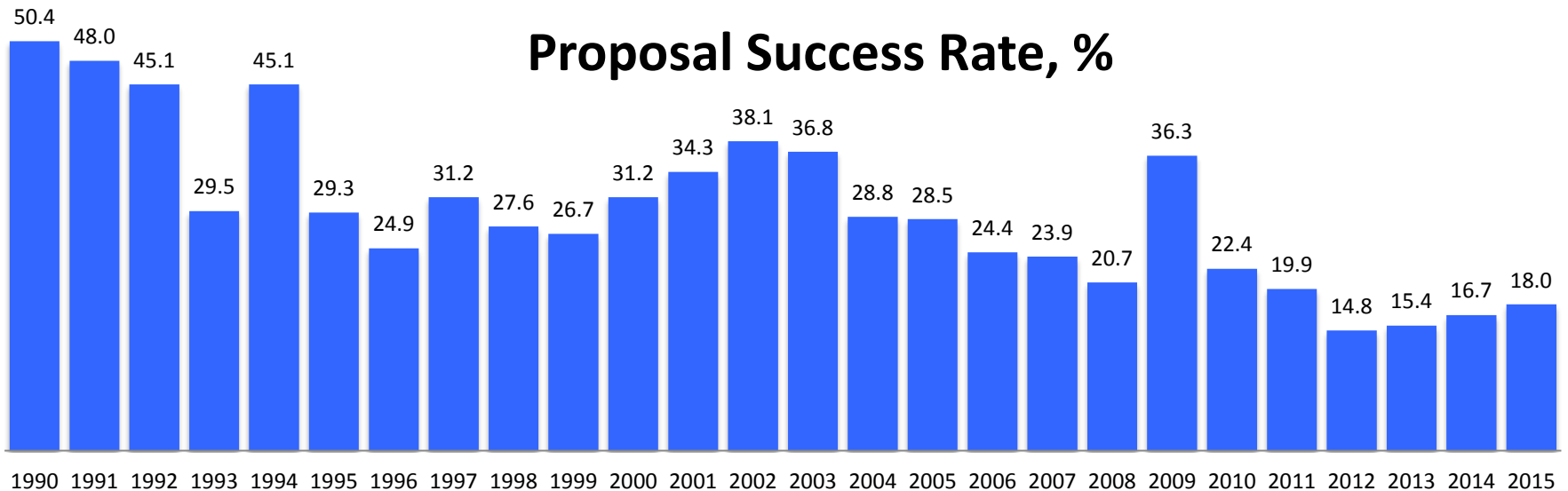
# AAG Funding History, 1990-2015

Realized budgets have prevented the increase to ~\$54M recommended in *NWNH*

## AAG Budget, \$M



## Proposal Success Rate, %





# Mid-Decadal Survey Statement of Task

- Given funding circumstances that are substantially below those described in *NWNH*, the committee's review will describe:
  - The most significant scientific discoveries, technical advances, and relevant programmatic changes in astronomy and astrophysics since *NWNH*;
  - How well the Agencies' programs address the strategies, goals, and priorities outlined in *NWNH* and other NRC reports;
  - Progress toward realizing these strategies, goals, and priorities; and
  - Any actions that could be taken to maximize the science return of the Agencies' programs.
- Have NSF responses to funding realities (e.g., AST Portfolio Review, funding and programmatic choices) been consistent with the spirit of *NWNH*?



# Mid-Decadal Survey Status

- Committee chaired by Jackie Hewitt, MIT
- Three face-to-face meetings
  - October 8-10; December 12-14; January 11-13
- Report expected in spring 2016
  
- Note: NSF presentation to October 8-10 meeting, available on either AST or NRC web sites, includes a comprehensive summary of AST responses to all *NWNH* recommendations



# Portfolio Review Status



# Next “Senior Review”

- *NWNH*, p. 32:
  - “NSF-Astronomy should complete its next senior review before the mid-decade independent review that is recommended elsewhere in this report, so as to determine which, if any, facilities NSF-AST should cease to support in order to release funds for (1) the construction and ongoing operation of new telescopes and instruments and (2) the science analysis needed to capitalize on the results from existing and future facilities.”
- This became the AST Portfolio Review (PR)





# Portfolio Review Purpose & Outcome

- Portfolio Review Committee (PRC) was charged to recommend a balanced program, in realistic funding scenarios, that did the best job of responding to *NWNH* science program
  - Recommendations resulted in a balance among facilities, mid-scale programs, and grants that stayed similar to the balance in 2010
- Why did PRC recommend divesting facilities, which reduces community access to research tools?
  - Need to retain balance between community research tools (large and mid-scale facilities) and direct research funding (mid-scale experiments and individual investigator awards) in order to best sustain the astronomical enterprise

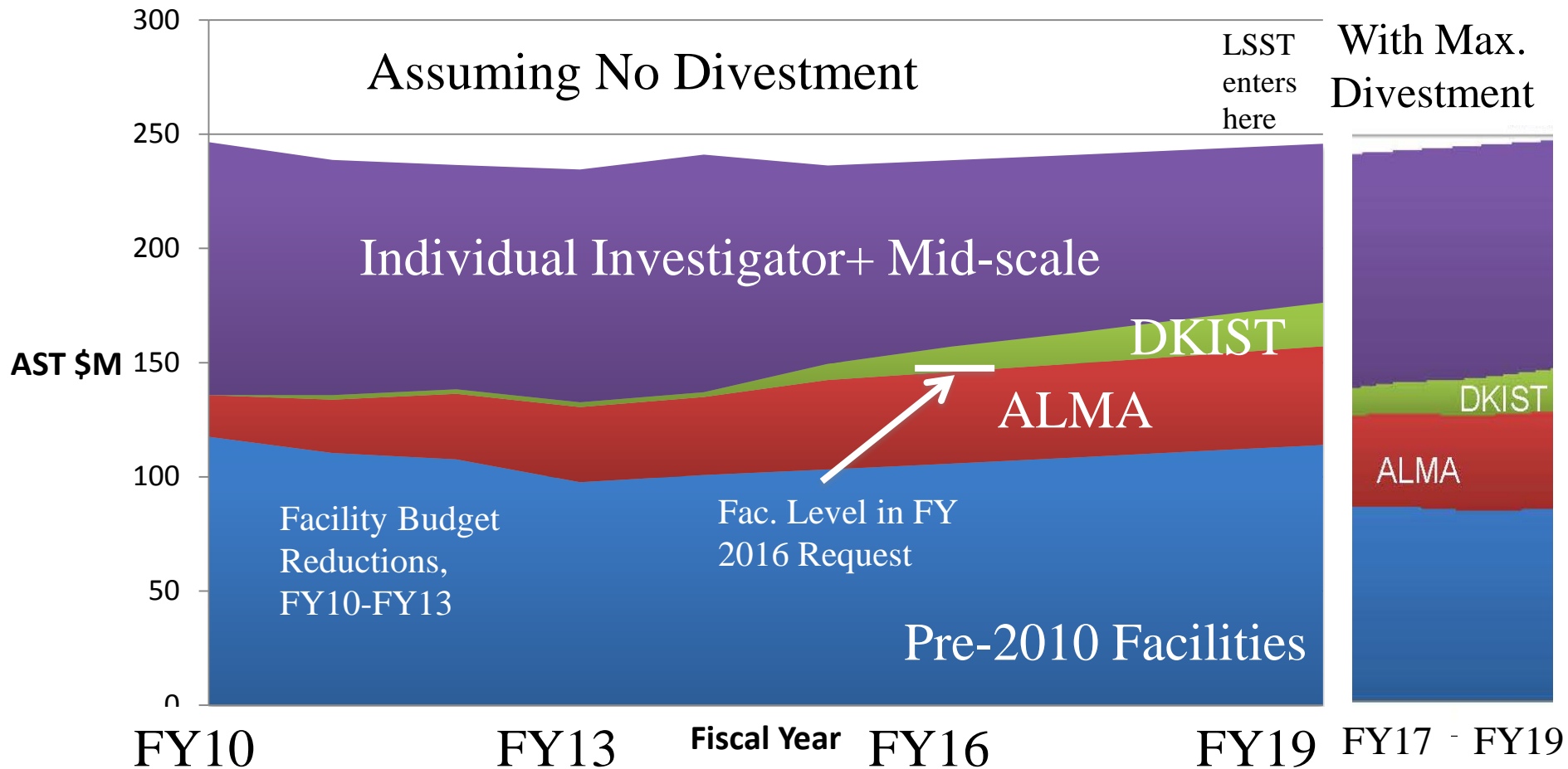


# Divestment Activities

- Portfolio review identified facilities recommended for divestment from AST budget, or for future consideration
- NSF (through a contractor) is currently concluding engineering studies and baseline environmental surveys for a number of telescopes and observatories
  - Goals: Identify key issues, bound costs of different alternatives, and provide NSF information needed to assess viability of options
- Generic alternatives
  - New partnership arrangements (preferred, but complicated)
  - Conversion to new mission, including scope reductions
  - Mothballing
  - Decommissioning
- Real progress being made on partnerships, with ongoing negotiations in many cases



# AST Portfolio Scenarios from FY 2013



- Chart above shows the maximum impact of divestment (or non-divestment) within a likely budget scenario



# What Comes Next

- After receiving engineering reports, NSF will identify viable options for evolution of different facilities/telescopes
  - If new partner options are in place for a facility, development of partner agreements may be the next step
  - Options such as scope reductions require study of alternatives, under National Environmental Policy Act
    - Formal and open process, including consultation of stakeholders and opportunity for comment/input
    - “No-action” alternative (i.e., continue operations as in the past) is always an alternative that must be considered
  - Following conclusion of formal alternative consideration, NSF will select a preferred alternative for each facility and then seek to execute that alternative



# Facility Futures

Telescope	Status
KPNO 2.1m	Caltech-led consortium (Robo-AO) operating for FY 2016-2018
Mayall 4m	Slated for DESI; bridge from NSF; NSF/DOE MOU in place
WIYN 3.5m	NOAO share to NASA-NSF Exoplanet Observational Research Program; NSF/NASA MOU in place for transition
GBT	Engineering study under way; separation from NRAO in FY 2017
VLBA	Engineering study under way; separation from NRAO in FY 2017
McMath-Pierce	Engineering study; university-led consortium seeking funding
GONG/SOLIS	SOLIS is off Kitt Peak; GONG refurbishment; MOU with NOAA in draft form
Dunn Solar Tel.	Engineering study under way; partner discussions in progress
Arecibo	Engineering study under way; issued Dear Colleague Letter seeking viable concepts for future operations (deadline January 15, 2016)
SOAR	Post-2020 status to be reviewed



# OIR System Study



# NRC/CAA OIR System Study

- “A Strategy to Optimize the U.S. Optical and Infrared System in the Era of the Large Synoptic Survey Telescope (LSST)”
- Recommended by AAAC in 2013
- Committee chaired by Debra Elmegreen, Vassar College
- Three face-to-face meetings in 2014
  - July 31/August 1; October 12-13; December 2-3
- Report delivered in April 2015
- NSF initial response in Dear Colleague Letter NSF 15-115, issued in August 2015
  - Extensive discussions and planning ongoing, with both NOAO and LSST



# OIR System Recommendations-1

- R1: Direct NOAO to administer telescope-time exchange system
  - Under discussion with NOAO; may need injection of funds
  - First, need data on who wants to offer time in marketplace
  - This is the most challenging recommendation
  
- R2: NOAO to lead community-wide planning process and facilitate System organizing committee. NSF would solicit proposals to meet prioritized capabilities.
  - A natural role for NOAO
  - [Action: See response to R3 below](#)





# OIR System Recommendations-2

- R3: Wide-field highly multiplexed spectroscopic capability
  - Community working group (R2) needed to define highest priority science case and instrument requirements.
  - Action: NSF wrote to NOAO and LSST in August asking them to work jointly to develop specific requirements for R3 and R4
  - Action: Kavli Institute is supporting a workshop in May 2016 to move toward development of specific instrument requirements. Input process for this workshop is under way



# OIR System Recommendations-2

- R4a: Support development of event brokers for LSST
  - Action: NSF is funding several projects along these lines
    - Zwicky Transient Facility through MSIP (see plenary talk)
    - INSPIRE grant: Joint Arizona-NOAO
  - Special instance of the more global issue of development of Level 3 data products for LSST
- R4b: Position Gemini-S for faint object spectroscopy early in era of LSST operations
  - Gen 4#3 instrument for Gemini may meet this recommendation
  - Action: Feasibility studies for Gen 4#3 completed, with summaries reported out at Gemini science meeting in June 2015
  - Action: Gemini Request for Proposals under construction, for release in 2016



# OIR System Recommendations-3

- R4c: Ensure that OIR system time can be allocated for faint transient observations prioritized by LSST event broker
  - Action: NSF is in discussion with Gemini partners and NOAO (see R4D below)
- R4d: Enhance coordination among federal telescopes in Southern Hemisphere to optimize LSST follow-up
  - Action: NSF has told AURA that the first LSST operations proposal must take advantage of synergies with NOAO (scientific and operational); ongoing discussions with LSST, NOAO, AURA, DOE
  - Action: Gemini (Gemini Board + Observatory) is presently developing a Strategic Science Vision that will incorporate the changed landscape of OIR telescopes in the post-2020 period
  - NSF believes that “follow-up” should mean coordination for a range of studies, not just for transient sources



# OIR System Recommendations-4

- R5: Plan for an investment in one or both Giant Segmented Mirror Telescopes
  - Action: MSIP competition is open to instrument proposals
- R6: Continue to invest in development of critical technologies, including Adaptive Optics and precision Radial Velocities
  - Action: Precision RV is a goal of NN-EXPLORE, with concepts for Extreme Precision Doppler Spectrometer now under evaluation by NASA, with NOAO and NSF input
- R7: Coordinated suite of schools, workshops, and training networks for training in instrumentation, software, and data analysis
  - AST believes this is not sufficient for maintaining and enhancing instrumentation and data science expertise, and will continue to consider possibilities



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# Questions?