



NSF Division of Astronomical Sciences (AST) Program Update

Ralph Gaume

Division Director (acting)

March 29, 2017



High-Level Summary

- Outstanding science opportunities offered/developed
 - ALMA, EVLA, Dark Energy Camera, DKIST, LSST
 - >100 research awards/yr in AAG, plus MSIP, ATI, AAPF, REU, PAARE
 - Interagency and International collaborations: DES, DESI, NN-EXPLORE, Arecibo, LBO, ALMA, Gemini, LSST.
 - Beyond AST budget, NSF FY17 budget requests over \$87 million on construction of AST facilities (DKIST and LSST)
- Budget
 - FY 2017 budget is still unknown (CR through 28 April)
 - Unknown prospects for FY 2018 budget
 - Unknown prospects for budget increases this decade
- Hiring Freeze, upcoming Attrition Plan
- Divestment of some NSF/AST facilities
- NSF Management transitions
- NSF is moving
- Challenges are many, but our community continues to make progress at the science frontiers



Highlights



ALMA: HD 163296

- ALMA observed both (1.3mm) dust and gas (^{12}CO , ^{13}CO , C^{18})
- Three gaps observed in dust ring:
 - At 60, 100, 160 AU
- 2nd and 3rd ring depleted in both gas and dust, attributed to potential Saturn mass planets.
- 1st ring depleted in dust, but not gas, dust gap possibly created by non-planetary process.
- Isella et al., 2016 (Phys. Rev. Lett. 117, 25)



Arecibo, VLA, VLBA, Gemini: FRB 121102

- Fast Radio Bursts (FRB) are (1-10) millisecond radio pulses of astronomical origin, discovered 2007
- FRB 121102 discovered at Arecibo Observatory during Pulsar ALFA survey
 - Follow up subsequently discovered 10 additional bursts.
- Spitler et al., 2016, (Nature 531, 7593)
- VLA localized the position, and discovered persistent component
- VLBI established coincidence of burst and persistent sources (within 100 ly)
- Gemini N observations associated the position with a dwarf galaxy
- Lead-off AAS press conference in Jan.



Credit: Danielle Futselaar



Daniel K. Inouye Solar Telescope (DKIST)

- DKIST will be a 4.2-meter solar telescope to study the Sun at the fundamental 20-km scale of the solar magnetic structures.
- Completion in FY 2020 at Haleakala Observatory (Maui).
- Hawaii Supreme Court affirmed construction permit (Oct. 6)
- Top: Artist's view of DKIST enclosure with cutaway
- Bottom: Base ring of Telescope Mount Assembly (right) inside the DKIST enclosure (left).





Large Synoptic Survey Telescope

- 10 year survey of 10s of billions of objects in space and time
- F1.2, 8.4m primary, FOV 3.5d (9.6 sq d)
- 3.2 Gpixel camera, 2 sec readout, ~15 TB per night
- 825 visits per pointing (main survey = 18,000 sq d)
- ~10 M alerts per night, 60 sec latency
- Construction progressing, late 2022 start date for survey.





Transitions



Personnel Transitions: AST and MPS

- Ralph Gaume was selected as Deputy Division Director in Nov. 2016
 - Was in acting DDD role from June - November 2016
- NSF is conducting a search for a new AST Division Director, to replace Jim Ulvestad
 - Job opened November 1, 2016, closed February 6, 2017
 - Recruitment committee was established: Roger Blanford, Joel Bregman, Debra Elmegreen, Lyman Page, Caty Pilachowski
- **Recent transitions**
 - NSF Assistant Director (AD) overseeing Directorate for Mathematical and Physical Sciences (MPS), Fleming Crim, completed his 4-yr term on January 13, 2017.
 - Jim Ulvestad became (acting) AD for MPS on January 14, 2017
 - Ralph Gaume became (acting) Division Director for AST
 - Ed Ajhar became (acting) Deputy Division Director for AST



Division of Astronomical Sciences (AST)

Office of the Division Director



Ralph Gaume

**Acting Divisor
Director**



Edward Ajhar

**Acting Deputy
Division Director**



Craig McClure

Program Support Manager



Donna O'Malley

*Financial & Operations
Specialist*



Vernon Pankonin

Senior Advisor



Elizabeth Pentecost

Project Administrator

Administration



Allison Farrow

Program Specialist



Stephanie Hill

*Program Assistant
(Student)*



Diana Phan

Program Analyst



Matthew Viau

Program Specialist

Individual Investigator Programs and Astronomy & Astrophysics Research Grants



James Neff

Program Director
IIP Coordinator;
Education &
Special
Programs
(REU, PAARE)



Richard Barvainis

Program Director
Extragalactic
Astronomy &
Cosmology



Glen Langston

Program Director
Galactic
Astronomy



Harshal Gupta

Program Director
Astronomy &
Astrophysics
Postdoctoral
Fellowships



Joan Wrobel

Program Director
CAREER;
Extragalactic
Astronomy &
Cosmology



Faith Vilas

Program Director
Solar and
Planetary
Research
Grants



Hans Krimm

Program Director
Stellar
Astronomy &
Astrophysics



Peter Kuzczynski

Program Director
Advanced Technologies
& Instrumentation,
Major Research
Instrumentation



Linda French

Program Director

Facilities, Mid-Scale, & MREFC Projects



Christopher Davis

Program Director
Gemini
Observatory



Philip Puxley

Program Director
National Radio
Astronomy
Observatory



David Boboltz

Program Director
National
Solar
Observatory



Nigel Sharp

Program Director
Large Synoptic
Survey
Telescope



Edward Ajhar

Program Director
Green Bank
Observatory, Long
Baseline Observatory



Joe Pesce

Program Director
**Arecibo
Observatory**

Vernon Pankonin
National Optical Astronomy Observatory

Richard Barvainis
Mid-Scale Innovations Program

Philip Puxley
Atacama Large Millimeter Array

ESM



Thomas Wilson

Program Director

Joe Pesce
Program Director



NST/AST Hiring

- AST Division Director
 - Closed February 6th

- AST program...

ON HOLD

- ... General Employee

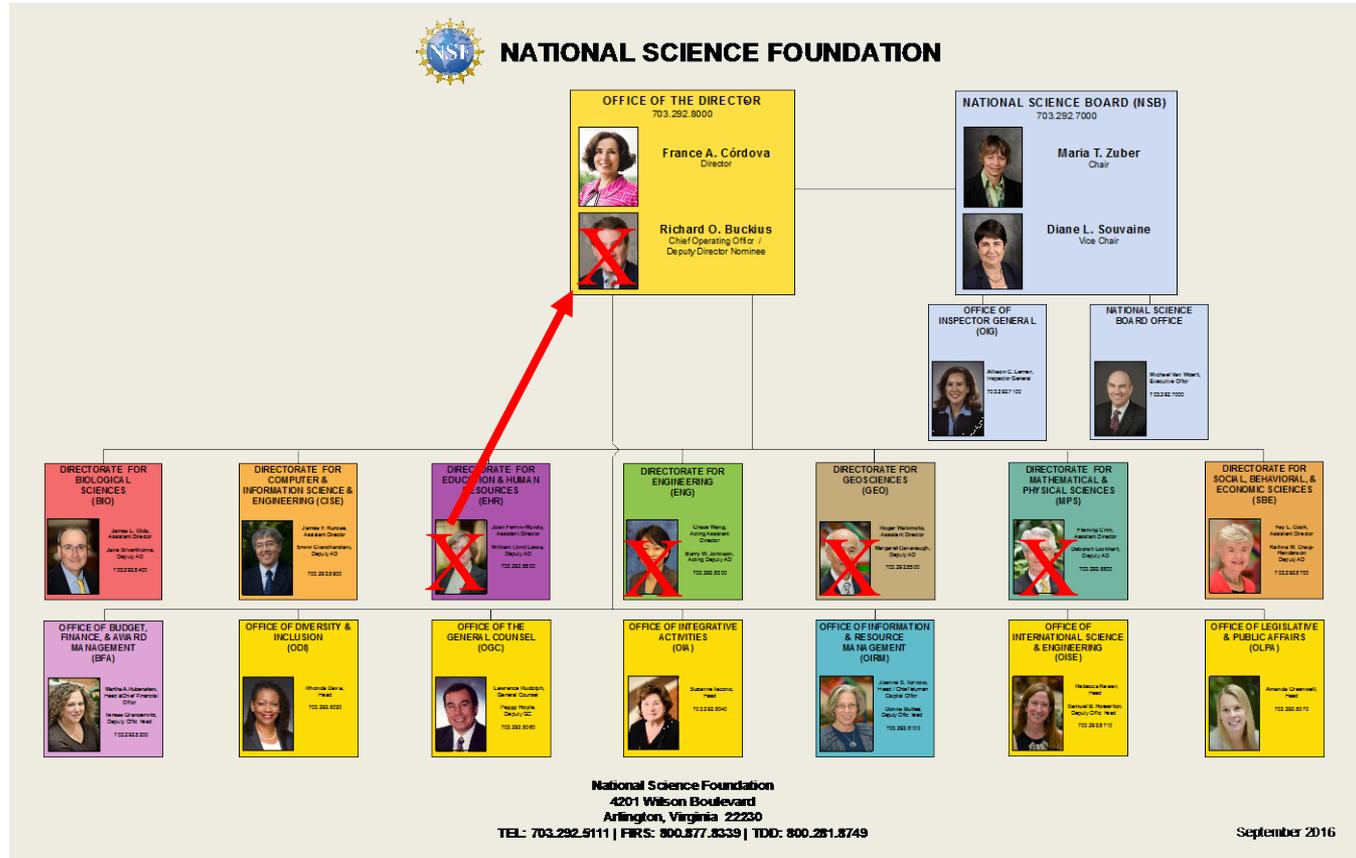
potential for one or more hires (potential for 2nd ESM hire)

- AST Rotators, Intergovernmental Personnel Act (IPA)
 - Open until filled, Google: [NSF AST 17-001](#)
 - AST Dear Colleague Letter (AST-17-001)



Transitions: NSF

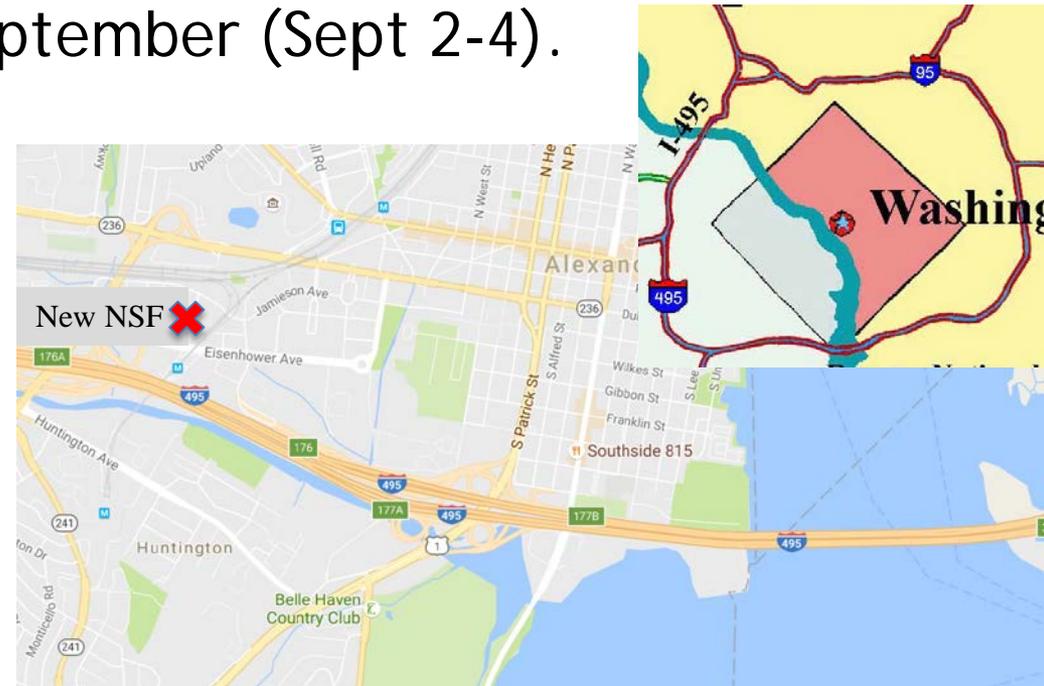
- Major NSF leadership transition
- January 2017: New Acting ADs for MPS, ENG
- February 2017: New Acting ADs for EHR, GEO, and new Acting Chief Operating Officer





NSF is Moving!

- NSF will move from its current location in Arlington, Virginia to a location in Alexandria, Virginia in July-September 2017.
- The Directorate for Mathematical and Physical Sciences, including AST, is scheduled to move over the extended Labor Day weekend in September (Sept 2-4).





Budget



New NSF Authorization Bill

- “American Innovation and Competitiveness Act” passed Congress in December 2016.
 - Awards should be in the national interest—tied to Broader Impacts review criterion
 - No funding levels specified for NSF as a whole, or for individual Directorates
 - Considerable direction regarding facility oversight
- See FYI #156 (20 Dec 2016) at www.aip.org/fyi
- Committee on Science, Space, and Technology (SST) intends to pursue a fresh NSF authorization bill in the current Congress (See FYI #33 (17 March 2017)
 - Two hearings thus far: March 9 & 21



FYI: The AIP Bulletin of Science Policy News

A publication of the American Institute of Physics

Number 156: December 20, 2016

In Surprise Move, House Sends America COMPETES Act Successor to President

In what one senator called an “*overtime victory for science in the closing days of 2016*,” the House passed the Senate’s “American Innovation and Competitiveness Act,” a bipartisan successor to the America COMPETES Acts of 2007 and 2010. President Obama is expected to sign it into law.

Many assumed that time had run out for the “[American Innovation and Competitiveness Act](#)” (AICA) to become law this year. But at the eleventh hour, the Senate was able to negotiate a version of the AICA that could secure bipartisan and bicameral support, and both chambers passed the bill in the waning days of the 114th Congress.

Sponsored by Sens. Cory Gardner (R-CO) and Gary Peters (D-MI), the AICA emerged this year as a potential successor to the America COMPETES Act. The final bill includes compromises in a number of policy areas, ranging from grant evaluation criteria to funding authorizations to large facility management. Notably, the most controversial provisions from the House’s counterpart to the AICA, the “[America COMPETES Reauthorization Act of 2015](#),” are excluded from the final bill.

First update to COMPETES since 2010

First enacted to much fanfare in 2007 and last updated in 2010, the COMPETES law has been used to set policy for the National Science Foundation, the National Institute of Standards and Technology, the Office of Science and Technology Policy, the Department of Energy Office of Science, and various STEM education programs across the federal government.

Since 2010, multiple attempts to update the legislation failed to win support from both chambers. Most recently, the House [approved](#) a COMPETES reauthorization in 2015, but the bill faced [strong opposition](#) from the scientific community and key Democrats. The bill passed on a party-line vote and the Senate never took it up.

In contrast with the House’s approach, this year the Senate opted to develop a bill which could garner broad bipartisan support. After holding three roundtables with leaders from the R&D community, the Senate introduced the AICA this June and passed a modified version on Dec. 10 just before leaving town for the year.

However, by then the House had already adjourned, leading many to believe that the bill had no chance of making it across the finish line in the current Congress. Even leaders of the Senate Commerce Committee, which drafted the legislation, [expressed](#) to think that time had run out. [Despite](#) that, the committee would



FY 17 Budget

- Continuing resolution through April 28
 - Level-funding is fine, in principle, but,
 - Difficult to execute a budget when the top line is unknown...
- After April 28 we don't know...
 - 5 months left in FY 2017
 - President's FY 2018 Budget Blueprint has requested a \$28B supplement to the discretionary budget for FY 2017 partly offset by a reduction of \$18B in non-defense discretionary funding.



FY 2015-2017 Budget for MPS & AST

\$M	FY15 Actual	FY16 Request	FY16 Estimate	FY17 Request Total	FY17 Request Disc.
NSF Total	7344	7724	7464	7964	7564
NSF R&RA	5934	6186	6034	6425	6079
MPS	1337	1366	1349	1436	1355
AST	245.2	246.5	246.7	262.6	247.7



FY 2017 AST Request: \$262.6 M

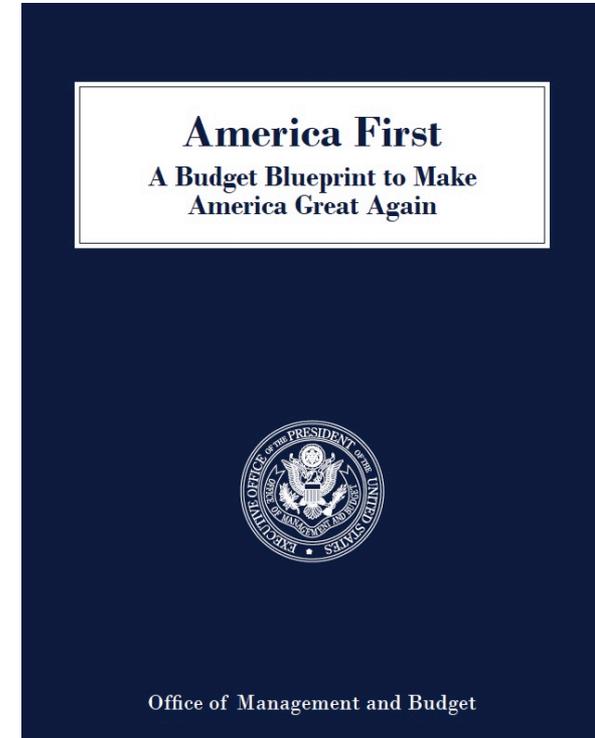
Program	\$M	Program	\$M
ALMA	43.25	AAG	43.38
NRAO	32.00	MSIP	18.00
NOAO	21.83	ATI	8.00
Gemini	20.42	CAREER	4.90
DKIST	14.00	AAPF	2.40
GBO+VLBA	11.50	REU	2.00
NSO (sans DKIST)	6.00	PAARE	1.50
Arecibo	4.20	“Mandatory”	14.88
DKIST mitigation	2.00	Misc+expenses*	12.35

*Misc+expenses includes Panels, IPAs, GSMT, DESDM, KITP, SPT, Spectrum, Education/Special Programs, Aspen Center, NSF ops, unallocated grants, etc.



FY 2018 Budget

- NSF was not explicitly cited in “America First”
- Details for all other agencies are expected in future full Budget



50

SUMMARY TABLES

Table 2. 2018 Discretionary Overview by Major Agency

(Net discretionary BA in billions of dollars)

	2017 CR/Enacted ^{1,2}	2018 Request ²	2018 Request Less 2017 CR/Enacted	
			Dollar	Percent
Base Discretionary Funding:				
Other Agencies	29.4	26.5	-2.9	-9.8%
Subtotal, Discretionary Base Budget Authority	1,068.1	1,065.4	-2.7	-0.3%

- NSF cannot discuss full Budget details until public release due to pre-decisional nature.

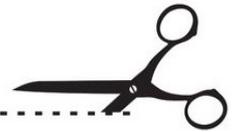
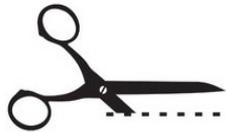


FY 2018 Budget

Table 2. 2018 Discretionary Overview by Major Agency

(Net discretionary BA in billions of dollars)

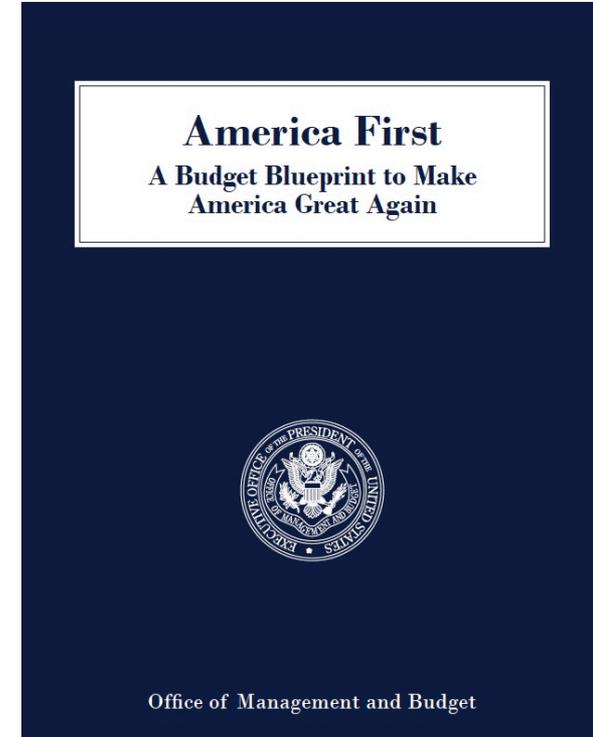
	2017 CR/Enacted ^{1,2}	2018 Request ²	2018 Request Less 2017 CR/Enacted	
			Dollar	Percent
Base Discretionary Funding:				
<hr style="border-top: 1px dashed black;"/>				
Other Agencies	29.4	26.5	-2.9	-9.8%
Subtotal, Discretionary Base Budget Authority	1,068.1	1,065.4	-2.7	-0.3%





FY 2018 Budget

- NSF was not explicitly cited in “America First”
- Details for all other agencies are expected in future full Budget

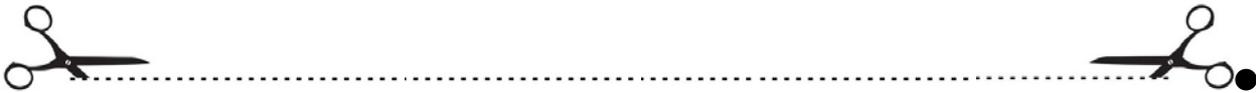


50

SUMMARY TABLES

Table 2. 2018 Discretionary Overview by Major Agency
(Net discretionary BA in billions of dollars)

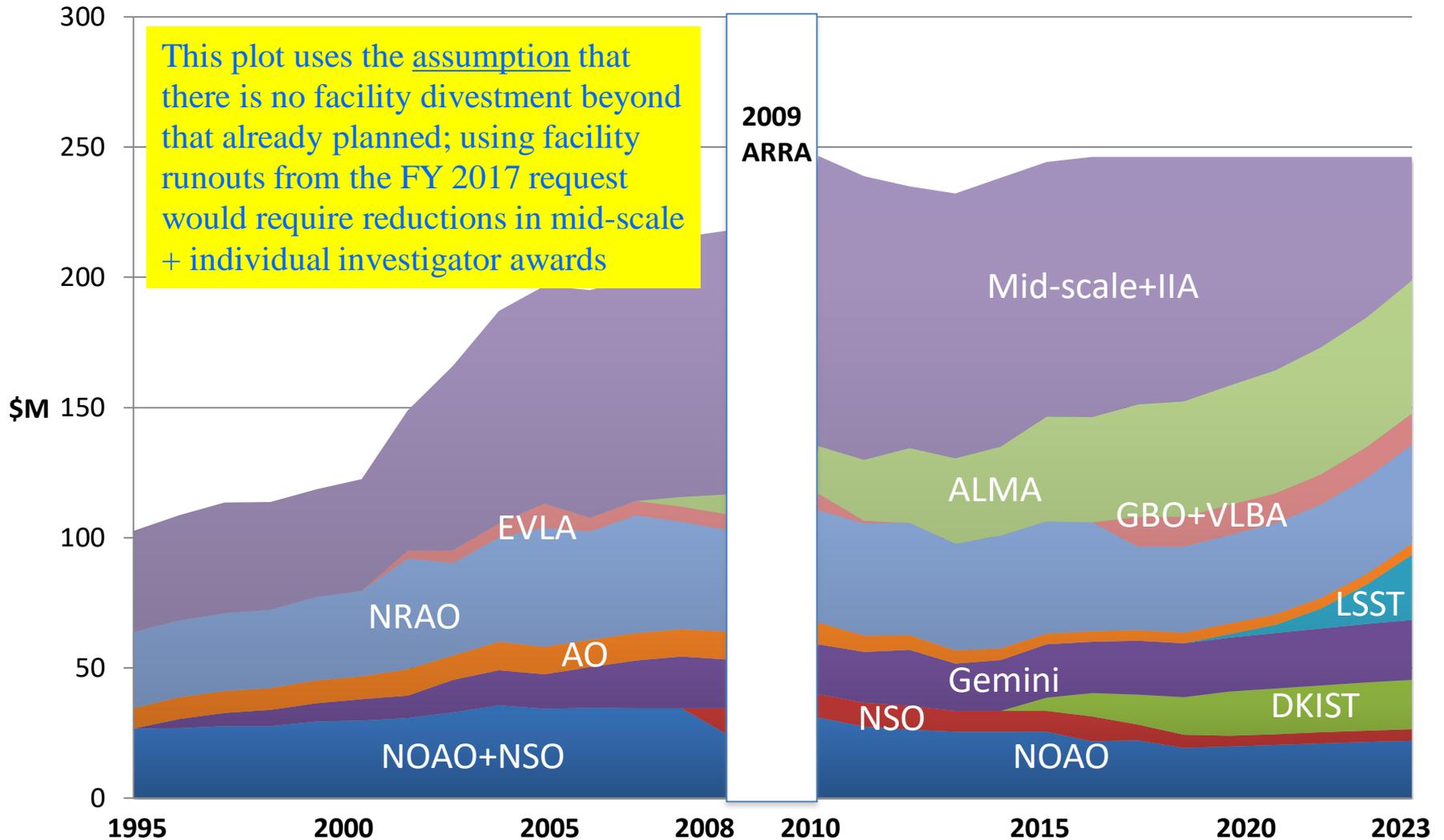
	2017 CR/Enacted ^{1,2}	2018 Request ²	2018 Request Less 2017 CR/Enacted	
			Dollar	Percent
Base Discretionary Funding:				
Other Agencies	29.4	26.5	-2.9	-9.8%
Subtotal, Discretionary Base Budget Authority	1,068.1	1,065.4	-2.7	-0.3%



- Full Budget release anticipated in mid-May.
- FY 2018 appropriation date uncertain.

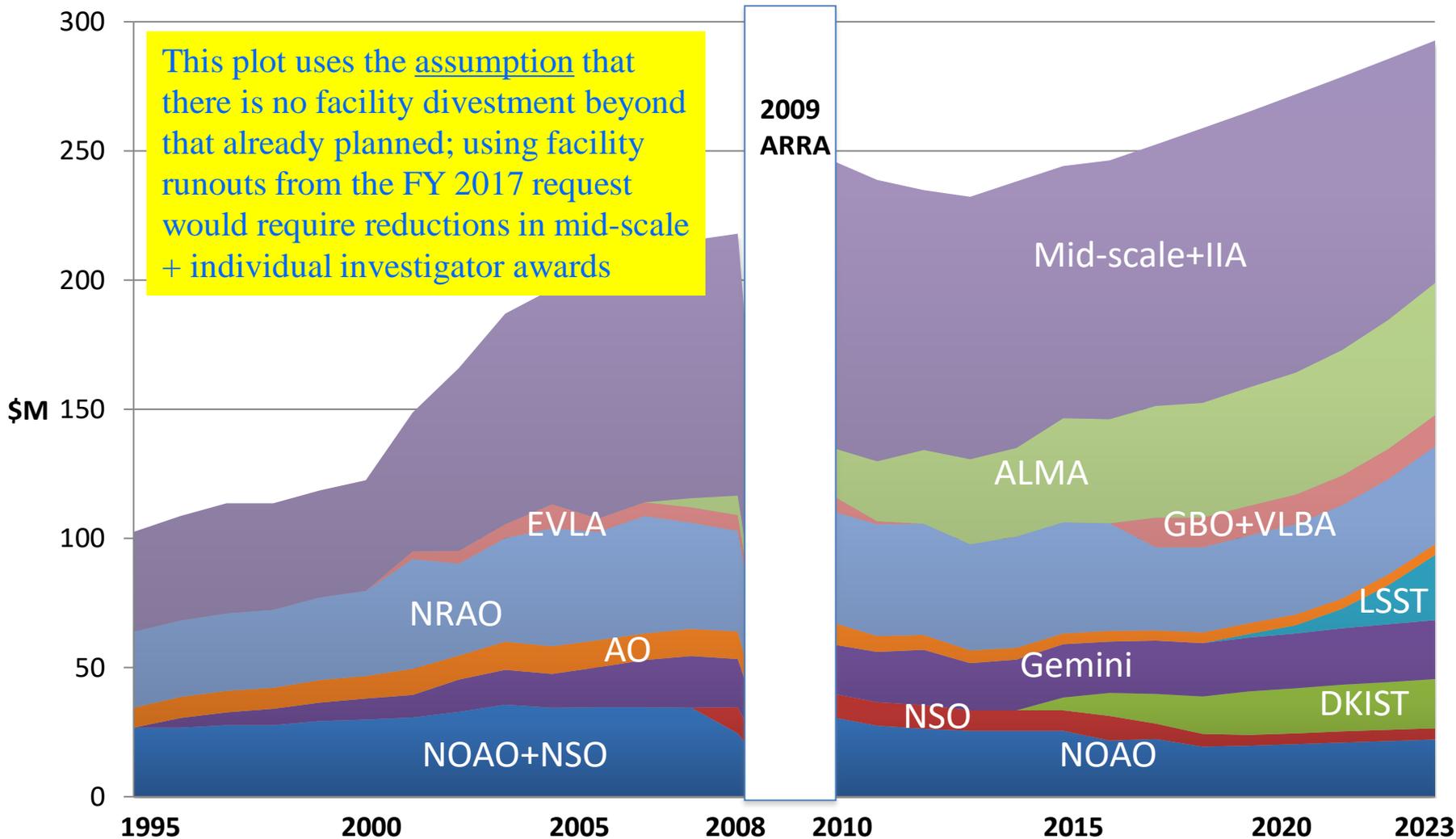


AST, Hypothetical 0.0%/yr Increase after FY16



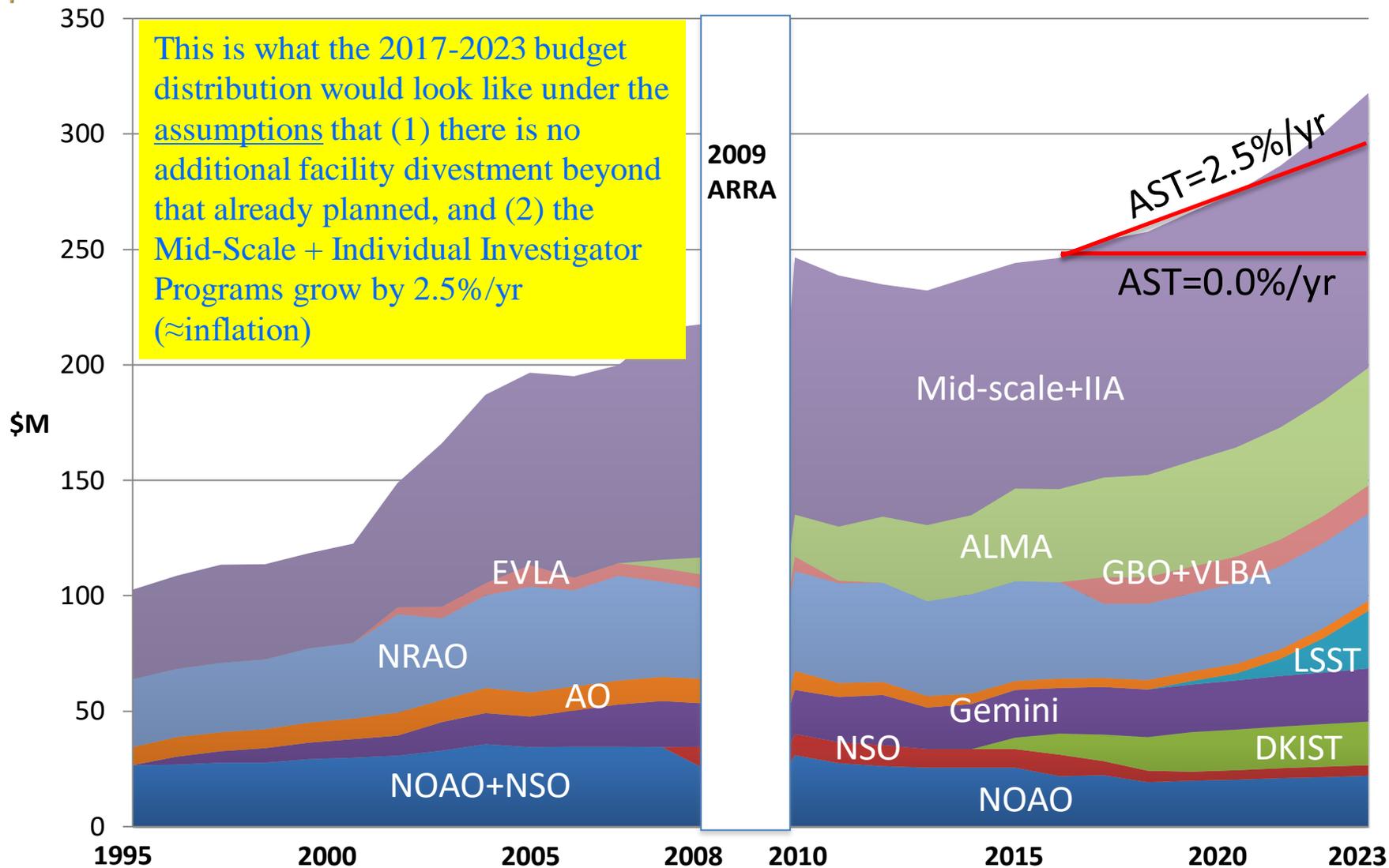


AST, Hypothetical 2.5%/yr increase after FY16





Hypothetical “Constant” Individual Investigator Program





IIP update



IIP Update

- AAG submission deadline was 15 November
 - 592/463 proposals/projects in EXC+GAL+SAA (minus solar)
 - 2% more proposals than 2016, but fewer than peak in 2015
 - Panels underway
- *No Proposal Deadline* pilot underway for the Planetary/Exoplanetary and Solar portions of AAG
 - Will make an assessment at the end of the year
 - Planetary: proposals significantly down, 1 panel has run, another scheduled
 - Solar: proposals slightly up (DKIST effect?), 1 panel scheduled
- Mid Scale Instrumentation Program (MSIP)
 - Update (next chart)



MSIP Round 2 Awards, FY 2016-2017

Awarded Proposal	PI	Total NSF Funds	Yr Funded
Zwicky Transient Facility	Kulkarni	\$9.0M	FY 2014
Advanced ACTPol	Staggs	\$10.0M	FY 2014
H Epoch of Reionization Array	Parsons	\$2.1M	FY 2014
Event Horizon Telescope	Doeleman	\$6.5M	FY 2015
POLARBEAR	Lee	\$5.0M	FY 2015
NANOGrav Phys Frontier Ctr	Siemens	\$14.5M (AST 20%)	FY 2015
CARMA closeout	Carlstrom	\$2.0M	FY 2014
CLASS-CMB, Large Ang. Scale	Bennett	\$4.4M	FY 2016
TolTEC, mm camera on LMT	Wilson	\$6.1M	FY 2016/17
HERA	Parsons	\$9.5M	FY 2016/17
SuMIRE (Subaru galaxy surv.)	Strauss	\$5.5M	FY 2016
CHARA (open access)	ten Brummelaar	\$3.9M	FY 2016
Las Cumbres (open access)	Boroson	\$3.0M	FY 2016/17
MAPS: The MMT Adaptive optics exoPlanet characterization System	Hinz	\$2.0M	FY17



New Worlds New Horizons: Midterm Assessment



New Worlds, New Horizons: A Midterm Assessment

- *Recommendation 3-1: “National Science Foundation (NSF) should proceed with divestment from ground-based facilities which have a lower scientific impact, implementing the recommendations of the NSF [AST] Portfolio Review, that is essential to sustaining the scientific vitality of the U.S. ground-based astronomy program as new facilities come into operation.”*
 - Response: NSF is very actively pursuing divestment, including partnerships, collaborations, and development of three Environmental Impact Statements.
 - Savings forecasted to date are approximately \$10-12 million, compared to ~\$40 million recommended by Portfolio Review.
 - These savings, together with other difficult programmatic decisions, have enabled the Astronomy and Astrophysics Research Grants (AAG) program to return to the same level as FY 2010 and FY 2011, while bringing ALMA into full operations and starting the Mid-Scale Innovations Program.



New Worlds, New Horizons: A Midterm Assessment

- *Recommendation 3-2: “The NSF and the National Science Board should consider actions that would preserve the ability of the astronomical community to fully exploit the Foundation’s capital investments in ALMA, DKIST, LSST, and other facilities. Without such action, the community will be unable to do so because at current budget levels the anticipated facilities operations costs are not consistent with the program balance that ensures scientific productivity.”*
- Response: This recommendation is aimed primarily at the larger NSF, not just at AST. It has contributed to an ongoing discussion about the challenges of balancing facility operations with other elements of the AST program. *The FY 2018 budget request is in preparation and all information with respect to the budget request is embargoed.*



Optimizing the US Ground-Based OIR System

OIR System Optimization Report

Recommendations

- 1/ Develop telescope time exchange **Capability**
- 2/ Enable on-going community-wide planning process
- 3/ Develop optical wide-field MOS capability in South

- 4A/ Develop LSST-scale event brokers **Time-domain**
- 4B/ Ensure faint object spectroscopy at Gemini South
- 4C/ Develop time-domain follow up capability
- 4D/ Enhance coordination of Gemini, NOAO, LSST

- 5/ Invest in one or both GSMT projects **The Future**
- 6/ Invest in instrument technology development (various)
- 7/ Support training programs in instrumentation, software, and data analysis expertise

**NOAO indicated explicitly
in many cases**

NSF Provided Directives to NOAO

The topical areas are based on OIR System Optimization recommendations.

1. Telescope Time Exchange & Data Access Across the OIR System
2. Planning New Capabilities
3. Event Broker Development, Archives, and Data Products Serving
4. LSST Follow-up Coordination
5. Community Preparation for the LSST Era

Overarching

- Much of this is “up scope”, beyond NOAO base budget.
- NSF has requested, and NOAO is providing, plans for possible funding.
- Initial Supplemental Funding Request (SFR) awarded in FY16.
- Larger SFR to cover FY 17, 18, & 19 is being prepared for submission
- Initial response to #2 above covered by Kavli sponsored workshop on capabilities needed to exploit LSST data.



Divestment



AST Budget Pressures

- Must plan for possibility of no budget increases for the balance of the decade or even, perhaps, decreases
- Need to balance facilities, small and mid-scale programs and individual investigator grants
- Mid-decadal survey report stated:

“The LSST operations cost of \$8 million at first, growing to \$25 million, will be an additional burden on the AST budget in the first half of the next decade. The committee strongly supports the goal of a balanced program that includes facilities, medium scale initiatives, and small-scale initiatives. Maintaining this balance is a challenge at the current level of funding.”



Transitions in AST Techniques

- Solar physics
 - DKIST is the first new AST solar observatory since ~1970.
 - Moving to combination of routine solar disk monitoring with investigations at fundamental length scale on Sun
- Night-time OIR astronomy
 - Concluding transition from era of multi-user 2-4m telescopes
 - Multi-user 6-10m telescopes, plus telescopes primarily dedicated to one or a few large projects and data sets
- Radio astronomy
 - Concluding transition from single-dish telescopes with limited angular resolution to versatile interferometers with arcsecond and subarcsecond imaging capability
- Each transition takes decades to occur
- Transitions track science and facility recommendations in decadal surveys



AST Facility Portfolio

- Portfolio Review Committee was commissioned in 2011 as broadly representative subcommittee of MPS Advisory Committee
- Portfolio Review Committee reported out in August 2012
 - Recommended a balance of small, medium and large programs that would require divestment of a number of operating telescopes from AST budget
 - Community Advice, including both the Astronomy and Astrophysics Advisory Committee (AAAC), National Academies Midterm Assessment of the decadal survey, and the CAA recommended (using the words of the CAA) that “Strong efforts by NSF for facility divestment should continue as fast as is practical.”



What Does “Divestment” Mean?

- The recommendations of the Portfolio Review Committee solely referred to removal of the funding of telescopes from the NSF/AST budget.
- Telescopes recommended for divestment are still important, and in some cases unique assets for astronomical research or other related uses.
- Hence the preferred divestment alternative, pursued vigorously by NSF since 2012, has been to find funding collaborations that enable some continued availability of NSF telescope assets for the research community.

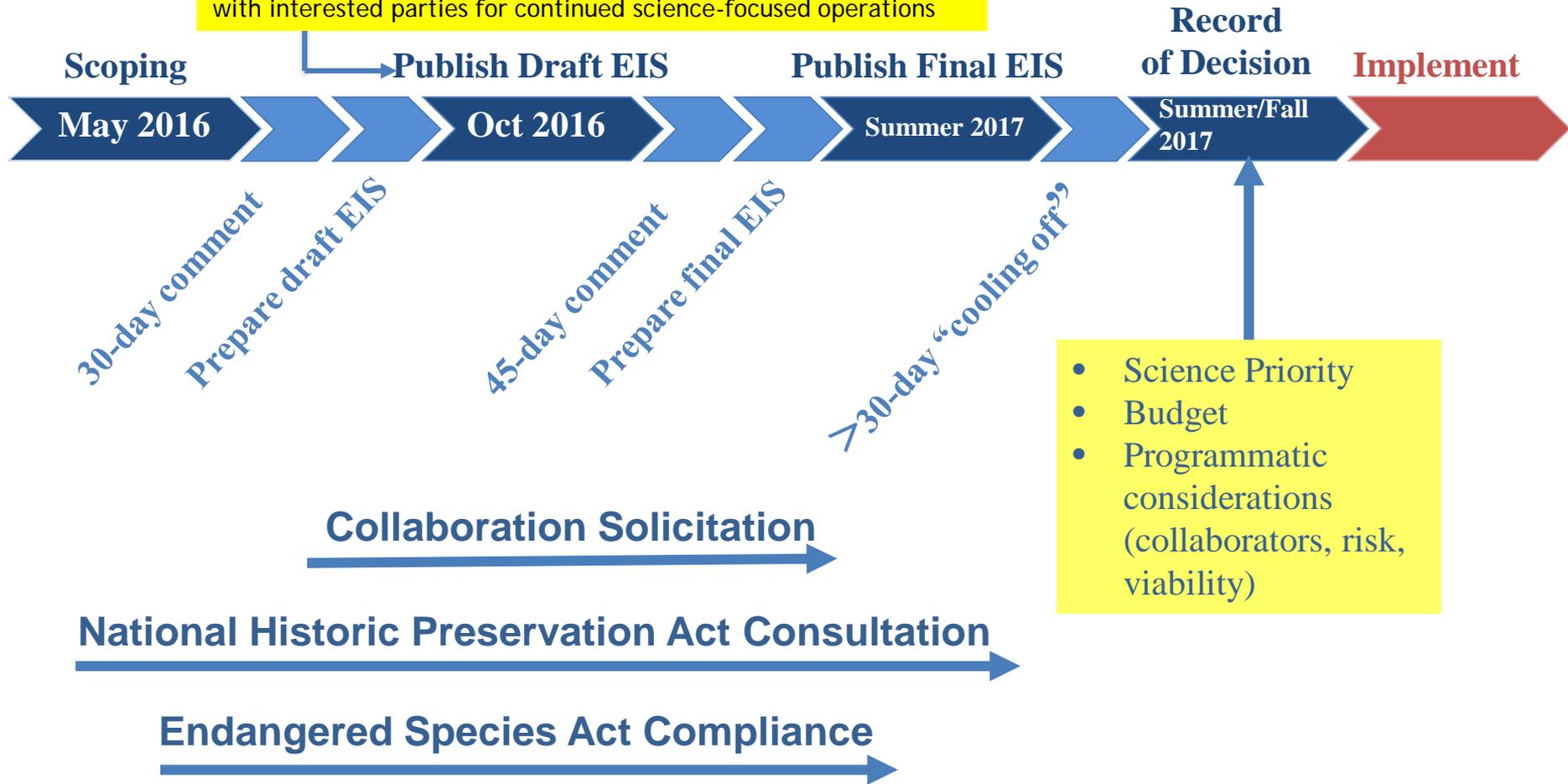


Divestment Summary

Telescope	Status
KPNO 2.1m	Caltech-led consortium (Robo-AO) operating for FY 2016-2018.
Mayall 4m	Slated for DESI; bridge from NSF to DOE; NSF/DOE MOU for transition.
WIYN 3.5m	NOAO share to NASA-NSF Exoplanet Observational Research Program; NSF/NASA MOU in place; NASA instrument selected.
GBO	~25% collaboration for basic scope; started Environ. Impact Statement (EIS) process on October 19. DEIS under prep
LBO/VLBA	Separation from NRAO in FY 2017; MOA with US Navy in place
McMath-Pierce	No obvious partner opportunities; very small user community.
GONG/SOLIS	SOLIS is off Kitt Peak; GONG refurbishment; Interagency Agreement with NOAA signed (NOAA sharing GONG operations costs).
Sacramento Pk.	University consortium in development, and NSF funded NMSU for transition to consortium; started EIS process; completion in 2017.
Arecibo	Formal EIS process under way, and issuance of Record of Decision targeted for 2017. Draft EIS released October 28. Final EIS under prep.
SOAR	Post-2020 status to be reviewed.

Target Dates for Arecibo Environmental Impact Statement (EIS)

Arecibo DEIS identified agency preferred alternative: Collaboration with interested parties for continued science-focused operations



Sac Peak and Green Bank are on similar paths, 2-6 months behind Arecibo.



Arecibo Solicitation

- Released: Wednesday January 25, 2017
- Proposals Due: Tuesday April 25, 2017
- Solicitation supports EIS through improved definition regarding the nature of potential collaborations with interested parties
- Voluntary committed cost-sharing is allowed:

- Funding profile:
- NASA to continue at current levels

Project Year	FY	NSF		
		MPS/AST	GEO/AGS	TOTAL
1	18/19	\$3,600,000	\$3,550,000	\$7,150,000
2	19/20	\$2,500,000	\$2,500,000	\$5,000,000
3	20/21	\$1,750,000	\$1,750,000	\$3,500,000
4	21/22	\$1,250,000	\$1,250,000	\$2,500,000
5	22/23	\$1,000,000	\$1,000,000	\$2,000,000

- Financial Viability is a major evaluation factor
- Title transfer will be considered