AST Portfolio Review and Divestment Update

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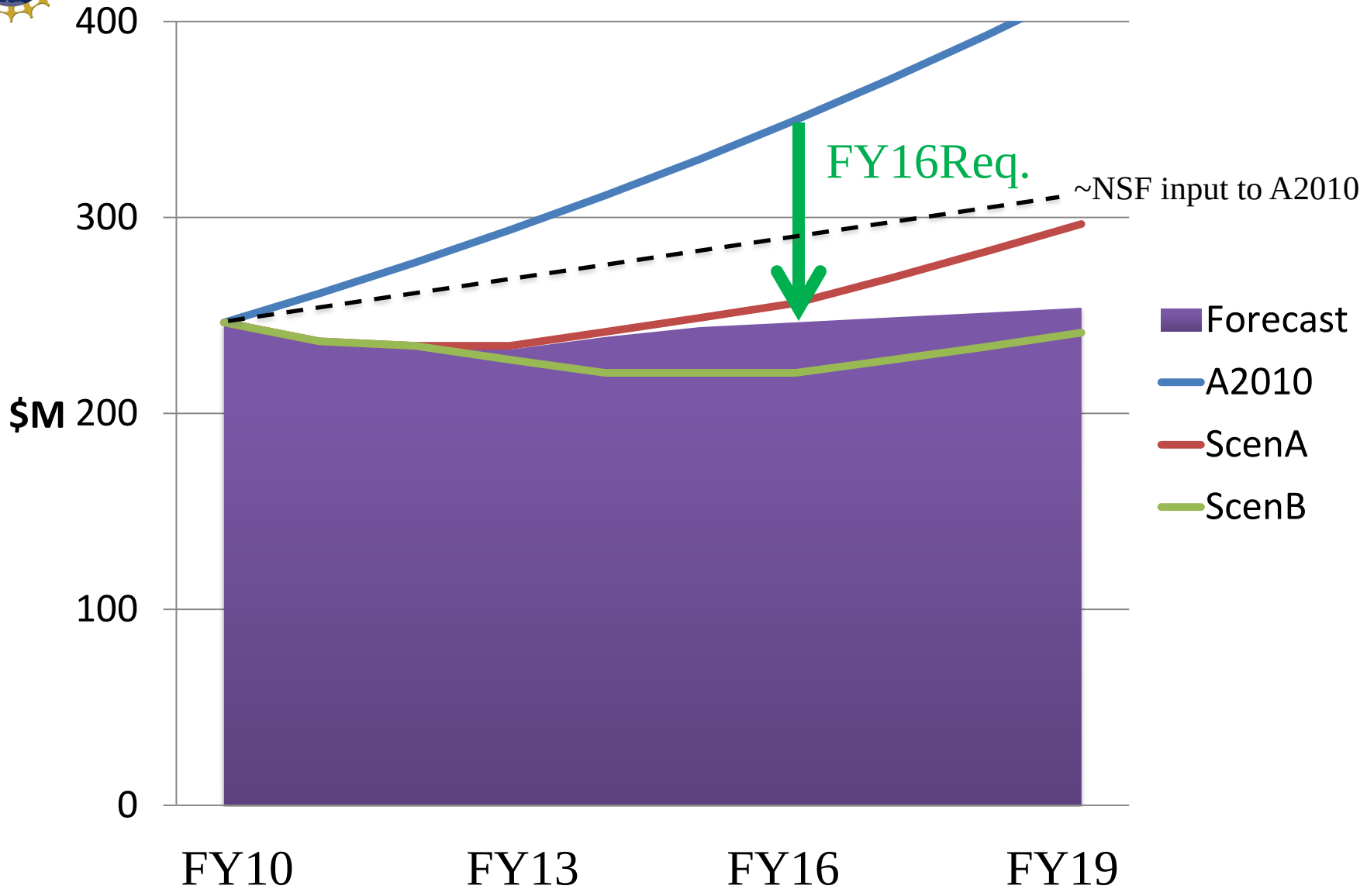
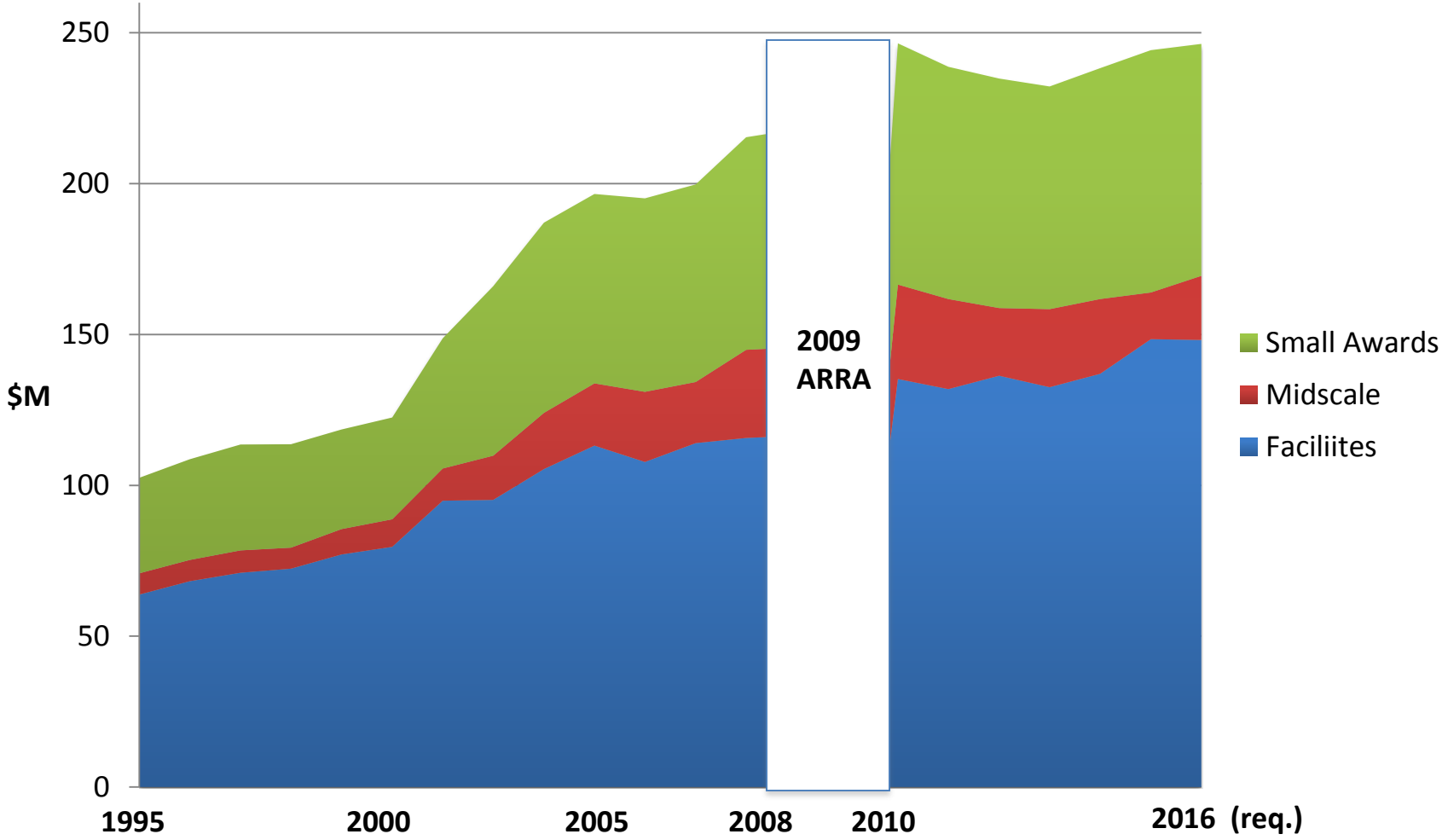
NWNH Budget vs. Actual AST Budget



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

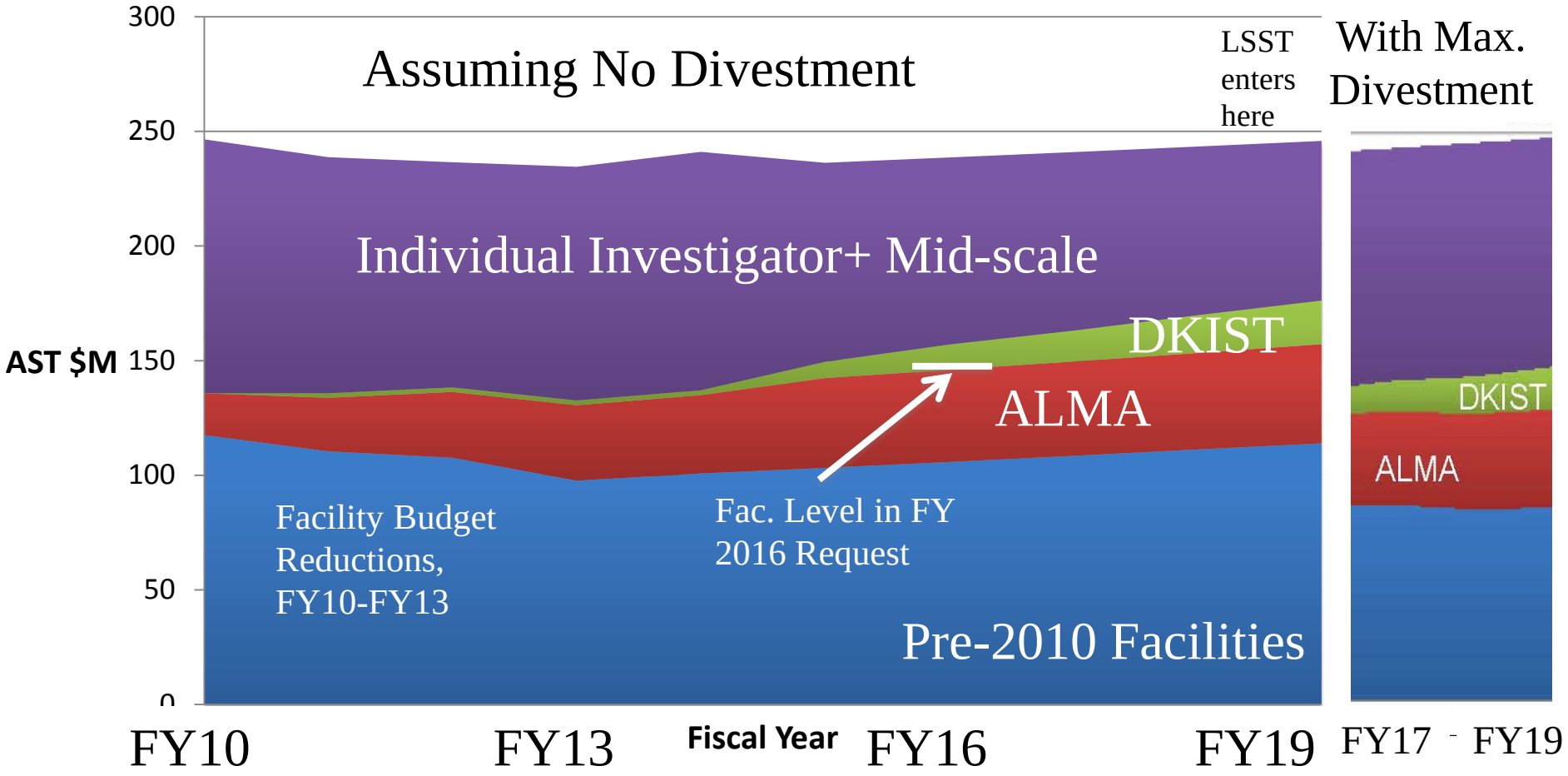
Next "Senior Review"

- *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 received in August 2012 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

AST Portfolio Scenarios from FY 2013



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

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

What Comes Next

- After receiving engineering reports during FY 2016, NSF will identify viable options for evolution of different facilities/telescopes
  - If new partner options are in place for a facility, development or completion 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 for transition
WIYN 3.5m	NOAO share to NASA-NSF Exoplanet Observational Research Program; NSF/NASA MOU in place
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; responses received January 15, 2016, to Dear Colleague Letter seeking viable concepts for future operations; analysis of responses is ongoing
SOAR	Post-2020 status to be reviewed

Divestment 1-Kitt Peak

- Mayall telescope: slated for DOE-supplied Dark Energy Spectroscopic Instrument (successor to BigBOSS concept)
  - NSF providing bridge funding in FY 2016 and FY 2017, with combination of DESI targeting survey and open access
  - DOE will take over majority of funding in FY 2018, leading to DESI prime mission and full DOE funding in FY 2019
  - Small amount of community time may be available after FY 2018
- WIYN telescope: NASA/NSF Partnership for Exoplanetary Research (NN-EXPLORE)
  - NSF continuing to fund NOAO share of WIYN operations, currently being used for exoplanet research with existing instrumentation
  - NASA funding development of Extreme Precision Doppler Spectrometer (EPDS), aiming for installation in FY 2018-2019
  - NN-EXPLORE will focus on EPDS usage after installation
- 2.1-m: Caltech-led consortium, 2016-2018; Robo-AO

Divestment 2-GBT and VLBA

- Engineering studies under way for both
- GBT and VLBA were not included in recent NRAO management competition, and will be separated from NRAO after September 30, 2016
- VLBA funding partnerships include USNO partnership for measurement of Earth-orientation parameters and maintenance of celestial reference frame
- GBT funding partnerships include Breakthrough Prize Foundation usage for Search for Extraterrestrial Intelligence; also NANOGrav and WVU
- Detailed discussions ongoing for other possible partnerships

Divestment 3-Sacramento Peak

- Engineering study under way
- New Mexico State University taking the lead in forming a consortium that will operate Dunn Solar Telescope as a university-led facility rather than a national observatory
  - Invitations for partners published in Solar News
  - Meeting among NSF, NSO and potential partners in May 2015
  - If successful, partnership would result in Dunn access for some portion of the solar physics community, a training ground for the scientific community for DKIST, and possibly a site for further development of future DKIST instrumentation
  - NSF would partner with the new consortium in this endeavor
- For other NSO telescopes, see table above for brief summary

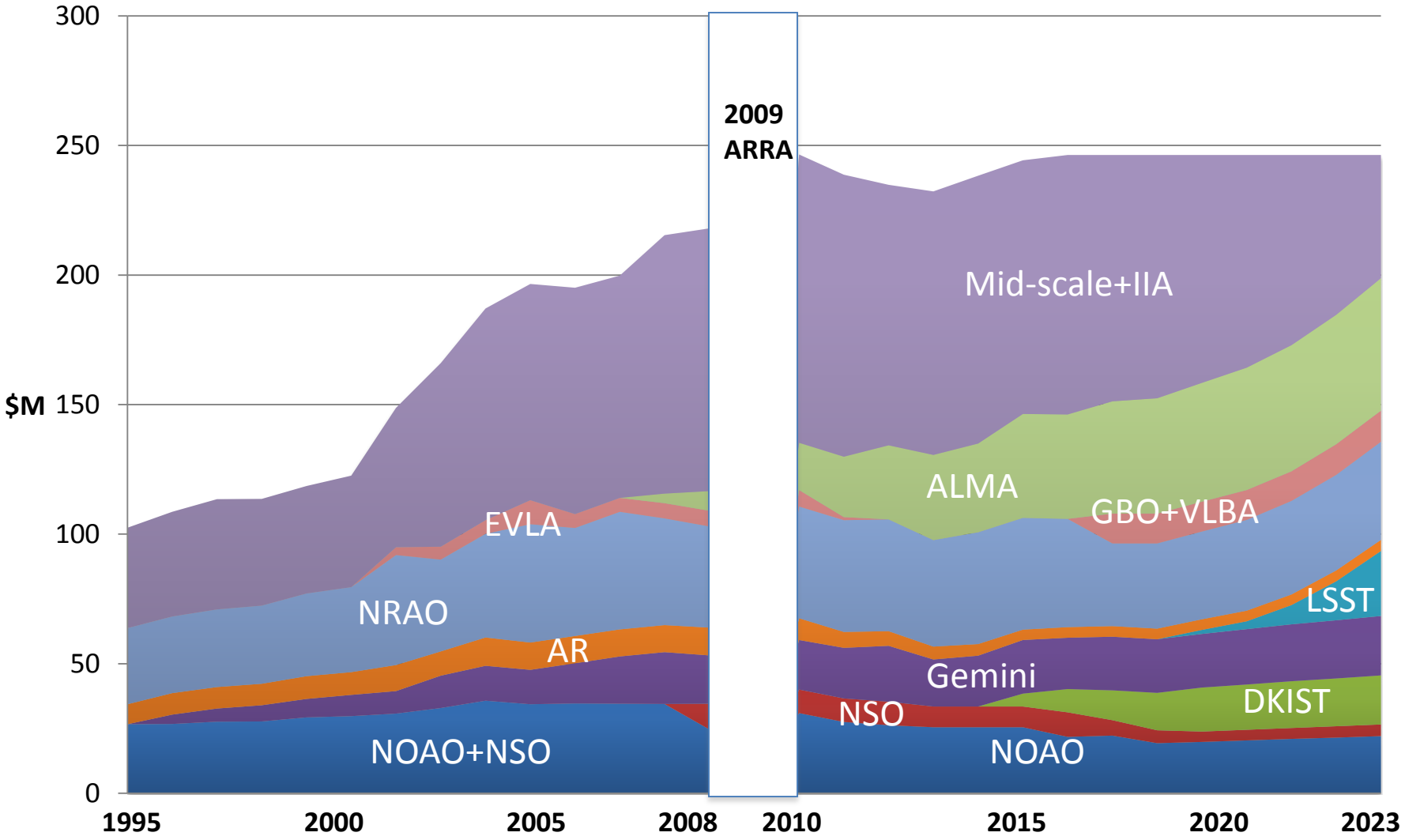
Divestment 4-Arecibo

- Most AO funding is received from NSF/MPS/AST, NSF/GEO/AGS, and NASA's Planetary Science Division
- AST Portfolio Review Committee recommended that AST's involvement in AO be reevaluated later in the current decade
- AGS is currently conducting a portfolio review of its research investments, expected to be completed early in 2016
- NSF issued a Dear Colleague Letter (DCL) in October 2015, requesting viable concepts (by January 15, 2016) for future Arecibo operations
  - Part of the reevaluation recommended to AST
  - Broad range of possibilities allowed; analysis of responses under way
  - Similar to a DCL issued for Green Bank and VLBA in 2013
- DCL response, completion of AGS review, completion of baseline engineering/environmental study, discussion with NASA, and results of NRC mid-decadal review all will be used by NSF in deciding on the next step for Arecibo
- <u>No decision has been made yet</u>

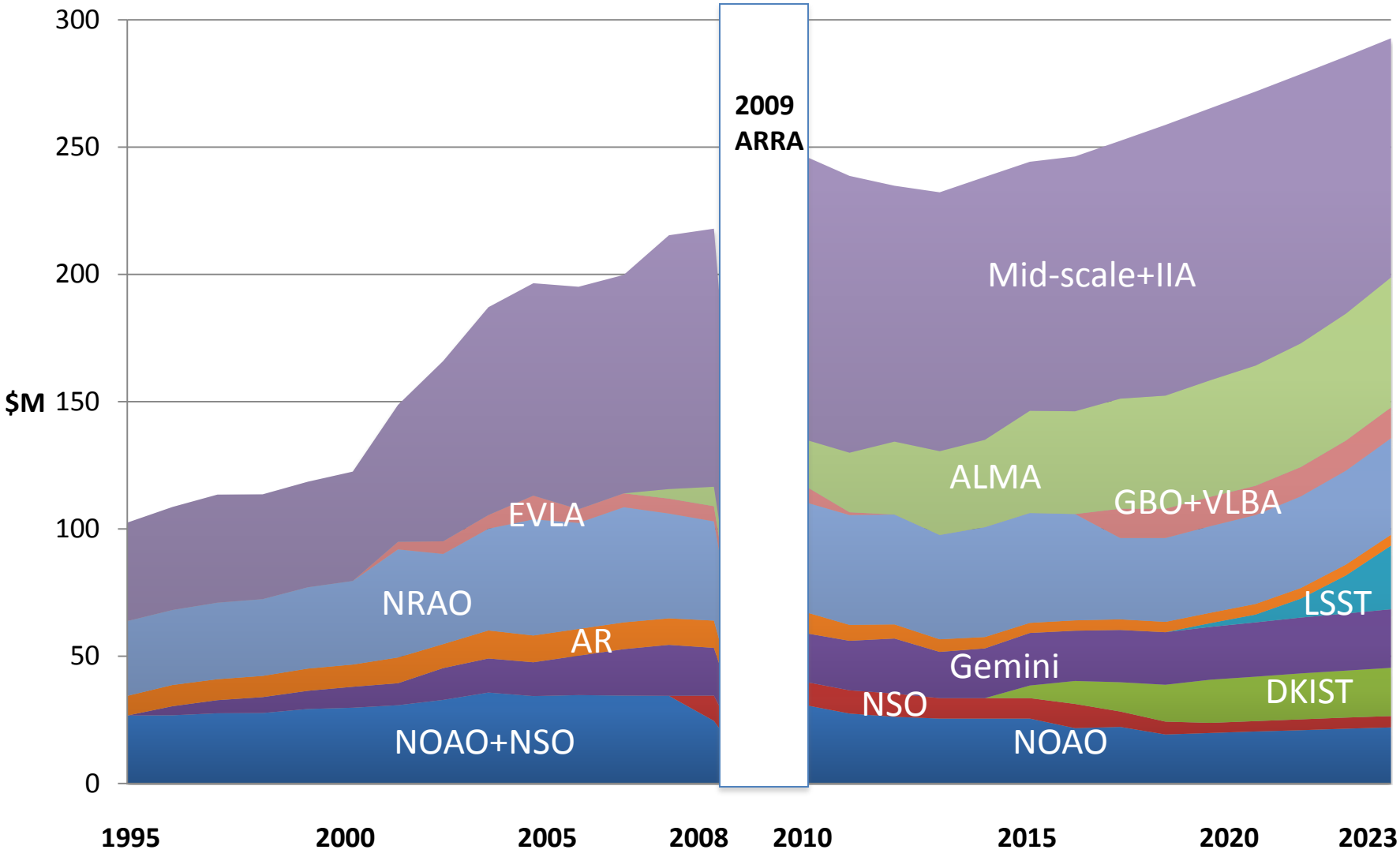
Major Assumptions on Next Slides

- FY 2016-FY2021 numbers incorporate the FY 2016 budget request and notional FY 2017-2021 run-outs
- McMath-Pierce, Dunn Solar Telescope, and half of the NSO Synoptic Program come off NSO budget by FY 2019
- Green Bank Observatory and VLBA separate from NRAO beginning in FY 2017, with significant partnerships; assumed flat thereafter
- AST investment in Arecibo assumed flat through FY 2021
- DOE takes over NOAO Mayall funding in FY 2018/2019
- LSST ramp is approximate
- Non-LSST facilities increase 2.5%/yr in FY 2022-2023
- No costs for mothballing, restoration, etc.
- AST budget increases 2.5%/yr (0%/yr) after FY 2016

AST, 0.0%/yr Increase after FY 2016



AST, 2.5%/yr increase after FY 2016



Summary

- Excellent progress being made on portfolio review, but AST will not be able to save all the funds recommended by Portfolio Review Committee
  - Savings in prospect so far total ~$10-15M
    - ~$7-8M at NOAO
    - ~$2-4M at NSO, depending on outcome of Sac Peak discussions
    - ~$4M at GBT+VLBA now, additional partnerships under discussion. (Also note added costs of separation from the rest of NRAO.)
  - Portfolio Review recommendation sums to ~$37M, not including the downward ramps that were already in progress for EVLA and Arecibo
    - Reaching savings in the vicinity of $25-30M will be very difficult
- Flat budgets into the LSST era will cause substantial portfolio damage unless more divestment occurs