NSF Astronomy Update: The Daniel K. Inouye Solar Telescope (DKIST)

Dave Boboltz (Program Officer, NSO/DKIST)

Committee on Solar and Space Physics (CSSP)

March 29, 2017

FY 2017 NSF Request by Account ($M)

	FY 2015 Actual	FY 2016 Actual	FY 2017 Discretionary	
Research & Related Activities	$ 5934	$ 6034	$ 6079	0.8%
Education & Human Resources	866	880	899	2.1%
Major Res Equip & Facilities Const.	201	200	193	-3.6%
Agency Ops & Award Mgmt.	325	330	373	13%
National Science Board	4	4	4	
Inspector General	14	15	15	
Total NSF	**$ 7344**	**$ 7463**	**$ 7564**	**1.3%**

Two Different Budget Lines for Facilities

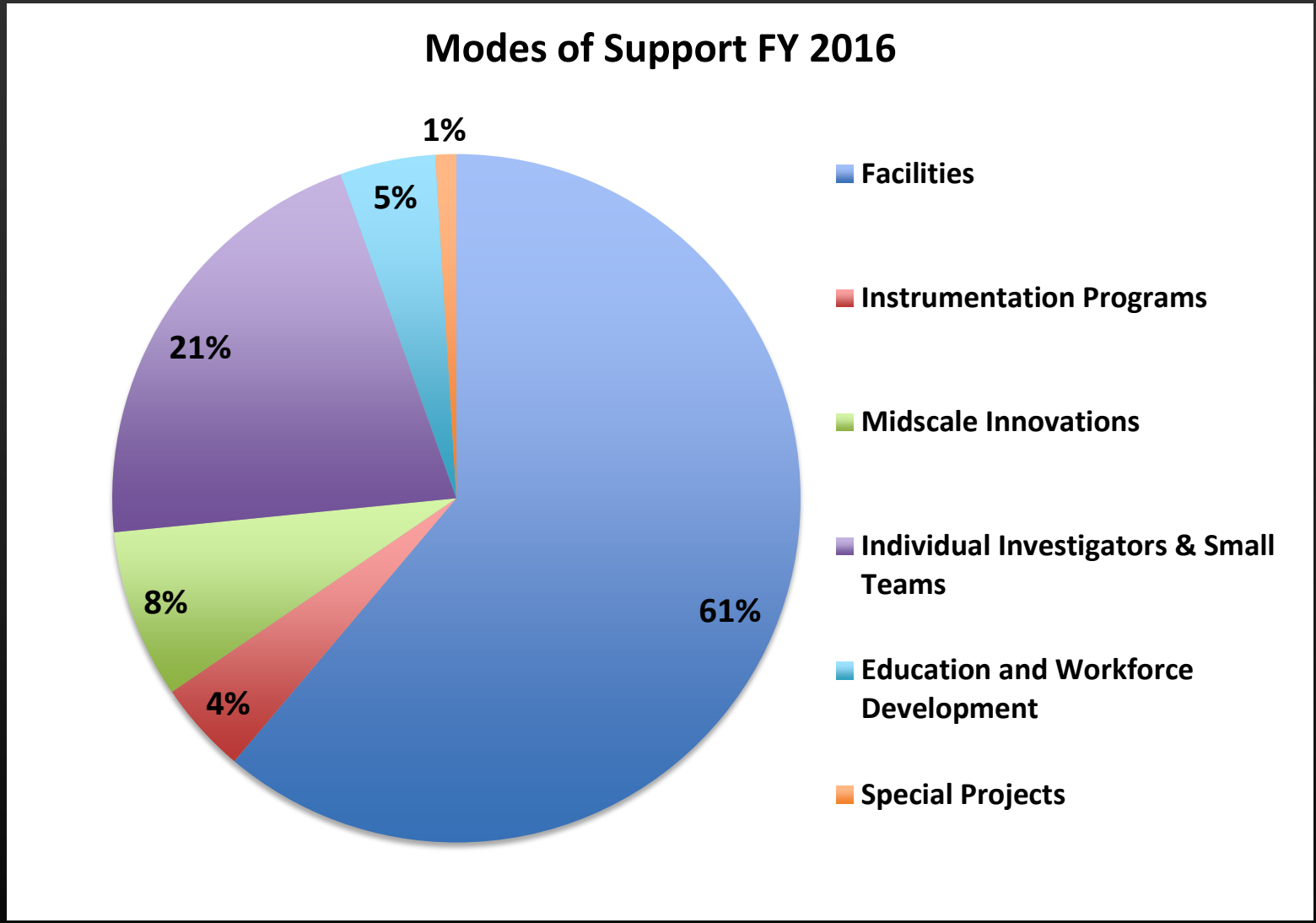
NSF FY 2017 Discretionary Request ($ in millions)	FY 2017 Request
Research & Related Activities (R&RA)	**$ 6079**
Education & Human Resources	899
Major Research Equipment & Facilities Construction (MREFC)	**193**
Agency Operations & Award Management	373
National Science Board	4
Office of Inspector General	15
Total NSF	**$ 7,564**

NSF FY 2017 MREFC Request ($ in millions)	FY 2017 Request
Regional Class Research Vessels (RCRV)	$ 106.00
Large Synoptic Survey Telescope (LSST)	67.12
Daniel K. Inouye Solar Telescope (DKIST)	20.00

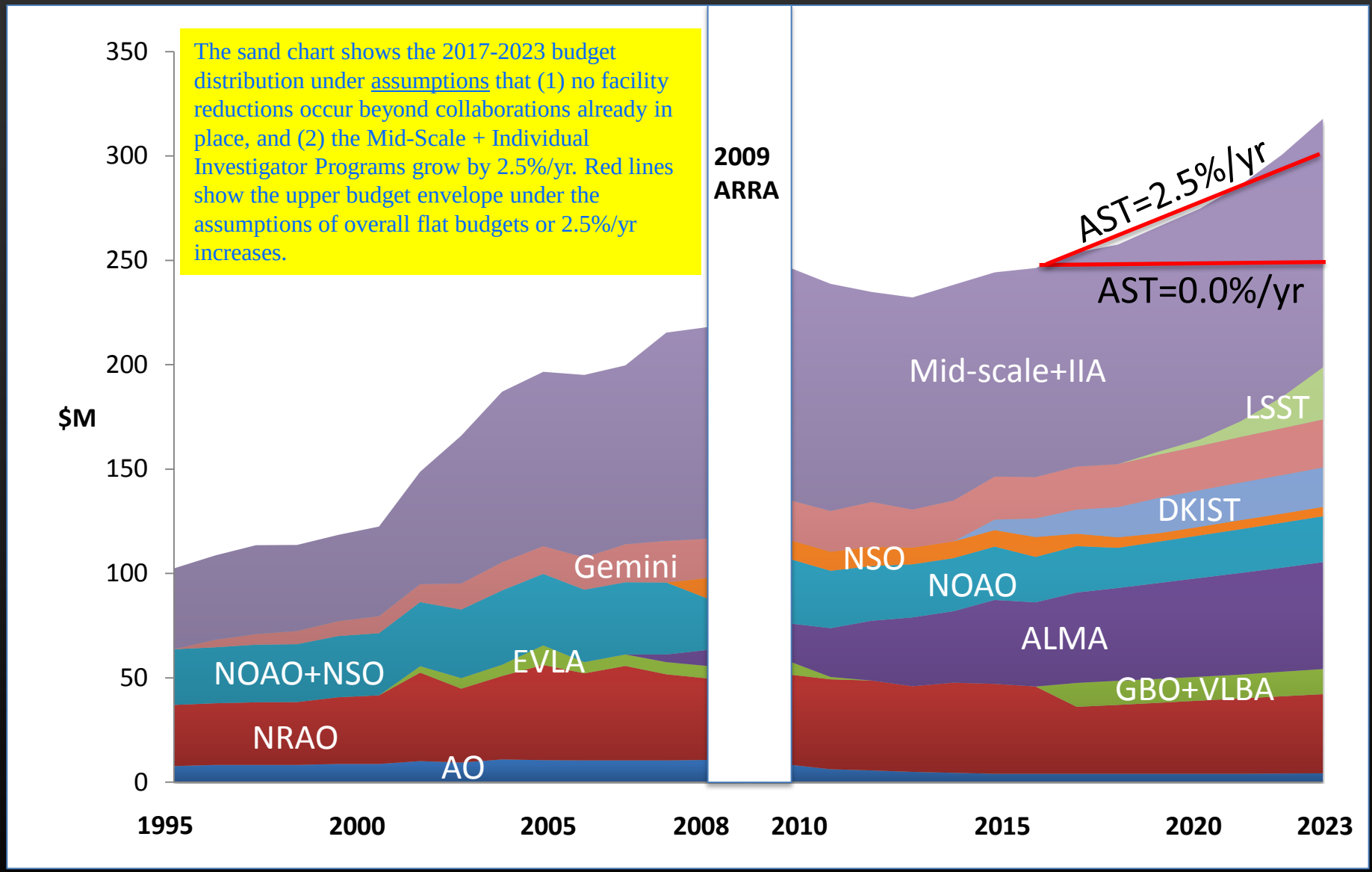
FY 2015-2017 Budget for MPS & AST

$M	FY15 Actual	FY16 Actual	FY17 Request Discretionary
NSF Total	7344	7463	7564
NSF R&RA	5934	6034	6079
MPS	1337	1349	1355
AST	245.2	246.7	247.7

Research Support Within AST



Hypothetical Budget Run-outs

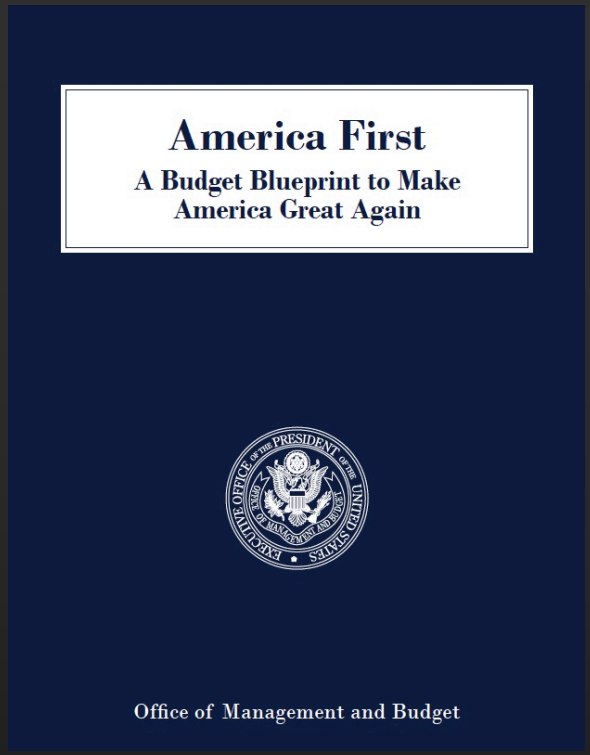


FY 2017 Budget

- Continuing resolution through April 28, 2017
  - 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 "skinny budget" has requested a $28B supplement for FY 2017 for DOD and DHS
  - Partly offset by reductions of $18B in the non-defense discretionary budget in FY 2017.

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

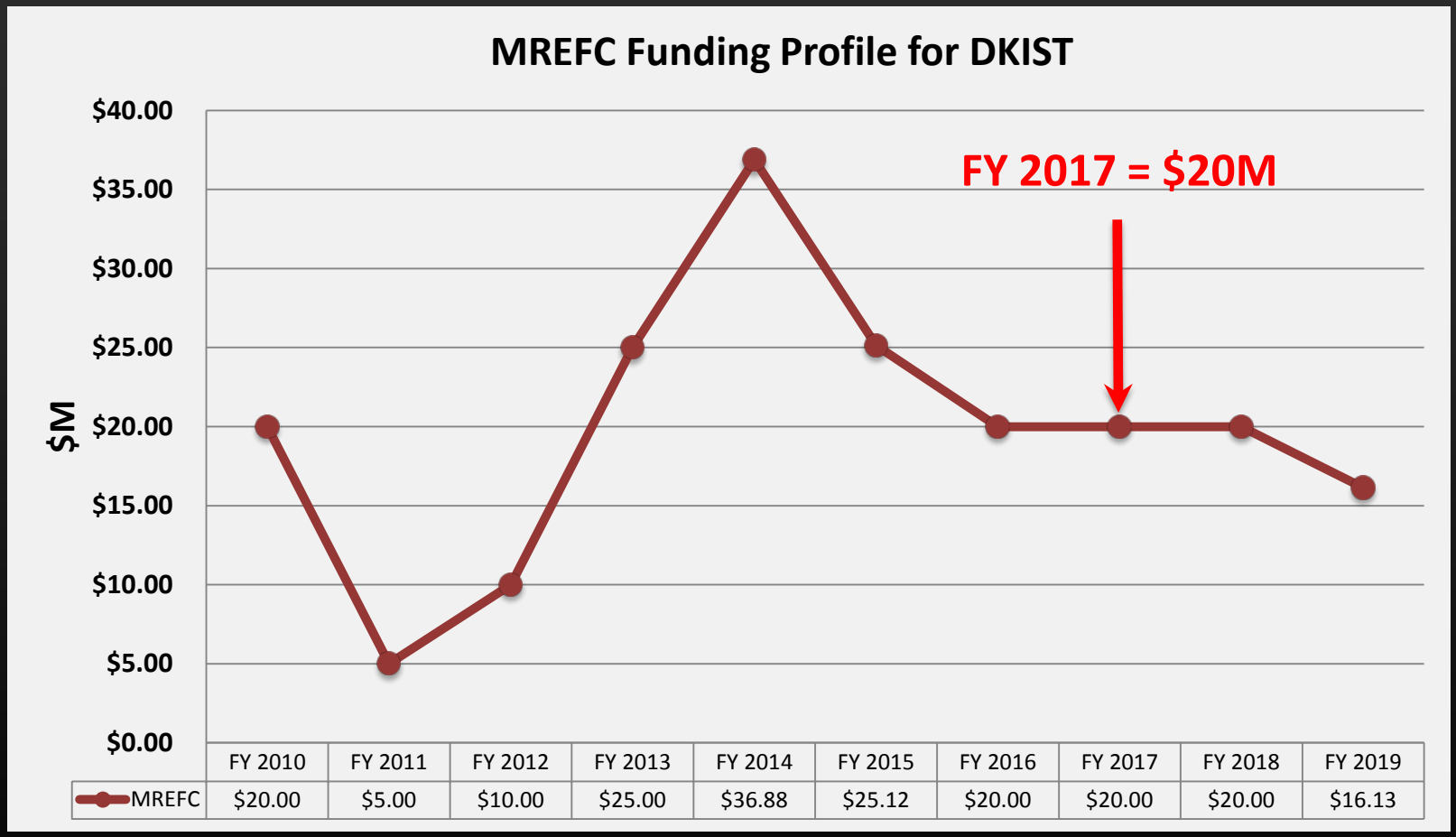
(Net discretionary BA in billions of dollars)

	2017 CR/Enacted [1,2]	2018 Request [2]	2018 Request Less 2017 CR/Enacted Dollar	2018 Request Less 2017 CR/Enacted 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.

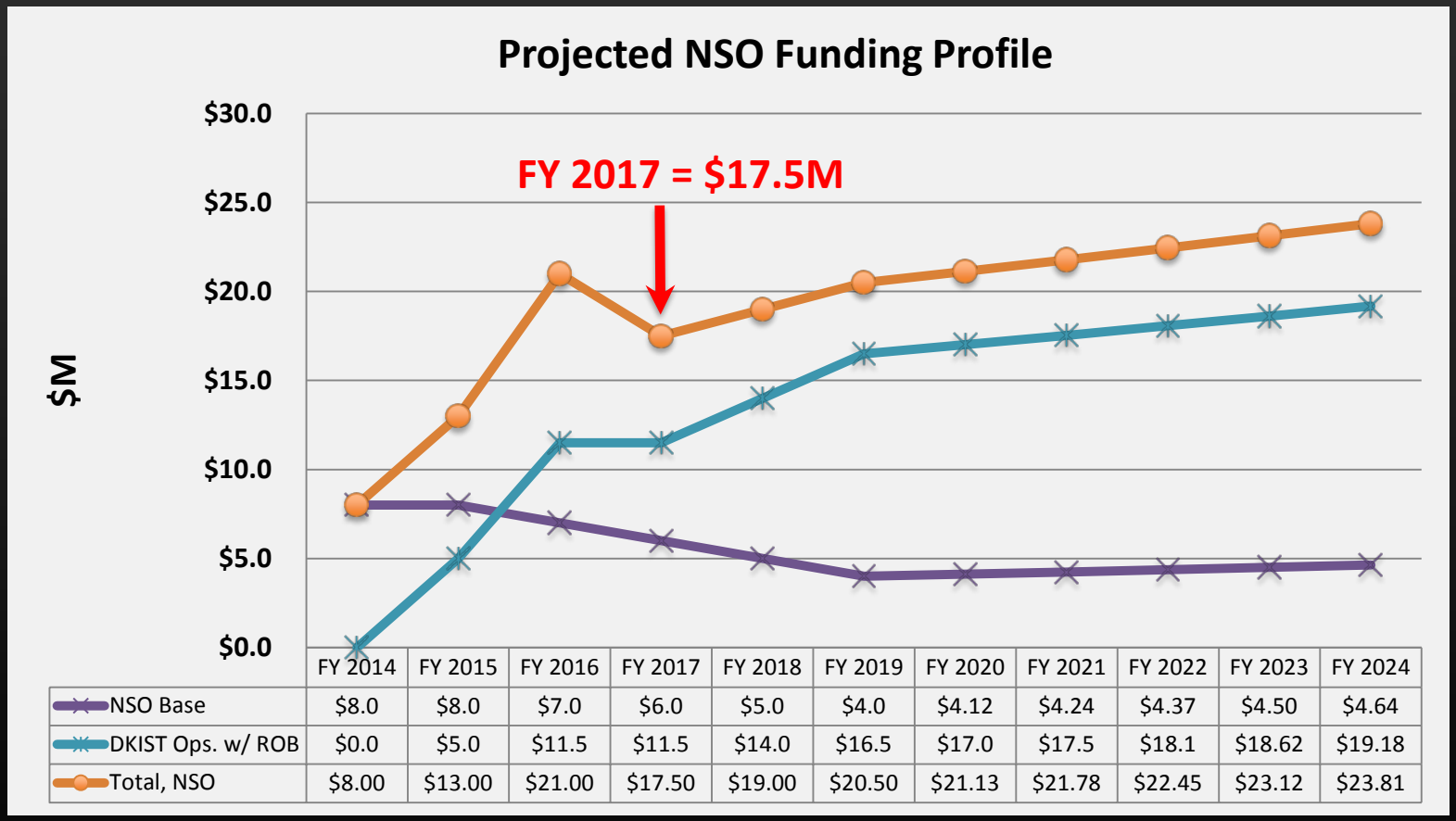
DKIST Construction Funding (MREFC)

- DKIST Re-baselined Total Project Cost = $344.13M
- FY 2017 increment recommended and awaiting award



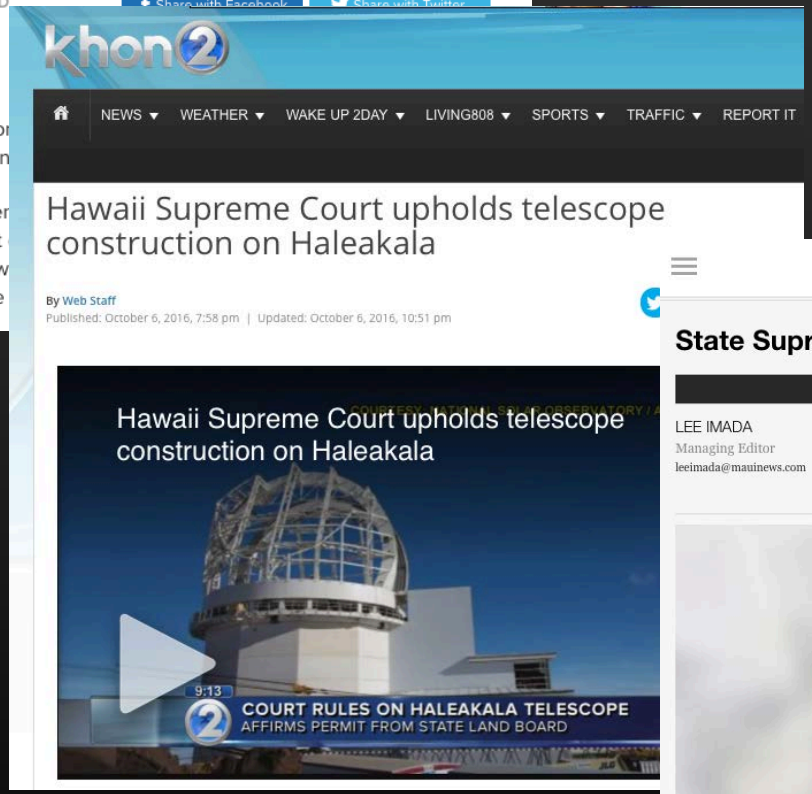
NSO Operations & Maintenance (R&RA)

- Total projected through FY 2024 = $201.84M
- FY 2017 Q1 and Q2 increments awarded = $8.75M



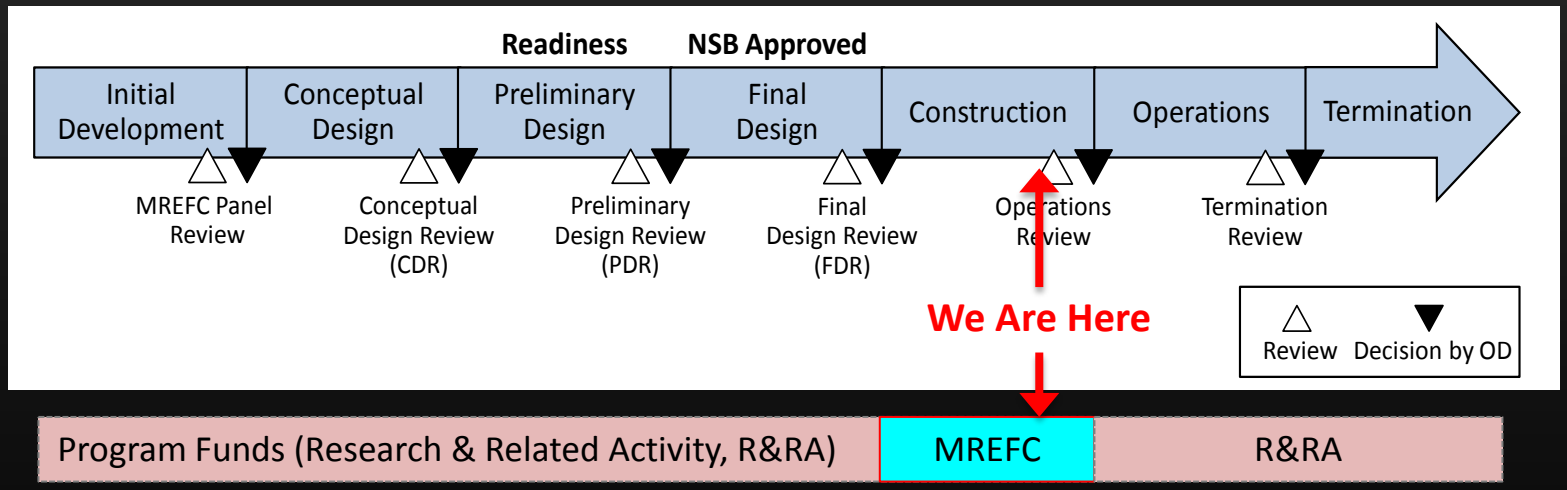
	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
NSO Base	$8.0	$8.0	$7.0	$6.0	$5.0	$4.0	$4.12	$4.24	$4.37	$4.50	$4.64
DKIST Ops. w/ ROB	$0.0	$5.0	$11.5	$11.5	$14.0	$16.5	$17.0	$17.5	$18.1	$18.62	$19.18
Total, NSO	$8.00	$13.00	$21.00	$17.50	$19.00	$20.50	$21.13	$21.78	$22.45	$23.12	$23.81

Hawaiian Supreme Court Ruling: Oct. 6, 2016

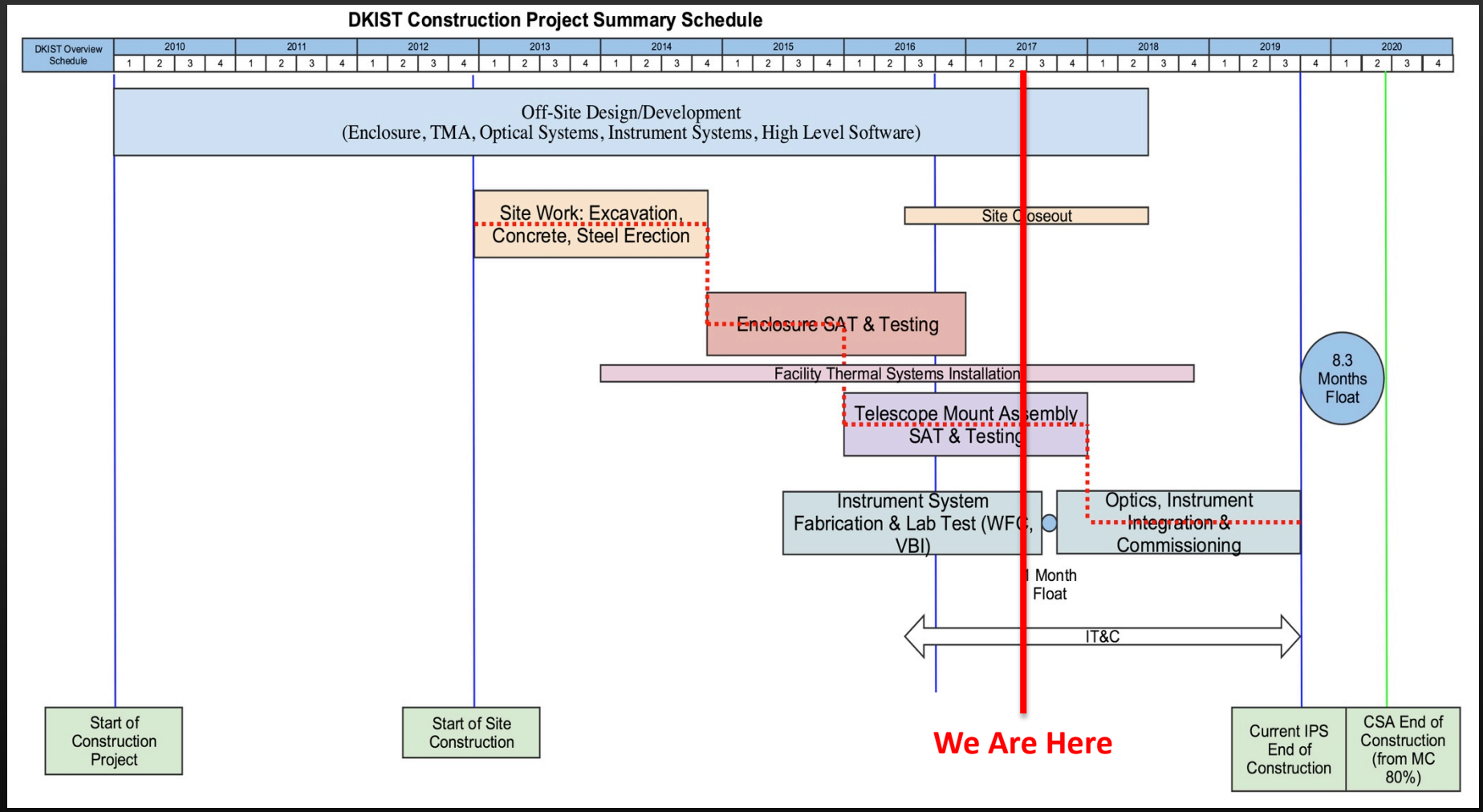


- The ruling came down the day after my last presentation to the CSSP

DKIST in the NSF Facility Lifecycle



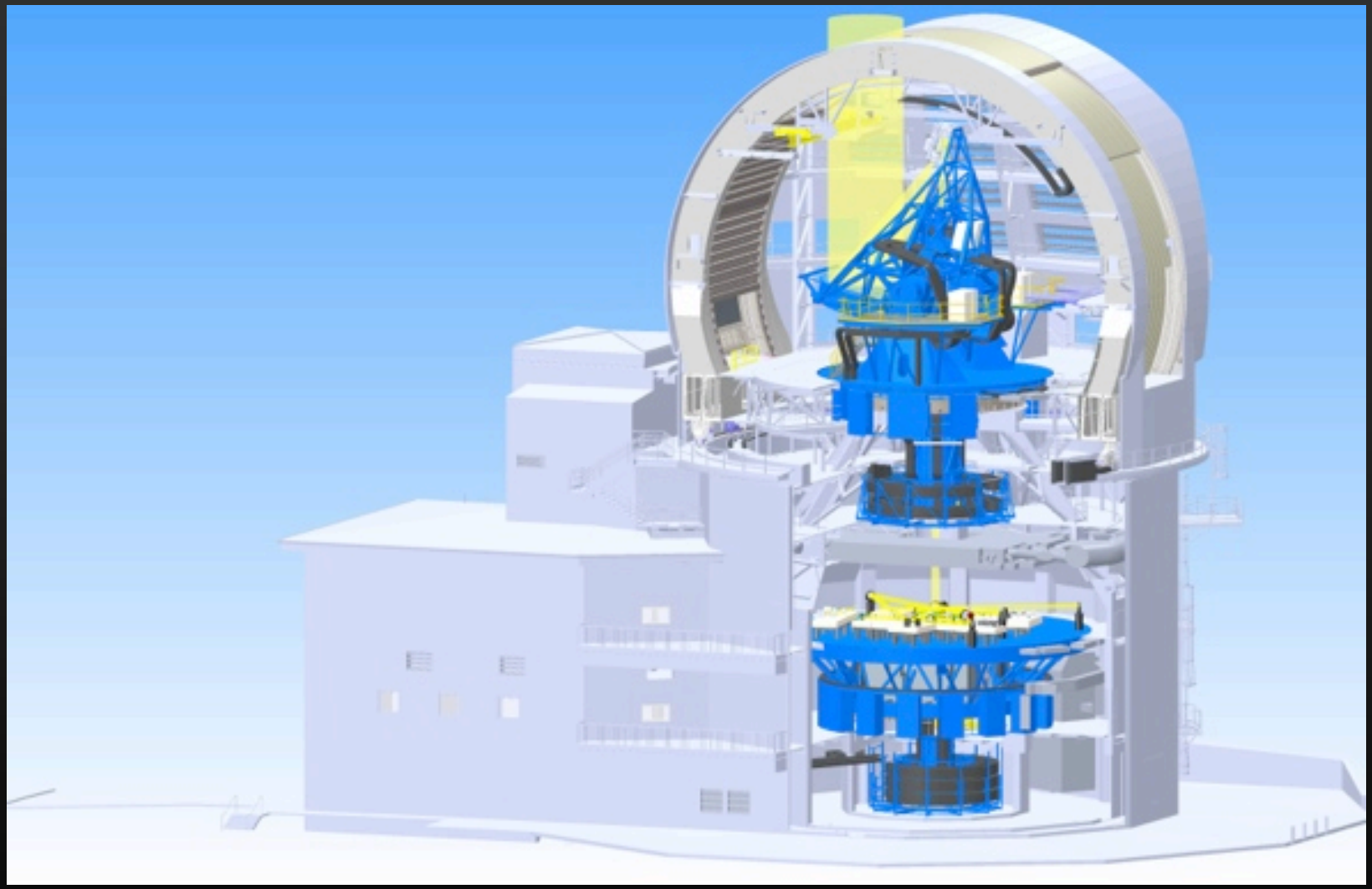
DKIST Summary Schedule



Enclosure: March 2016

Enclosure: March 2017

DKIST Cutaway View

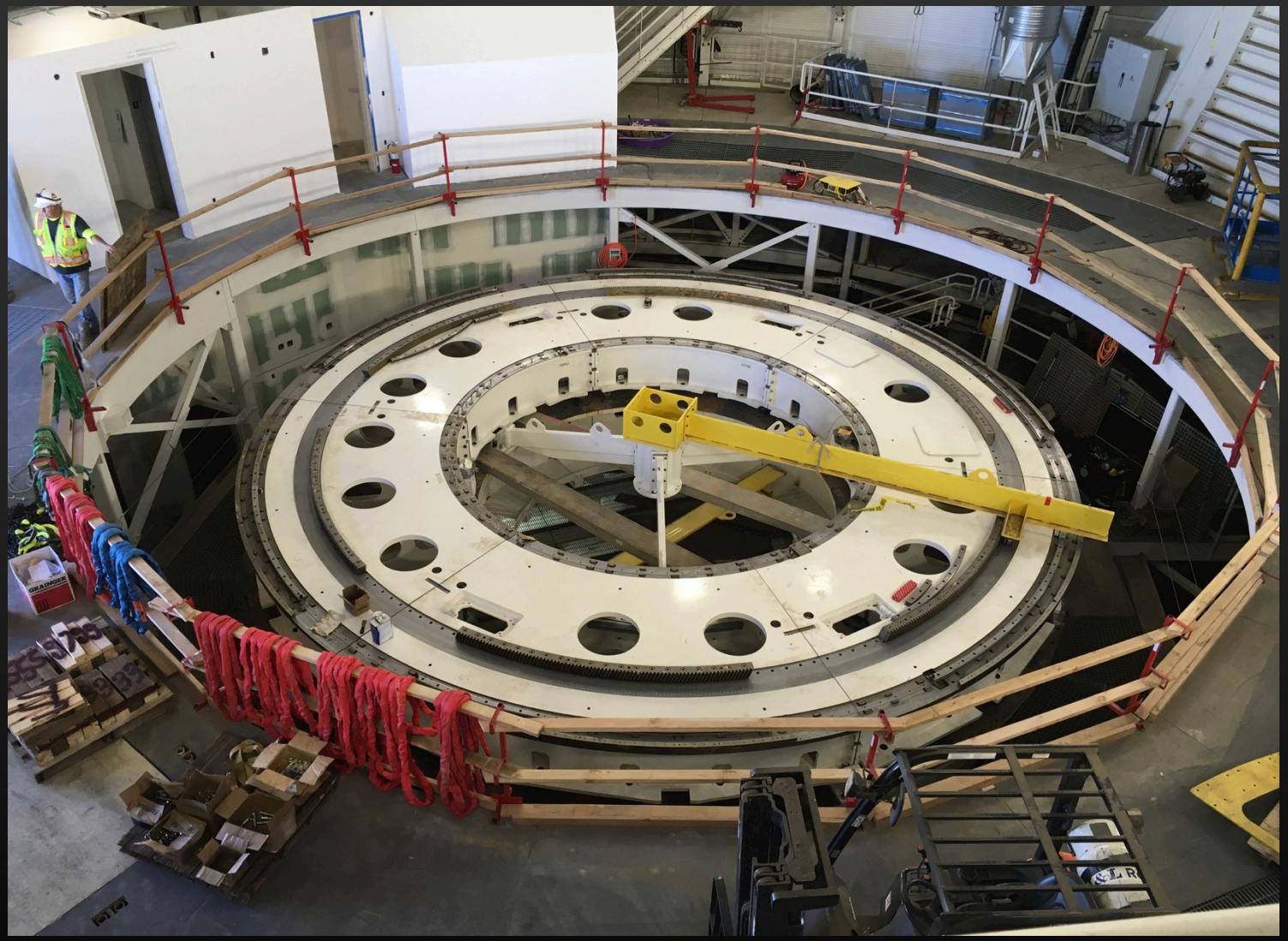


Coudé Rotator: March 2016

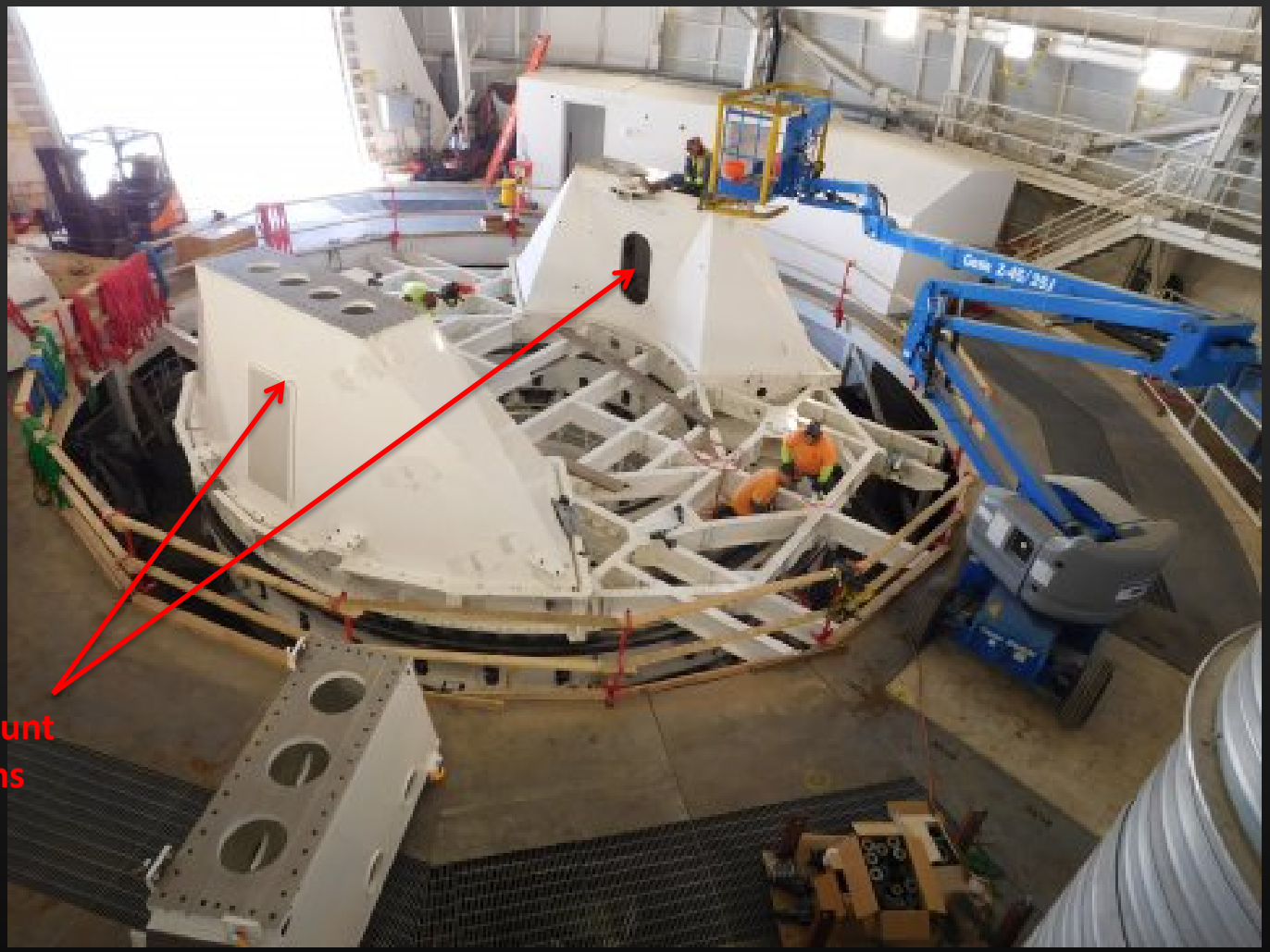
Coudé Rotator: March 2017

- Currently undergoing site acceptance testing

Telescope Mount: October 2016

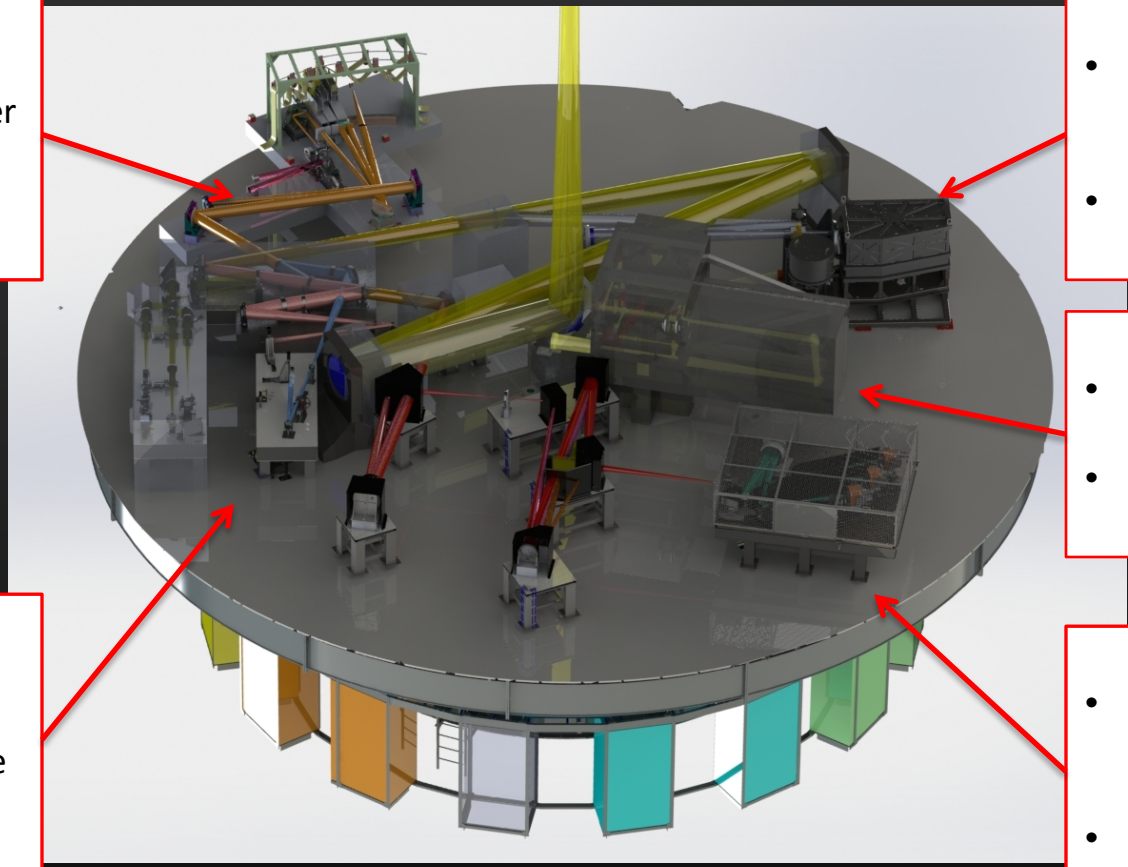


Telescope Mount: March 2017



Instruments

ViSP
- Visible Spectropolarimeter
- Being Built by: the High Altitude Observatory



Cryo-NIRSP
- Cryogenic Near-infrared Spectropolarimenter
- Being Built by: University of Hawaii

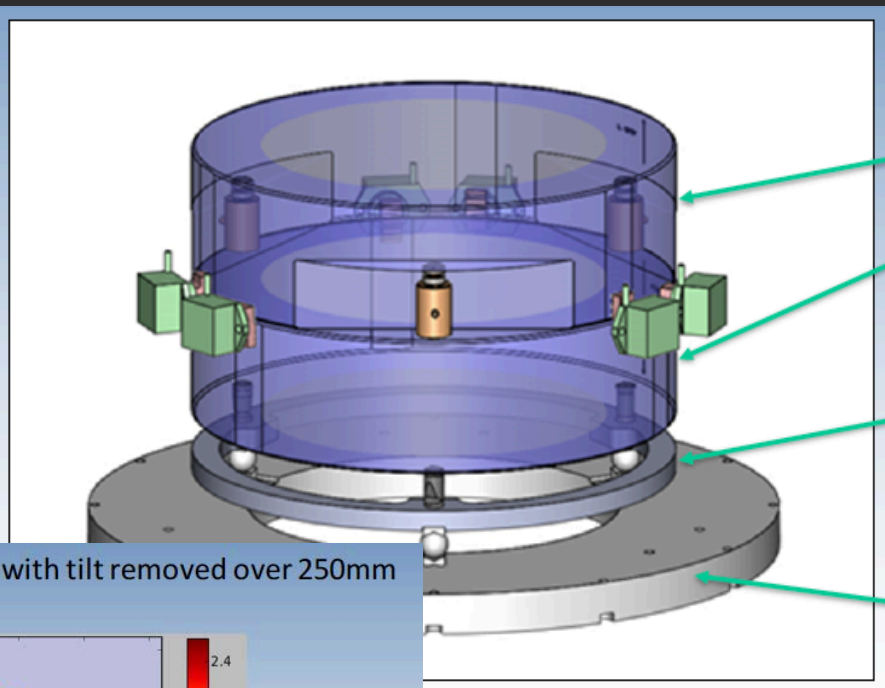
VTF
- Visible Tunable Filter
- Being Built by: KIS, Germany

VBI
- Visible Broadband Imager
- Being Built by: the National Solar Observatory

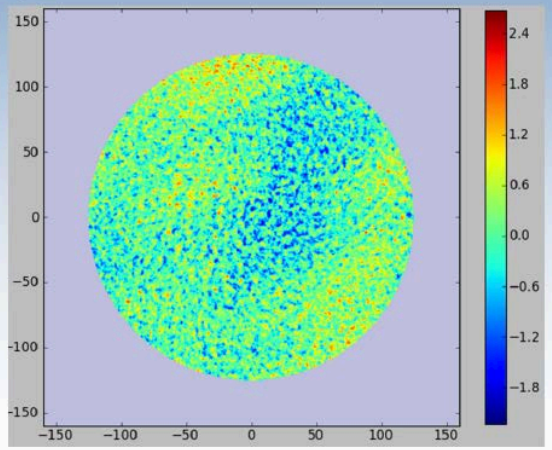
DL-NIRSP
- Diffraction Limited Near-infrared Spectropolarimeter
- Being Built by: University of Hawaii

VTF: Excellent progress with key technology

- Etalon plates manufactured by Zygo Corp.
- Manufactured LIGO mirrors
- Sub-nm tolerances



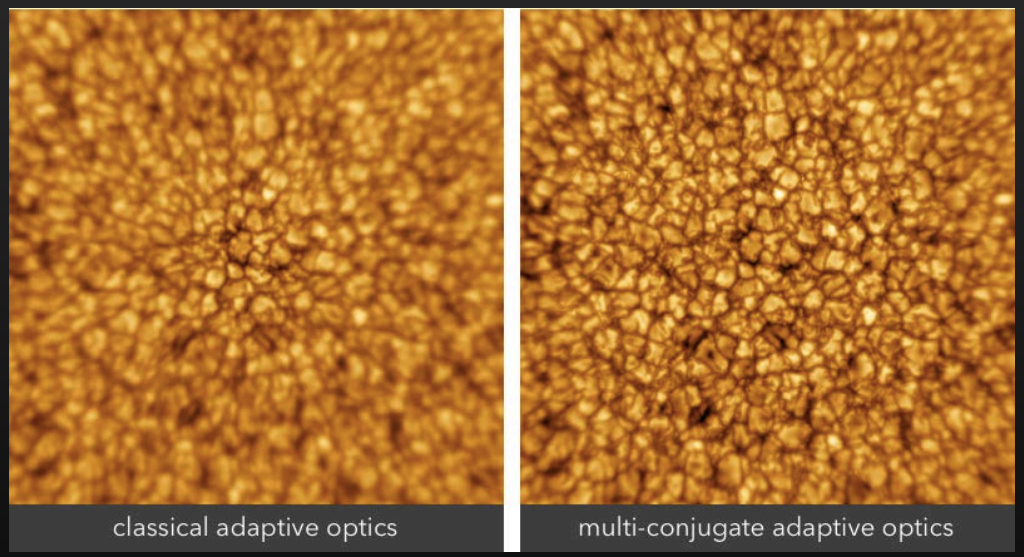
Average of the 3 measurements with tilt removed over 250mm diameter aperture.

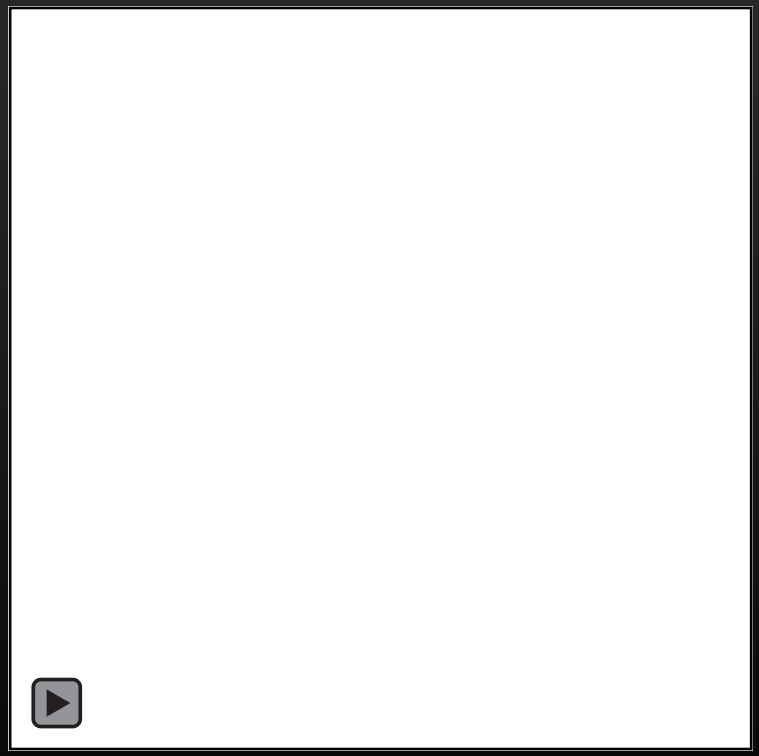


0.542nm RMS 4.895nm PV

Multi-Conjugate Adaptive Optics (MCAO)

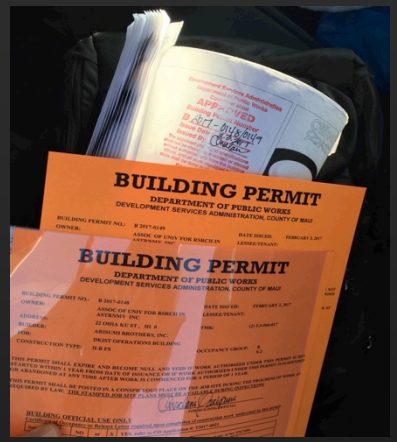
- MCAO under development at Big Bear Solar Observatory (BBSO)
- Uses 3 deformable mirrors to compensate for turbulence at 3 different heights in the atmosphere
- NSO personnel leading the effort
- NSF funded through AST-ATI award
- Pathfinder for DKIST next-generation AO system





DKIST Remote Office Building (ROB)

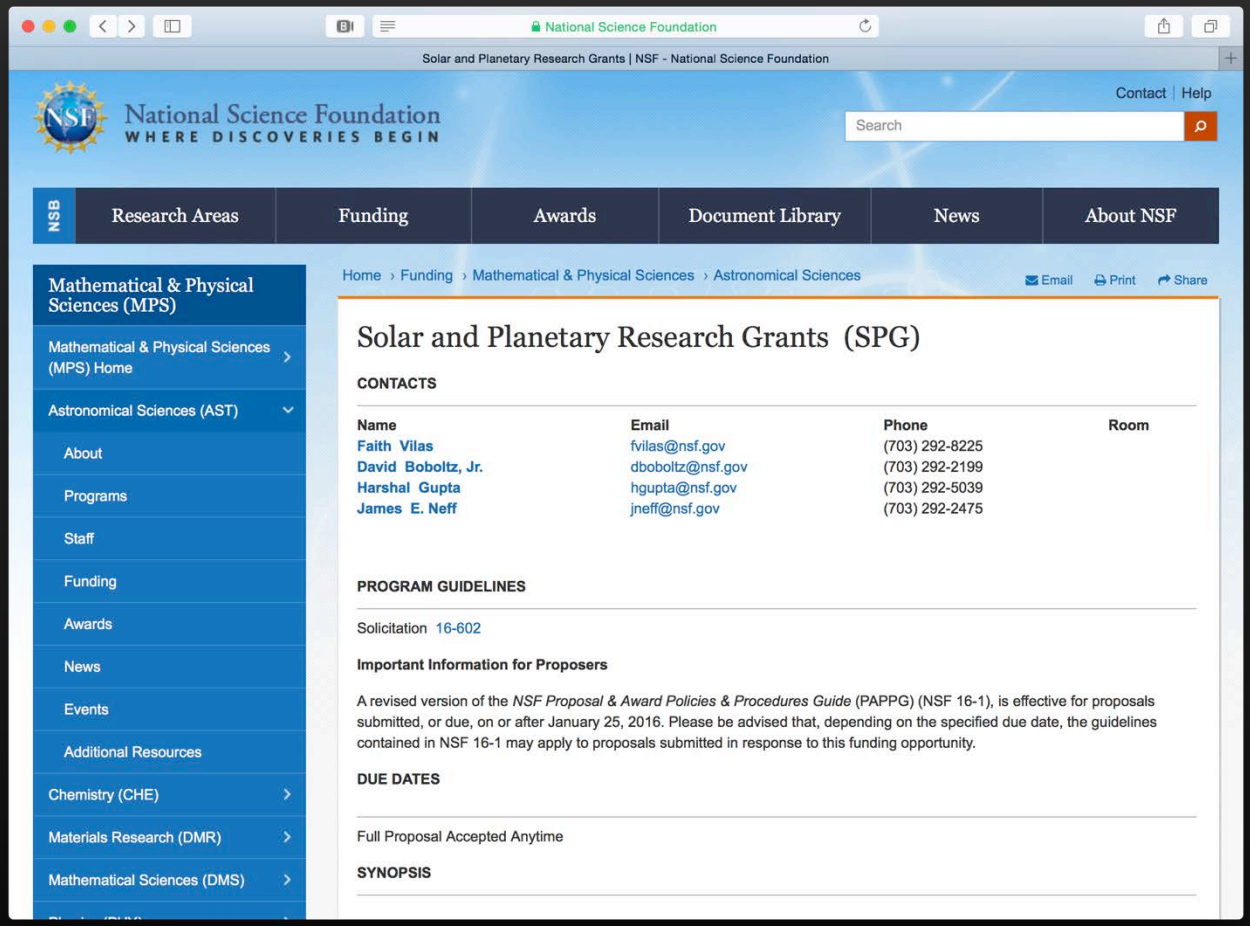
- Located in Pukalani, Maui, HI next to UH-IfA
- NSF approved the purchase of land by AURA (July 31, 2015)
- AURA closed on the land purchase (Aug. 21, 2015)
- Final EA and Finding of No Sig. Impact (FONSI) (Apr. 6, 2016)
- AURA issued RFP to build the ROB (June 30, 2016)
- Bids received (Sept. 6, 2016)
- Project's Selection approved by NSF (Dec. 2, 2016)
  - Contractor Arisumi Bros.
  - $8.321M
- Construction schedule:
  - Site prep (Feb. 2017)
  - Approx. 15 months to complete



ROB Ceremony: March 3, 2017

AST No-deadline SPG Pilot Program

- SPG split from AAG; started October 2016
- Individual investigator research into solar and planetary astronomy including exo-planets
- 19 solar projects (32 proposals) received to date
- Solar panel in May

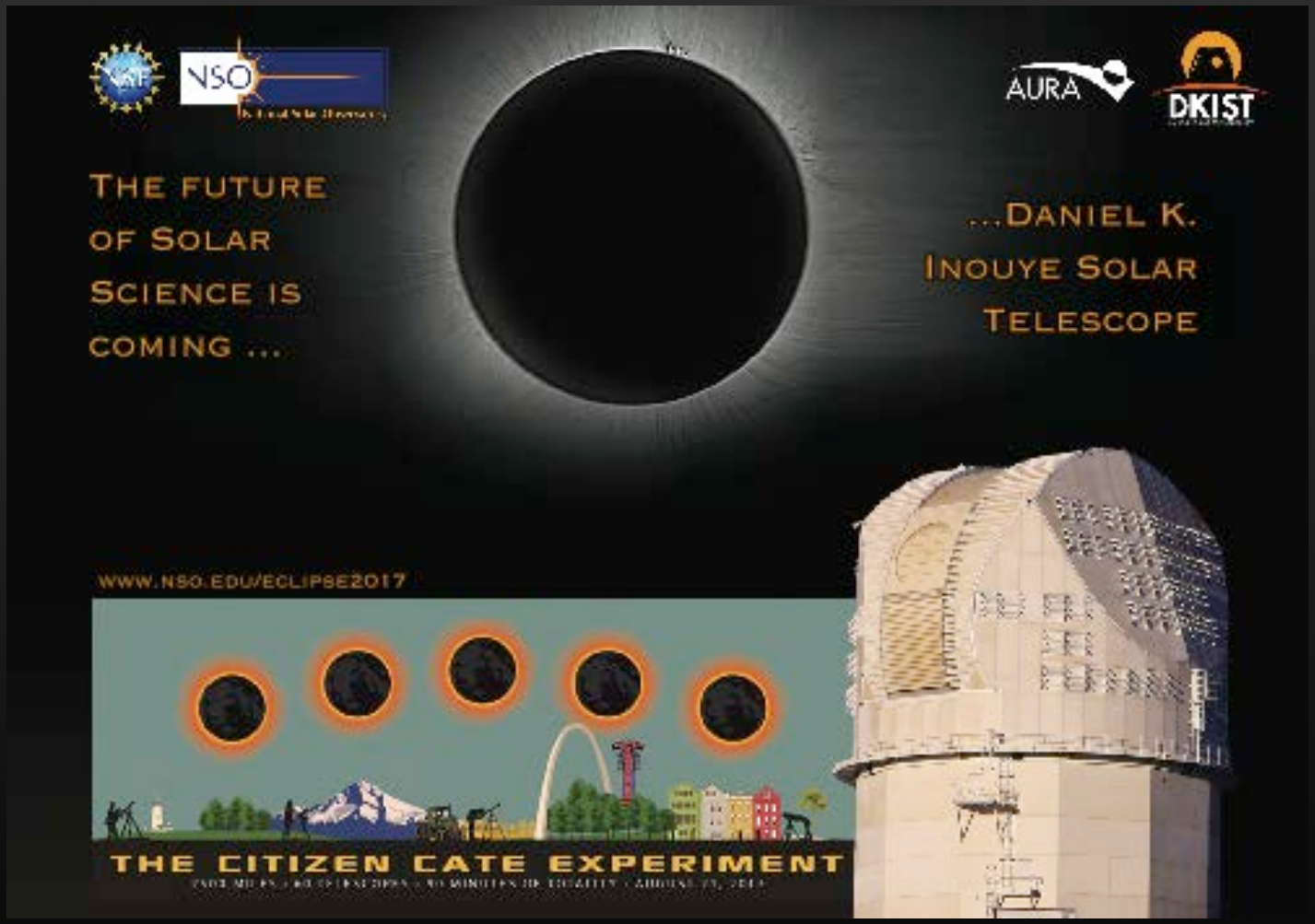


NSO-sponsored DKIST CSP Workshops

- NSO issued RFP for topical Critical Science Plan workshops
- 12 workshop proposals received
- Total number of scientists involved in submitted proposals: 187
  - 60% from the US, 34% from Europe, 6% Asia
- Total number of workshops approved: 9
- Total number of scientists in approved proposals: 165
- Expected number of science use cases: 99
- All workshops open to community participation

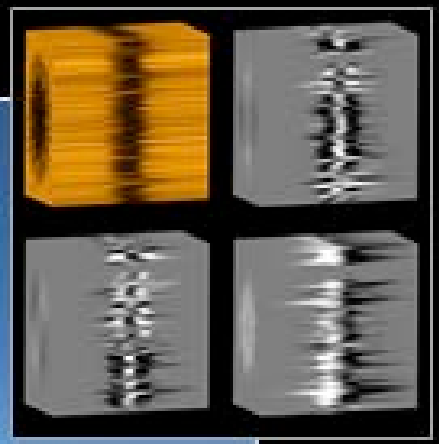
Workshop	Topic	Location(s)
IfA (some CfA)	Corona	Pukalani, Maui, HI
NMSU+UK	Connectivity (waves)	Las Cruces, NM/Newcastle, UK
SO/SPP	SO/SPP	JHU/APL (Laurel, MD)
UAH+Tokyo	Reconnection	Huntsville, AL/Tokyo, Japan
KIS (some CSUN)	MHD and Dynamo Processes	Freiburg, Germany
Rice	Flares	Houston, TX
Catholic U	Connectivity	Washington, DC
NSO/CU Boulder	Synoptic	Boulder, CO
Montana State	Special	Bozeman, MT

The 2017 Eclipse: Fantastic Opportunity for Public Outreach



Back-up Slides

Daniel K. Inouye Solar Telescope (DKIST)



NSO Facilities on Sacramento Peak

- Recommended for divestment by the 2012 AST Portfolio Review
- NSF funding to NSO for Sac Peak operations projected to ramp down to the end of 2017
- Engineering feasibility study (CH2M Hill) completed May 19, 2016
- Environmental Impact Statement (EIS)/Section 106 process started
  - Notice of Intent, July 5, 2016
  - Public scoping meeting, July 21, 2016
  - End of public comment, Aug. 5, 2016
  - Currently iterating with the USFS on the Draft EIS

Bridge to the Sunspot Solar Observatory Consortium (SSOC)

- Met with National Solar Observatory (NSO) and representatives of universities seeking to create a consortium to operate Sac Peak, May 2015
- NM State Legislature failed to fund highly rated NMSU request for funds to enable consortium, Feb. 2016
- NMSU submitted a proposal to AST for funding to bridge the gap between NSO and SSOC, May 2016
- Proposal awarded Sept. 2016
- 2 of 3 new hires made by NMSU
- Additional SSOC members still needed to ensure success

NSO Facilities on Kitt Peak

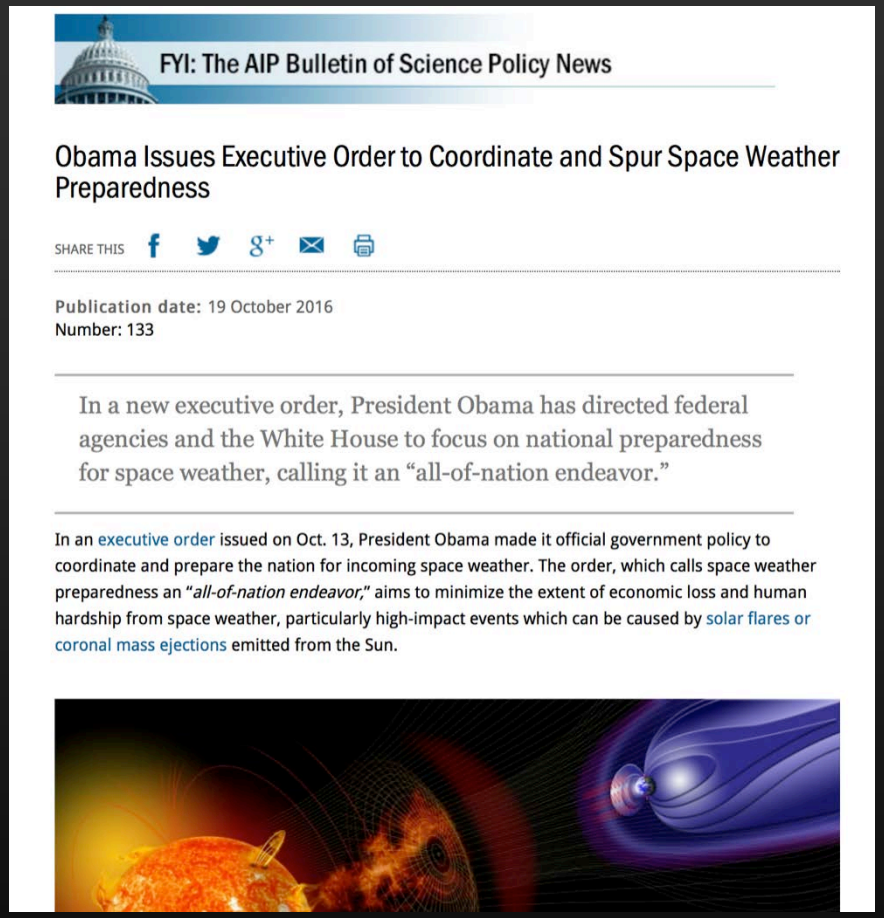
- Recommended for divestment by the 2012 AST Portfolio Review
- NSF minimal operations funding ramping down to 2017
- NSF engineering feasibility study (CH2M Hill) completed July 2016
- AURA/NSO will release an RFP next week with letters of intent due May 1, 2017.

NSO Integrated Synoptic Program

- Consists of SOLIS and GONG
- Recommended for 50% ($2M/year) divestment by the 2012 AST Portfolio Review
- Increased Federal awareness (i.e. NSWS and NSWAP) of space weather assets like GONG
  - $2.5M upgrade to GONG in the works
  - 2nd year of NSF-NOAA Interagency Agreement
- SOLIS projected to move to BBSO
  - Working on permitting

Executive Order: Space Weather

- NSWS/NSWAP will continue through recent executive order
- *"The Director of the National Science Foundation (NSF) shall support fundamental research linked to societal needs for space weather information through investments and partnerships, as appropriate."*
- NSF/AST and NSO contributing to national basic research efforts
  - GONG and SOLIS
  - DKIST



FYI: The AIP Bulletin of Science Policy News

Obama Issues Executive Order to Coordinate and Spur Space Weather Preparedness

SHARE THIS

Publication date: 19 October 2016
Number: 133

In a new executive order, President Obama has directed federal agencies and the White House to focus on national preparedness for space weather, calling it an "all-of-nation endeavor."

In an executive order issued on Oct. 13, President Obama made it official government policy to coordinate and prepare the nation for incoming space weather. The order, which calls space weather preparedness an "*all-of-nation endeavor*," aims to minimize the extent of economic loss and human hardship from space weather, particularly high-impact events which can be caused by solar flares or coronal mass ejections emitted from the Sun.