NSF Perspective on Decadal Survey

AAAC

October 7, 2010

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NSF-MPS/AST

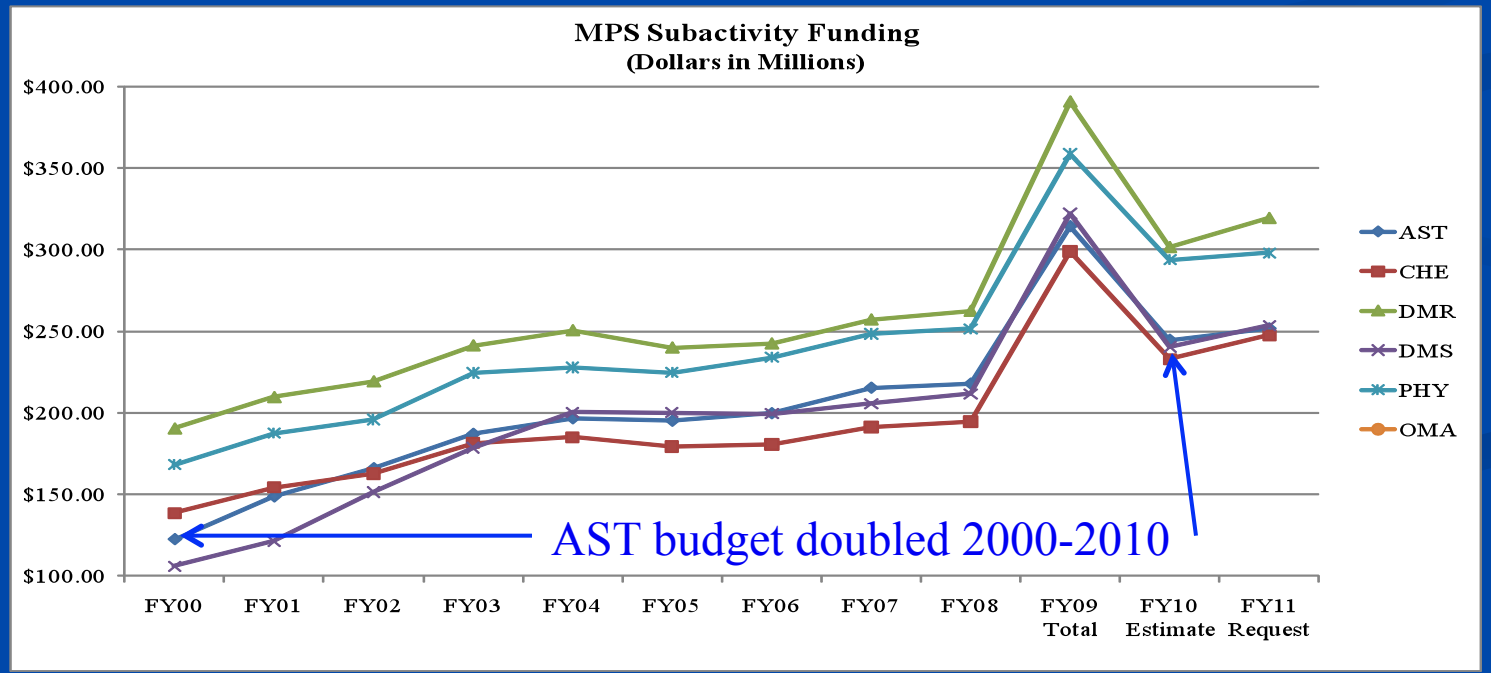
Topics

- AST & NSF Context
- Current Status of NSF Plans to Respond to Astro2010 Recommendations

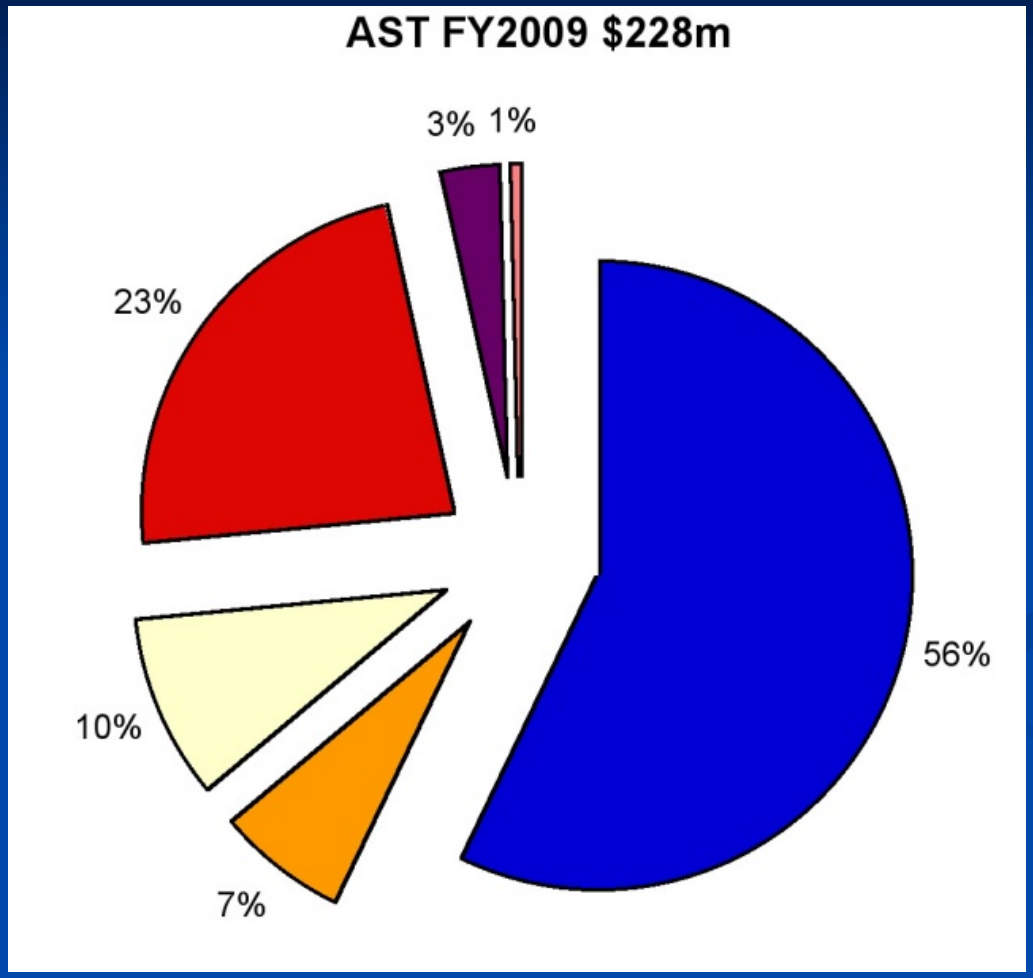
MPS FY 2011 Budget Request

(Dollars in Millions)

	FY 2009 Omnibus Actual	FY 2009 ARRA Actual	FY 2010 Estimate	FY 2011 Request	Change Over FY 2010 Estimate Amount	Change Over FY 2010 Estimate Percent
Astronomical Sciences	$228.67	$85.80	$245.69	$251.77	$6.08	2.5%
Chemistry	211.67	87.36	233.73	247.56	13.83	5.9%
Materials Research	282.52	108.17	302.67	319.37	16.70	5.5%
Mathematical Sciences	224.84	97.34	241.38	253.46	12.08	5.0%
Physics	262.47	96.30	290.04	298.19	8.15	2.8%
OMA	33.70	-	38.33	39.56	1.23	3.2%
Total, MPS	**$1,243.88**	**$474.97**	**$1,351.84**	**$1,409.91**	**$58.07**	**4.3%**



AST Budget Pie



FY11 Budget ~$250M

US Science-Funding Priorities

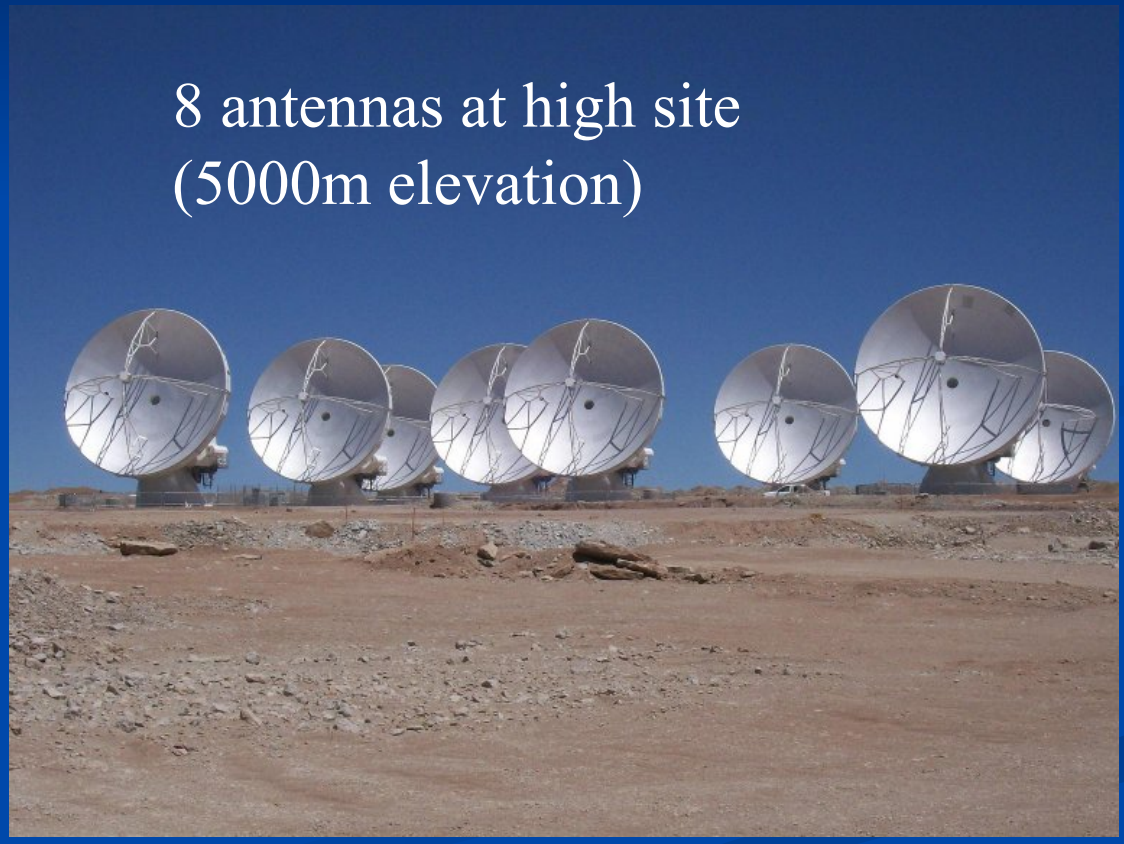
- Will NSF (or AST) budget double over 10 years?
- Six foci for FY12 S&T funding, as laid out in joint memo (July 2010) by Office of Science and Technology Policy (OSTP) and Office of Management and Budget (OMB)
  - Sustainable economic growth & job creation
  - Defeat diseases and reduce health-care costs
  - Clean energy future
  - Understand and mitigate global climate change
  - Improved ecosystem management for sustainability
  - Technologies to protect troops, citizens, national interests
- Astronomy does not easily map onto these science priorities, when compared to disciplines such as Earth Science, biological sciences, and engineering

Budget Guidance & Expectations

- AST budget guidance to Astro2010 was that purchasing power should be assumed to remain constant
  - Astro2010 used "optimistic" scenario of 4% annual increase in purchasing power (10-yr doubling with 3% inflation)
- FY11 NSF Budget Request: 7% increase overall, but 2.5% increase for AST
- Conclusion: It is likely that AST can support large fraction of Astro2010 only by significant reduction of some current programs/facilities
  - Aiming for overall portfolio review (called "Senior Review" in Astro2010) well before mid-decade

ALMA Status & Impact

- North American ALMA deliverables on track for completion by end of 2012
- Annual ALMA operations cost ramps up from $11M in FY09 to $39M in FY15
- This must be accommodated within AST base operating budget along with Astro2010 recommendations



NSF Large Project Funding

- Funding is in separate (non-AST) line for Major Research Equipment and Facilities Construction (MREFC)
  - Operations funding after construction must come directly from the baseline AST budget
- MREFC approval requires many steps
  - Pass Preliminary Design Review
  - "Compete" with other projects NSF-wide
  - Start okayed by NSB, recommended by NSF Director
  - Presidential budget request, passed by Congress

Long-Term MREFC Funding

- Typical annual MREFC funding is ~$200M
- At that level, no significant wedge begins to appear until FY14-FY15

From FY11 NSF request

MREFC Account Funding, by Project
(Dollars in Millions)

	FY 2009 Omnibus Actual	FY 2009 ARRA Actual	FY 2010 Estimate	FY 2011 Request	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	FY 2016 Estimate
AdvLIGO	$51.43	-	$46.30	$23.58	$20.96	$15.17	$14.92	-	-
ATST[1]			13.00	17.00	20.00	20.00	20.00	20.00	20.00
ARRV	14.13	148.07	-	-	-	-	-	-	-
ALMA	82.25	-	42.76	13.91	3.00	-	-	-	
IceCube	11.85	-	0.95	-	-	-	-	-	-
NEON	-	-	-	20.00	87.92	101.07	103.43	86.23	32.07
OOI	-	105.93	14.28	90.70	102.80	46.80	20.00	-	-
SPSM	1.10	-	-	-					
MREFC Account Total	$160.76	$254.00	$117.29	$165.19	$234.68	$183.04	$158.35	$106.23	$52.07

Totals may not add due to rounding.

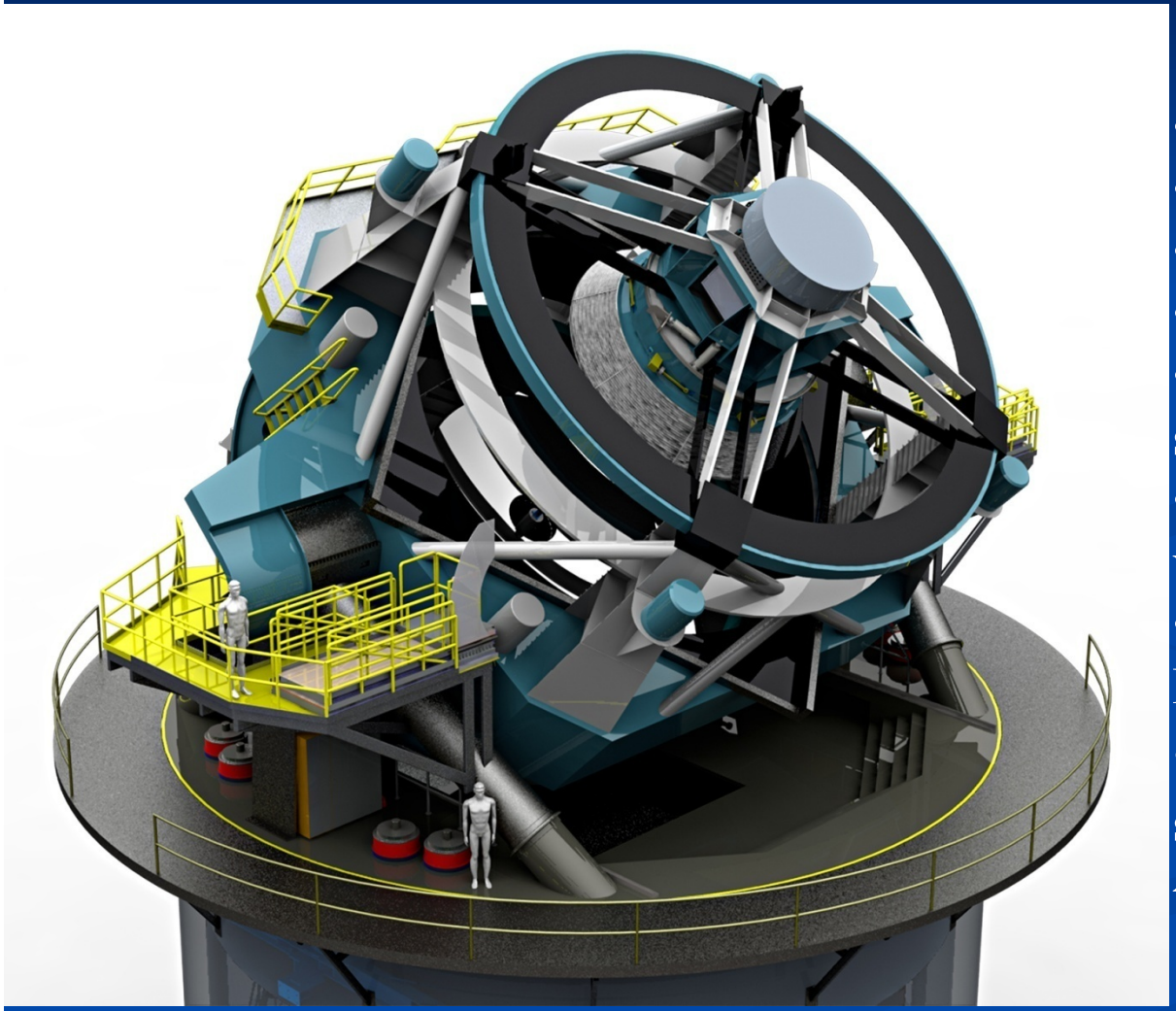
[1]Funds appropriated for ATST through ARRA in FY 2009, totalling $146.0 million, were obligated in January 2010.

Astro2010 Ground Recommendations

- Large Synoptic Survey Telescope (LSST)—Large, MREFC
- Mid-Scale Innovations Program—Large, non-MREFC
- Cerro Chajnantor Atacama Telescope (CCAT)—Medium
- ~$20M augmentation to existing and small programs—Small
- 25% federal investment in one Giant Segmented Mirror (GSMT) candidate—Large, MREFC
- 25% federal share in Atmospheric Cerenkov Telescope Array (ACTA)—Large, non-MREFC

- Large, medium, and small programs interleaved roughly according to priority and time sequence given by Astro2010 in the case when the AST budget does not follow a doubling path

The Large Synoptic Survey Telescope - LSST



Vital Statistics:

- 8.4 meter primary mirror
- 3.3 gigapixel digital camera
- 3.5 degree field of view
- 30 terabytes of data nightly
- Comprehensive operations simulator
- Complete coverage of the visible sky twice per week
- To be located on Cerro Pachon, Chile
- Broad science drivers from solar system to the structure of the universe.

LSST

- Significant design & development completed over last few years, some funded by NSF
- Multi-agency (NASA, DOE, NSF, OSTP) meetings have been held since Astro2010 release to discuss agency cooperation on LSST and WFIRST
  - LSST plan is for NSF to supply telescope and data systems, while DOE supplies the camera
- Discussions initiated with MPS Advisory Committee (meets in November) and National Science Board (meets in December & February) regarding advancement toward MREFC readiness
- Nigel Sharp has been assigned primary programmatic responsibility for LSST

Optimistic LSST Scenario

- Astro2010 recommendation — 2010
- Pass Preliminary Design Review — 2011
- Partnership agreements concluded — 2011
- NSF assesses LSST vs other MREFC projects
- NSB gives NSF director go-ahead for future budget request — 2012
- President's budget request, passed by Congress — 2013
- Initial MREFC funding — 2014

Mid-Scale Innovations-1

- No budget line or proposal opportunities in AST at ~$4M-$135M level
  - NSF-wide issue is being studied by NSB
- In AST, proposals in this range now treated one-at-a-time, overseen by program officers on ad-hoc basis
  - Advantage: No budget line needed in advance, and ability to shop proposals with partners (other agencies & divisions)
  - Disadvantage: Infrequent head-to-head competition
  - Funded in last decade: EVLA, NVO/VAO, VERITAS, CARMA, SDSS, PolarBear, ACT, MWA
    - Most of these involve significant interagency, university, or international partnerships, so that AST funding is highly leveraged

Mid-Scale Innovations-2

- Two possible options
  - Preferred: AST solicitation in FY12 or FY13 if funding wedge is available
  - Alternative: Wait for broader NSF-wide program
    - Could be akin to a Large MRI program
    - May be only option if AST budget does not permit a dedicated AST line
- Management structure will depend on program implementation

CCAT

- Cerro Chajnantor Atacama Telescope
  - 25-m diameter; mm and sub-mm wavelengths
  - Located at ~5600 m on mountain above ALMA
  - Conduct surveys as complement to ALMA
- Astro2010 Top Priority Mid-Range
  - Recommended for immediate start
- Currently in design and development for construction readiness in about two years.
- Earliest possible NSF construction funding 2013; Depends on:
  - Solidifying partnership for full funding.
  - Passing NSF critical review of scientific merit, technical readiness, cost.
  - Availability of funds.

Small Programs

- $8M (17%) increase in Astronomy & Astrophysics Research Grants program
  - Fold science priorities into current grant program?
- $5M (50%) increase in Advanced Tech. & Inst.
- $2M increase (10%) in Gemini contribution
  - UK pull out after 2012
- $1.5-2M increase in Telescope Systems Instrumentation
- $2.5M for Theory & Computation Networks

- These all depend on a steadily increasing budget, so AST can make no commitments at this time

GSMT

- Next-generation large optical telescope
  - Thirty Meter Telescope (TMT: Caltech & UC-led)
    - Site selected on Mauna Kea, Hawaii
    - Astro2010 estimates $1.4 billion at 70% confidence level (Project: $1.0B)
  - Giant Magellan Telescope (GMT: Carnegie & Arizona-led)
    - Site selected at Las Campanas, Chile
    - Astro2010 estimates $1.1 billion at 70% confidence level (Project: $0.7B)
  - European Extremely Large Telescope (42m in Chile)
- Astro2010 recommends federal investment in 25% share in one US-led telescope, with "immediate" selection
  - Eventual 50% share is mentioned, but AST considers this extremely unlikely in present environment

GSMT Selection

- What would a federal choice mean?
  - Not a "down-select" that kills any projects
  - Not a commitment to fund construction in MREFC
  - Investment in design & development for one telescope
  - Ops planning with expectations for federal user facility
    - Present operations cost estimates by TMT & GMT seem quite low
- Potential criteria for federal investment strategy on GSMT
  - Science program, US community benefit, technical feasibility, ops plans, partnership reality, site issues
- Cost and risk analyses will be critical elements of all criteria

- Don Terndrup has been designated as program officer to work on the complex investment selection

A Federal GSMT Scenario

- Based on Astro2010 prioritization — 2010
  - Assessment for federal investment strategy — 2011
    - TMT or GMT or investment in EELT?
  - Pass Preliminary Design Review — 2014
  - AST receives and evaluates proposal
  - NSF assesses GSMT vs other MREFC projects — 2015-2016
  - Proposal from NSF Director to NSB
  - President's budget request, passed by Congress — 2016-2017
  - Initial MREFC funding — >2017-2018

OIR System

- Astro2010: Re-adjust balance of current vs. future facilities
  - This will require an overall AST portfolio review
- Astro2010: Restructure Gemini, acquire increased Gemini share, and consider Gemini/NOAO consolidation
  - Share will increase from 50% to ~63% after 2012 because of UK pullout (increase of ~50 nights/year)
  - New structure of international partnership is under active discussion, as is Gemini/NOAO consolidation
    - The two are not easily decoupled, since NOAO is a US entity, but Gemini is a multi-lateral international observatory
  - Further discussions planned at November Gemini Board

Backups follow

Expectation from Past Surveys

- First-priority major ground-based recommendation is achieved (eventually)
  - Usually not completed until the following decade, and may take ~20 years after first recommendation
  - Typically ~1.5 "major" projects per decade
- Moderate-size recommendations
  - Considerable success in last three decades
  - Funding available for each is usually less than recommended

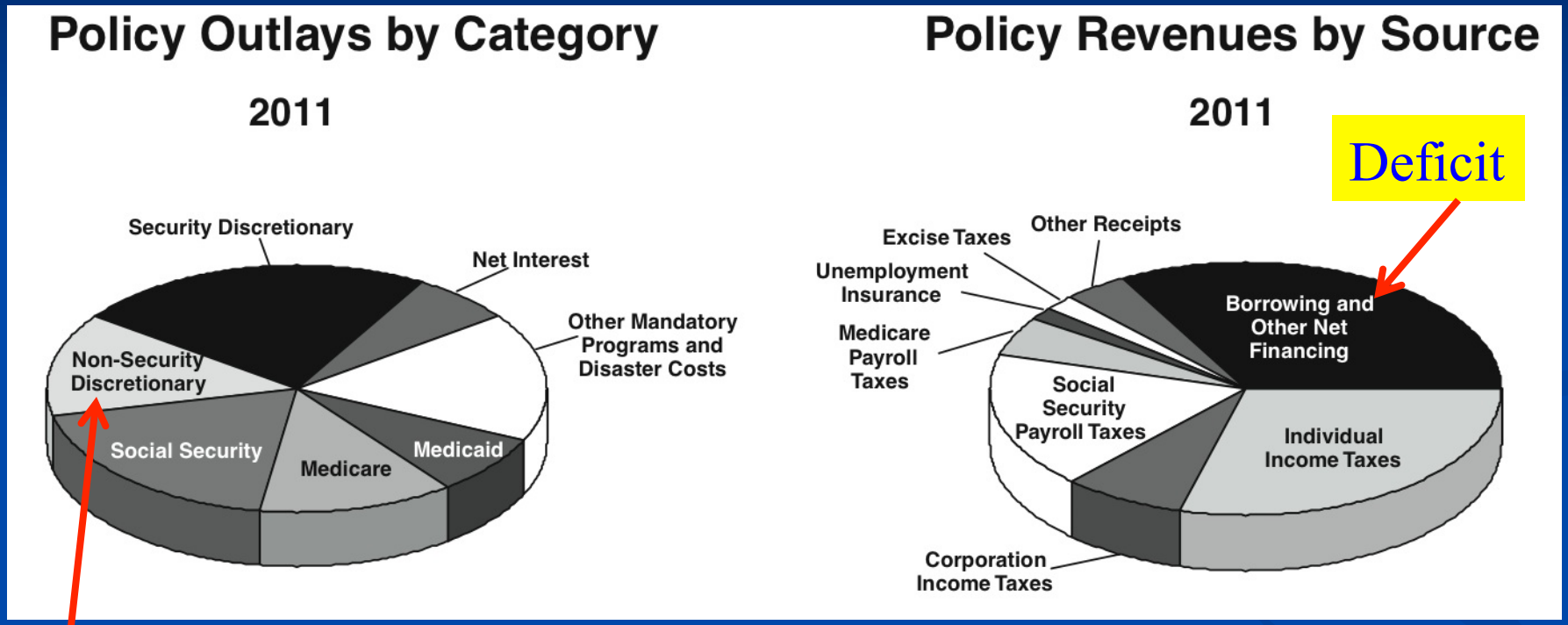
2000 Survey

- Three major ground programs: GSMT, EVLA, LSST
  - GSMT not started (not ready early in decade)
  - EVLA: part 1 nearly complete, part 2 not approved
  - LSST not started
- Moderate ground recommendations: TSIP, ATST, SKA technology, CARMA, VERITAS, FASR, South Pole Telescope
  - All except FASR started or completed in some form
  - ATST became a major project

1990 Survey

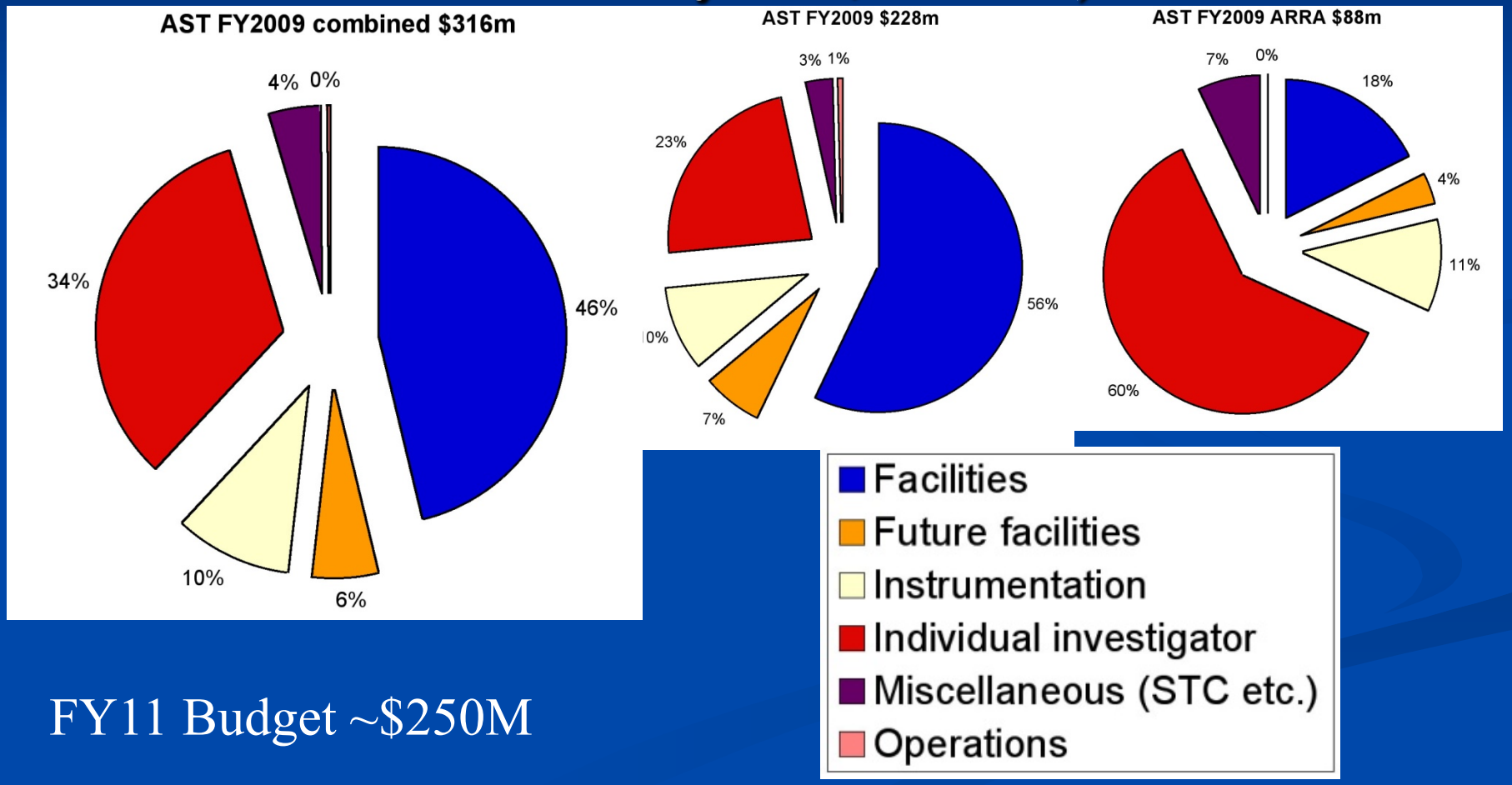
- Three major ground recommendations: 8m IR-optimized telescope, MMA, southern 8m telescope
  - The 8m telescopes became Gemini
  - MMA became ALMA
- Moderate ground recommendations: Adaptive optics, OIR interferometer, shared 4m telescopes, cosmic ray telescope, solar telescope, VLA upgrade
  - Top 3-4 done in some form

Federal Budget Breakdown



NSF & NASA live here

NSF-AST FY 2009 Program (including American Reinvestment and Recovery Act, ARRA)



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