IPSAG Workshop

August 2012

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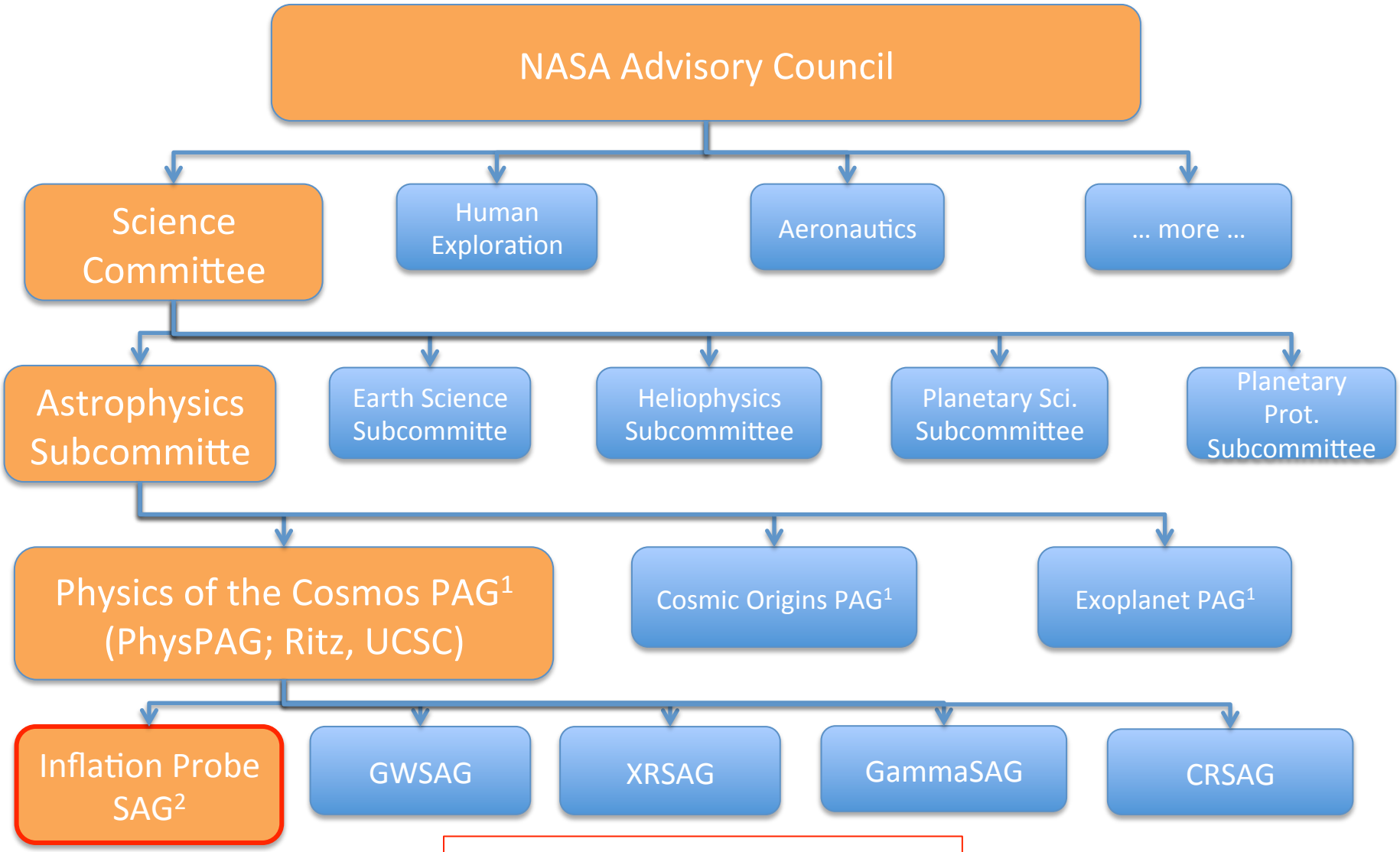
With many thanks to:
Jamie Bock, Al Kogut, Suzanne Staggs,
PCOS Program office and
Ann Hornschemeier

What is PhysPAG and IPSAG?



[1] PAG = Program Analysis Group
[2] SAG = Science Analysis Group

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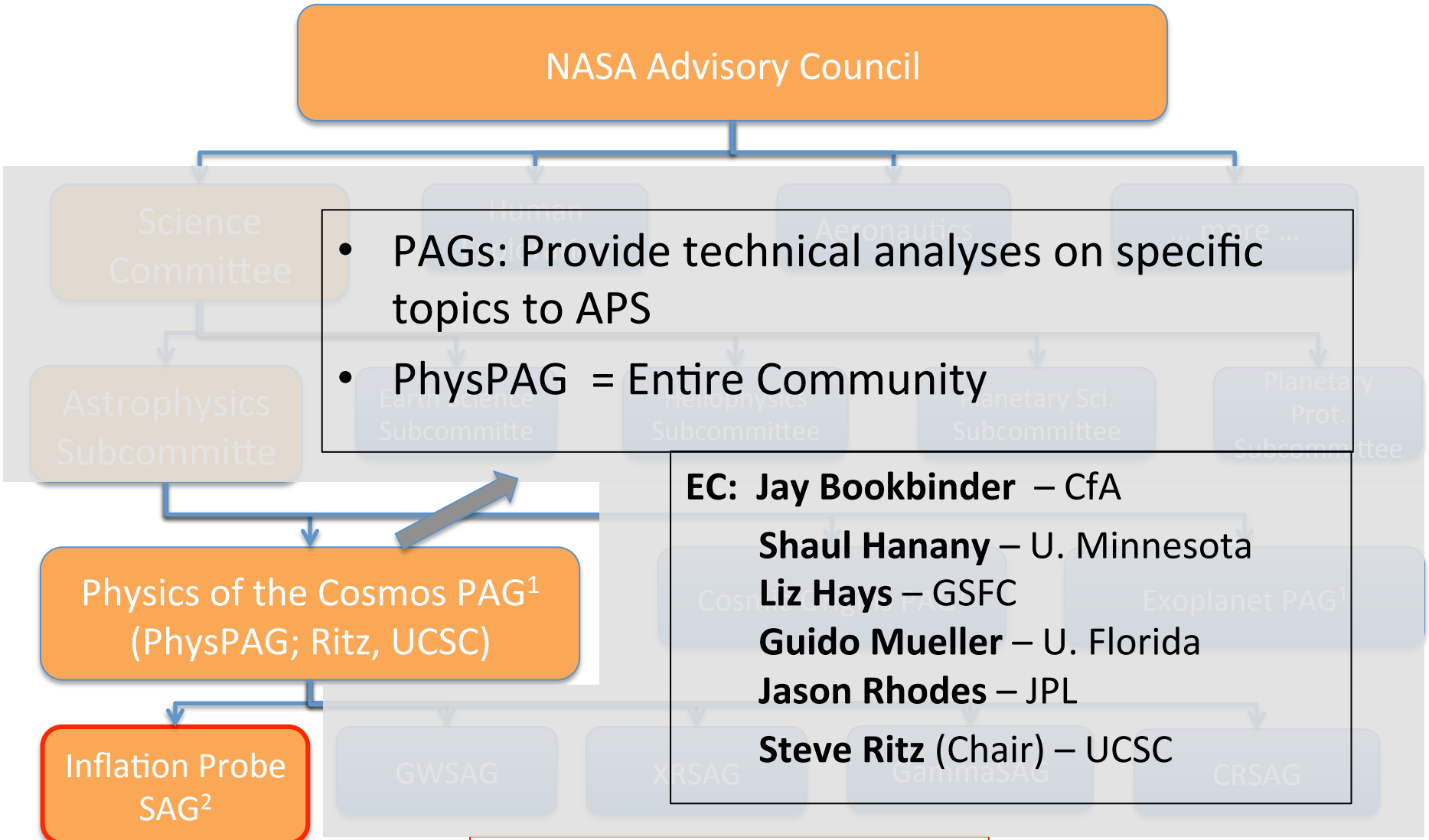

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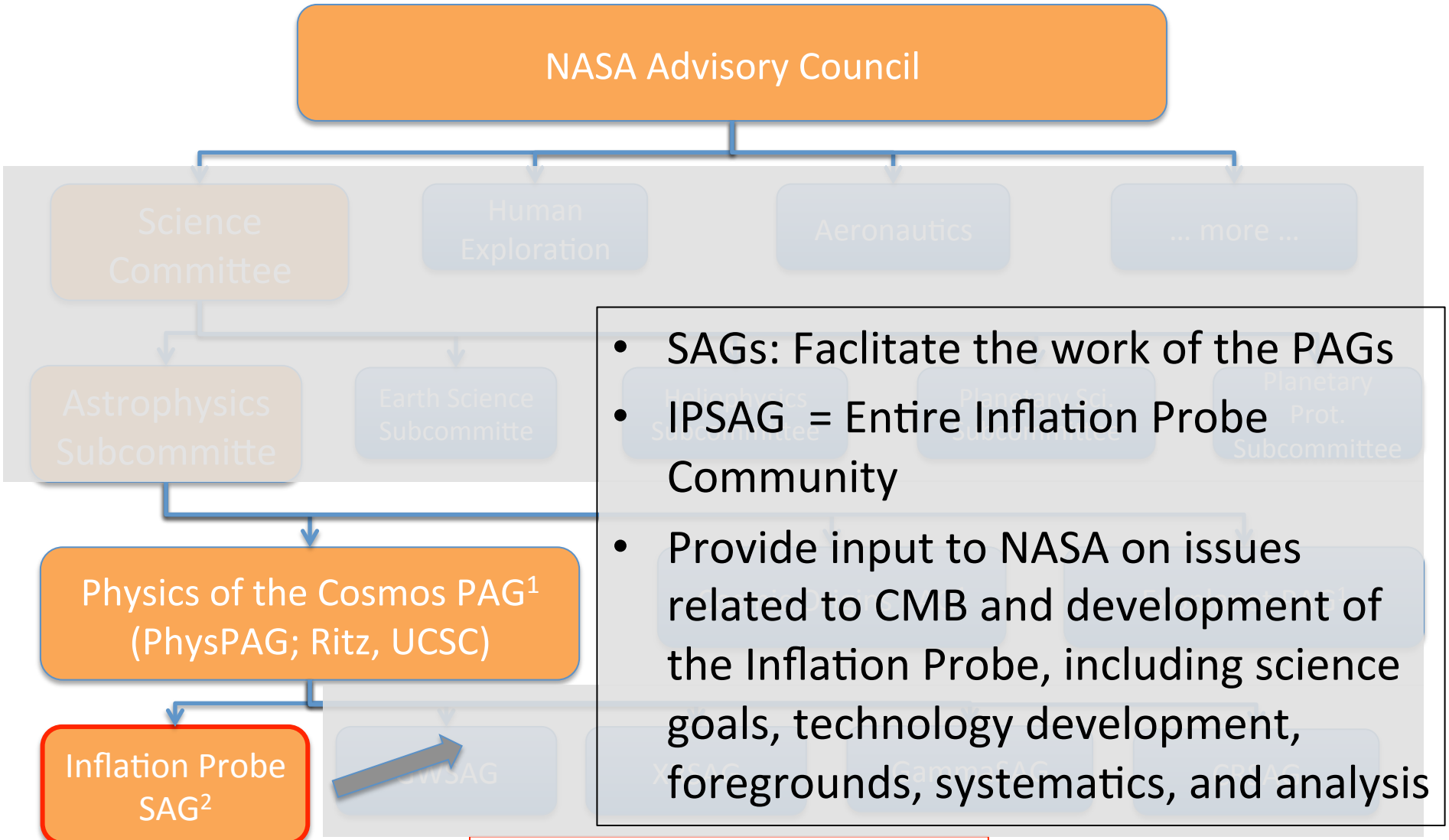

- SAGs: Faclitate the work of the PAGs
- IPSAG = Entire Inflation Probe Community
- Provide input to NASA on issues related to CMB and development of the Inflation Probe, including science goals, technology development, foregrounds, systematics, and analysis

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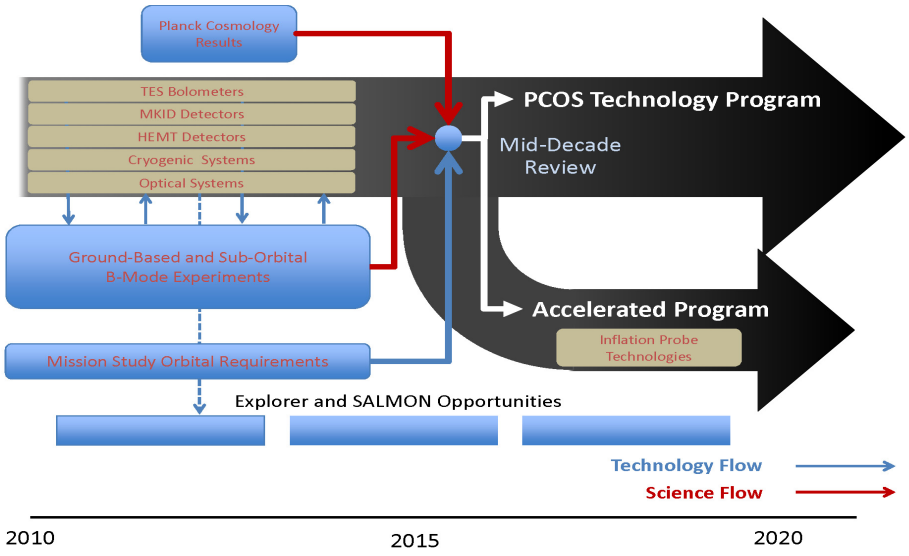
IP Community Plan for the Decade

- Start of satellite mission not sufficiently compelling now (2010)
- But may become high priority past mid-decade
- Must prepare for possible start of mission by end of decade



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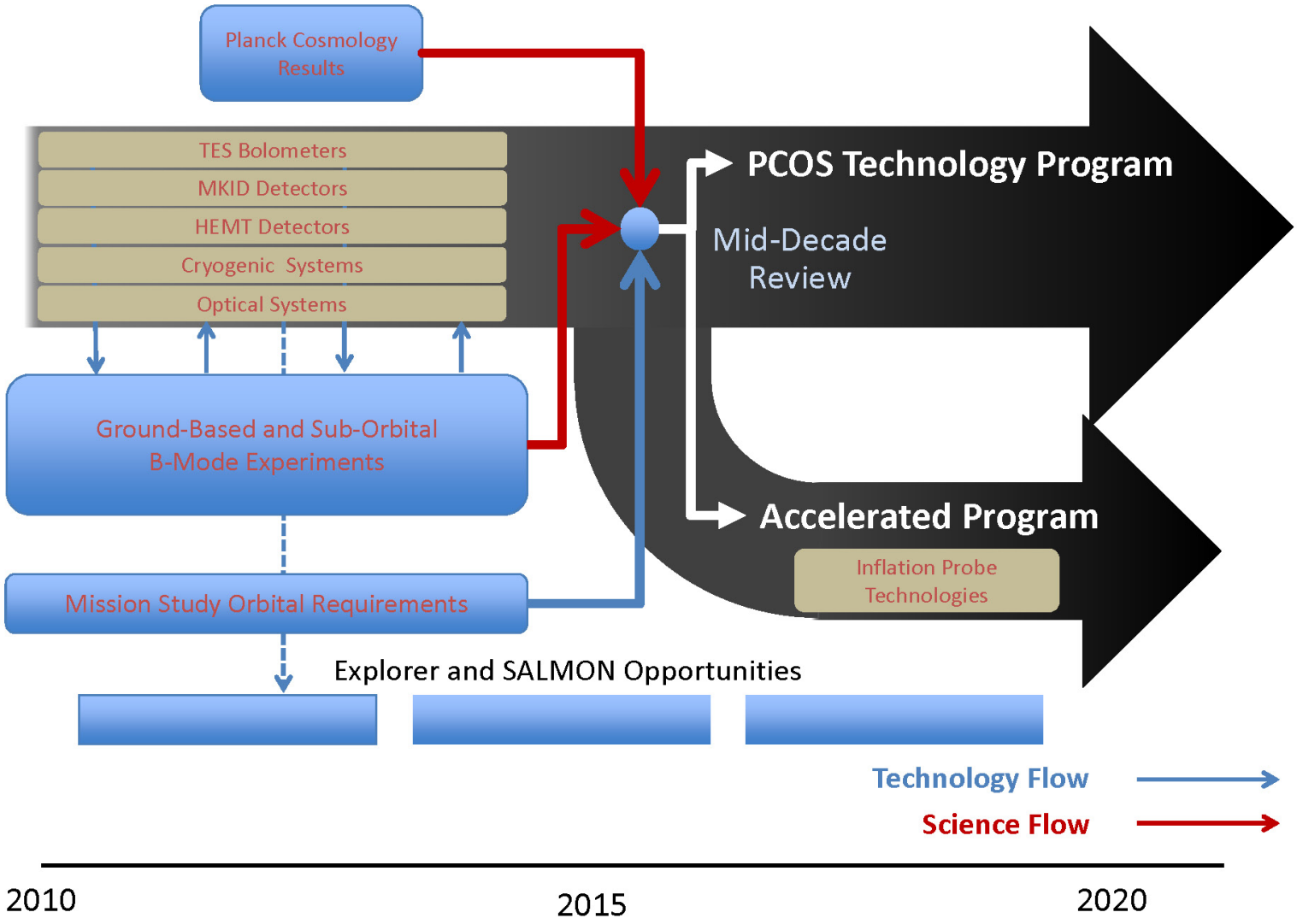
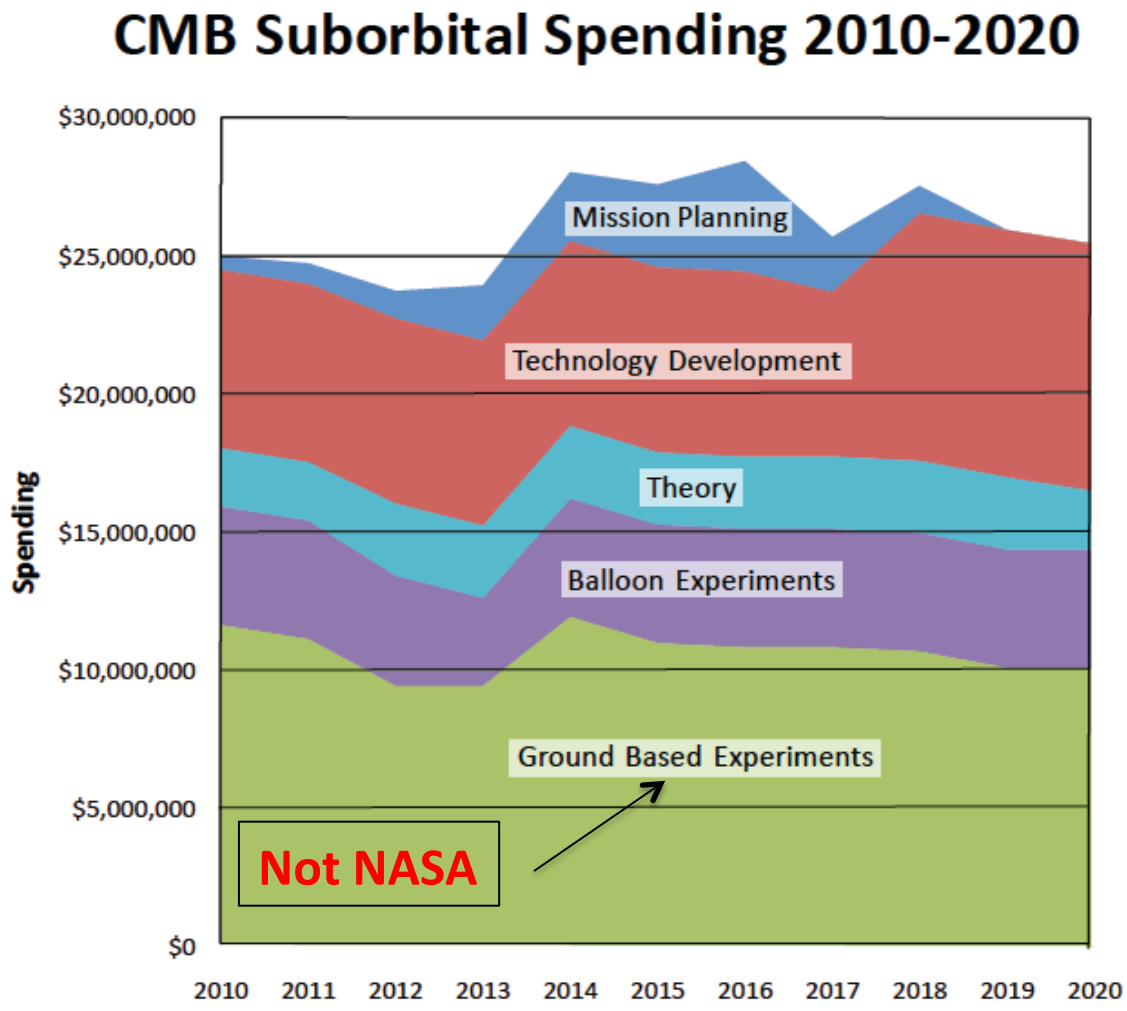


Plan Endorsed by NWNH

IP Community Plan for the Decade

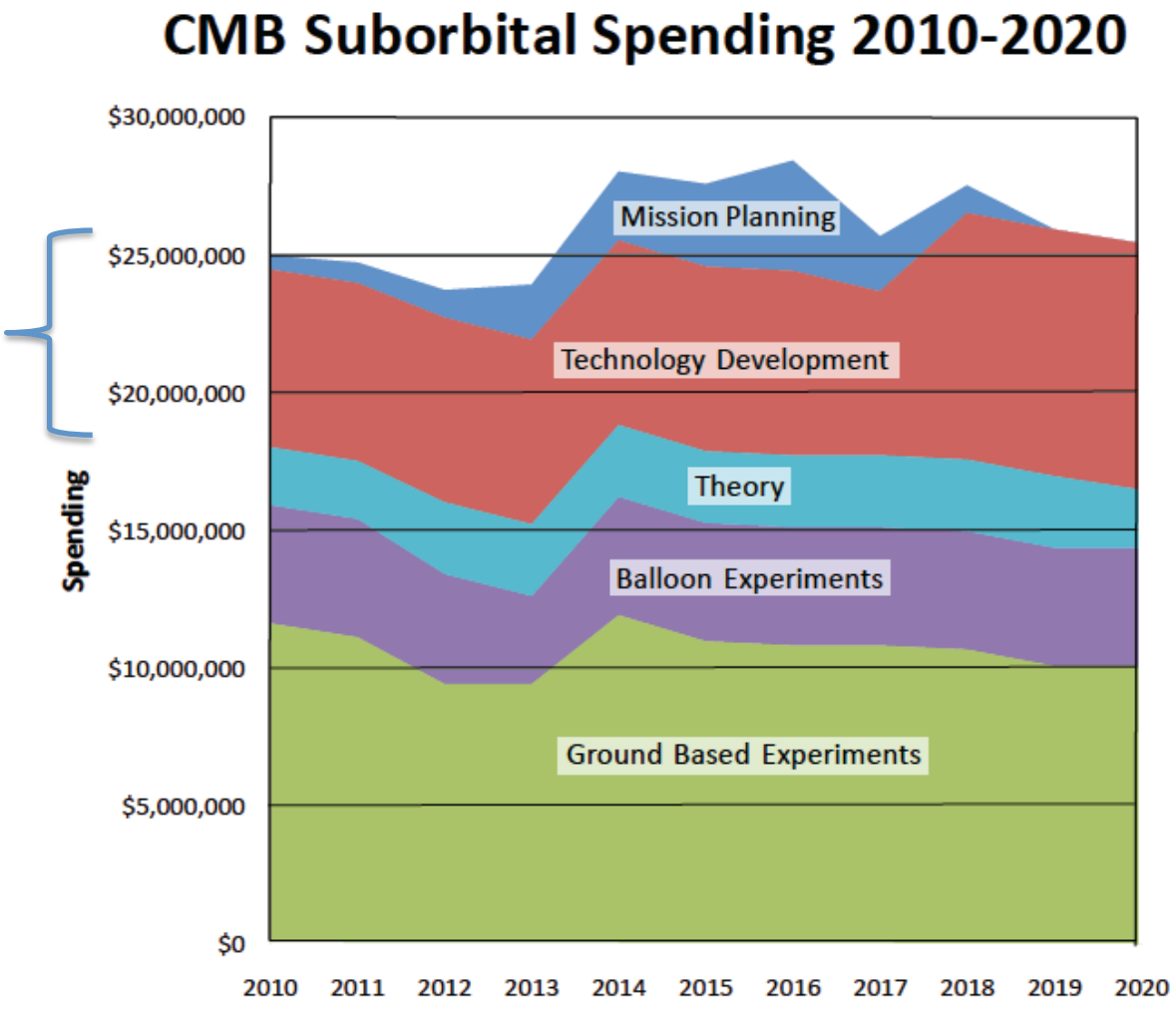
Existing, Competition Based Funding



Taken from CMB community 2010 white paper: "A program of Technology Development and Sub-Orbital Observations of the CMB Polarization Leading to and Including a Satellite Mission"

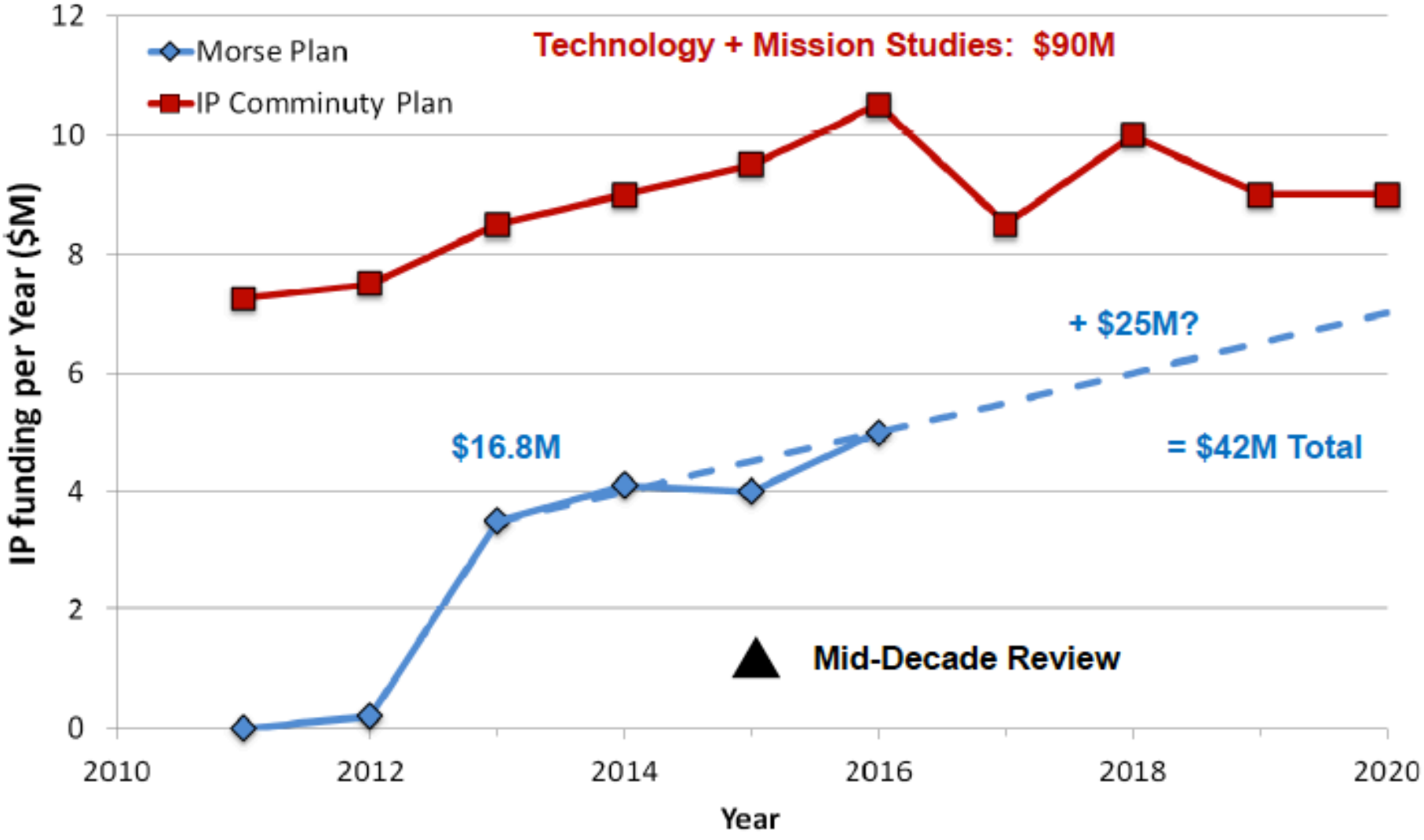
IP Community Plan for the Decade

- Strategic Astrophysics Technology program
- ~$1M/yr University Research + ~$5.5M/yr detector dev. centers
- Mission Planning: prepare concrete plan for mid-decade review



- **Decadal Recommendation: $60 - $200M / 10 year**

Morse's Response (as of 2/2011)



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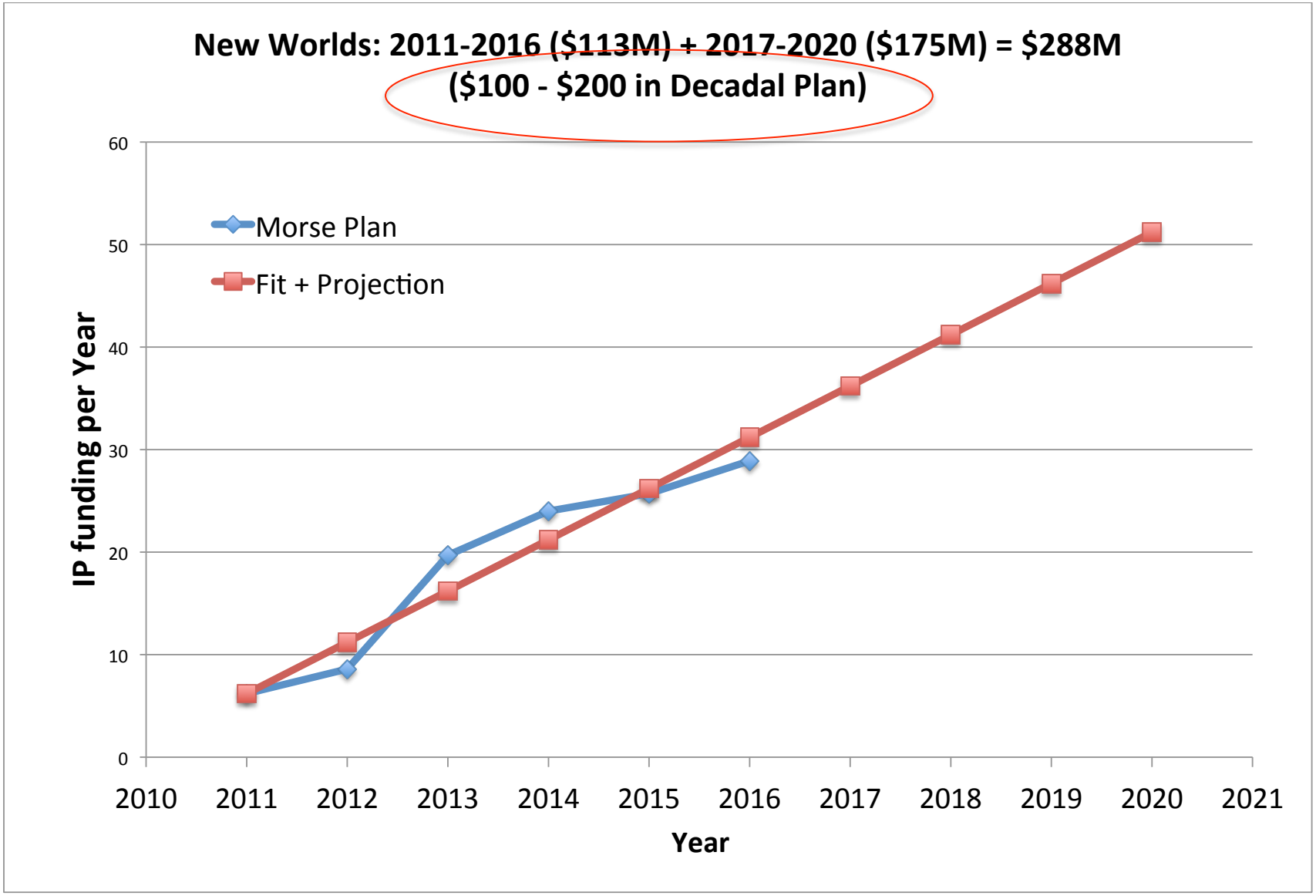
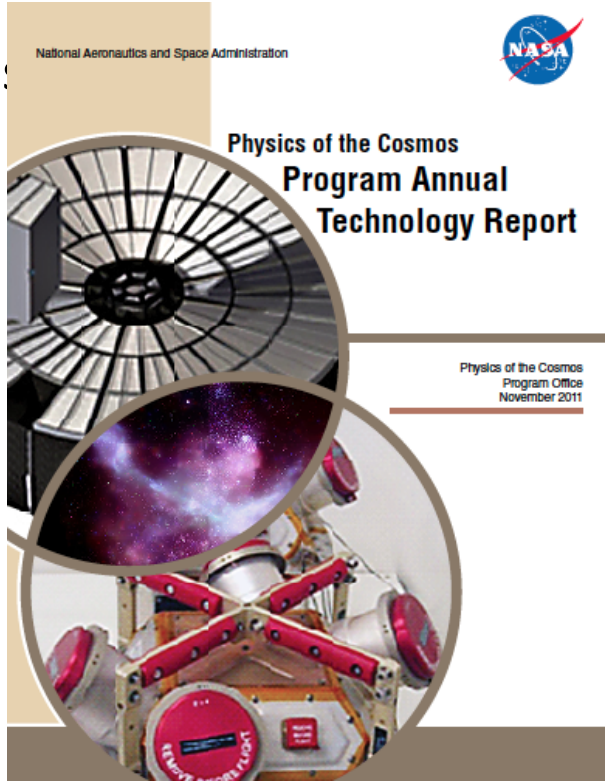


IPSAG 2011 Technology Plan

- Developed under auspices of the IPSAG
- Submitted to PhyPAG and PCOS (9/2011)
- Input to PCOS Program Annual Technology Report (PATR)
- Only community to provide a detailed technology development plan for the PATR (?)
- Four Areas:
  - Detector arrays – TES, HEMT, SQUIDS, Antenna
    (high, TRL 4-5)
  - Optics – AR coats, Pol. modulators
    (medium, TRL 2-5)
  - Coolers (passive, mechanical, sub-K)
    (low, TRL 3-9)
  - Advanced arrays – TES/MKID + RF resonators
    (low, TRL 3)



PATR Results

2011 PCOS Technologies Grouped by Priority

Priority	Technology	Science
1	X-ray calorimeter: central array (~1,000 pixels): 2.5 eV FWHM at 6 keV; extended array: 10 eV FWHM at 6 keV.	X-ray
	Telescope: Classical optical design. Surface roughness <lambda/30, backscatter/straylight. Athermal design with temp gradient dimensional stability: pm/sqrt(Hz) and μm lifetime, angular stability <8nrad	Gravitational Wave
	Laser: 10 yr life, 2W, low noise, fast frequency and power actuators	Gravitational Wave
	lightweight, replicated x-ray optics. Lightweight precision structure	X-ray
2	High resolution gratings (transmission or reflection)	X-ray
	High-throughput, light, low-cost, cold, mm-wave telescope operating at low backgrounds	Inflation
	Large format (1,000-10,000 pixels) arrays of CMB polarimeters with noise below the CMB photon noise and excellent control of systematics	Inflation
	Phasemeter: Quadrant photodetector: low noise. ADC: 10 yr life, low noise (amplitude and timing). Alignment sensing, optical truss interferometer, refocus mechanism	Gravitational Wave
	μN thrusters: 10 yr. life, low contam, low thrust noise. Not formation flying.	Gravitational Wave
	Cryocoolers for detectors and other instrument HW	X-ray

SAT Awards

For ROSES 2010 SAT: 5 grants awarded; 4 x-rays, 1 CMB

hattenburg, M.	MIT	Development of Fabrication Process for Critical-Ang X-ray Transmission Gratings
utz, M.	MIT	Directly-Deposited Blocking Filters for Imaging X-ra Detectors
ck, J.	JPL	Antenna-coupled Superconducting Detectors for Cosmic Microwave Background Polarimetry
Entaffer, R.	Univ of Iowa	Off-plane Gratings Arrays for Future Missions
id, P.	SAO	Development of Moderate Angular Resolution Full Shell Electroplated Metal Grazing Incidence X-ray Optics

Look to the Future: Today and Onwards

- There is an array of excellent sub-orbital experiments pushing the sensitivity, technology, systematics, and foreground frontiers
- There are paper proposals for future B-mode satellites (around the world)
- Technology is advancing very rapidly
- Are we and NASA ready for the possibility of B-mode detection? What needs to be done for the mid-decade review?
  - Do we need another round of mission studies?
  - What technologies need to be demonstrated, and what milestones need to be achieved by the mid-decade review?
  - How should the mid-decade review assess the readiness of the IP?
- What are the needs of the IP community if there is no detection very soon?

Plan for the Day

- 8:45 – Planck (Lawrence + Crill)
- 9:35 – Future Satellite Proposals (de Bernardis, Bock, Kogut, Hazumi)
- 11:00 – Paul Hertz
- 12:00 – 1:15 Lunch
- 1:15 – Sub Orbitals (Jones, Lee)
- 2:15 – Technology Development (Moseley, Irwin)
- 3: 10 – Break
- 3:30 – NASA
- 4:10 – Discussions + Summaries