
New Worlds,
New Horizons
in Astronomy and Astrophysics
NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

Task and Charge

Negotiated by NRC with Agencies; accepted by chair

- The Committee on Astro2010 will survey the field of space- and ground-based astronomy and astrophysics, recommending priorities for the most important scientific and technical activities of the decade 2010-2020. The principal goals of the study will be to carry out an assessment of activities in astronomy and astrophysics, including both new and previously identified concepts, and to prepare a concise report that will be addressed to the agencies supporting the field, the Congressional committees with jurisdiction over those agencies, the scientific community, and the public.
- In proposing a decadal U.S. research strategy for astronomy and astrophysics, the committee is expected to consider and make recommendations relating to the allocation of future budgets and address choices which may be faced, given a range of budget scenarios. For each prioritized activity, the committee will establish criteria on which its recommendations depend. The committee will make recommendations to the agencies on how to rebalance programs within budgetary scenarios upon failure of one or more of the criteria.

Decadal Surveys are >2 year deliberative exercises

They have detailed charges and extensive review

They should emphasize scientific prioritization over mission planning

They should not be expected to react to latest budgetary crisis

Summary

- This is an extraordinary time in the study of the cosmos, but also a time of serious constraints on federal discretionary budgets.
- The recommended program is science-driven and will enable progress across a large swath of research and open up more discovery space.
- A balanced program should be maintained throughout the decade. Effective international, public-private and inter-agency collaboration is required for success of the program.
- A serious effort has been made to appraise activity cost, risk and technical readiness.
- Mid-decade decisions should be made based on recommendations from an independent, strategic advisory committee.
- Astro2010 has had unprecedented involvement and support by the astronomical community and immense effort by the committee, panels and consultants, as well as the strong cooperation of the agencies and professional societies.

Budgetary Context

- Agency Guidelines (the pessimistic scenario)
  - NSF and DOE – constant budgets in fixed dollars ($FY2010)
    - NSF initiatives only possible at expense of existing program through Senior Review
    - Modest DOE program
  - NASA – constant real year dollars (declining budget in $FY2010)
    - WFIRST, Explorer augmentation, “small” program
- Survey Budgets (the optimistic scenario)
  - NSF and DOE – “doubling” = 4% per year growth in $FY2010
  - NASA – constant in $FY2010 dollars
- Notional “sand charts”
  - Exhibit possible spending profiles consistent with committee budgets and the recommended program, i.e. phasing
  - Allowed the committee to examine possible programmatic scenarios
  - Provide advice in less optimistic budget scenarios

Large Scale Space Program - Prioritized

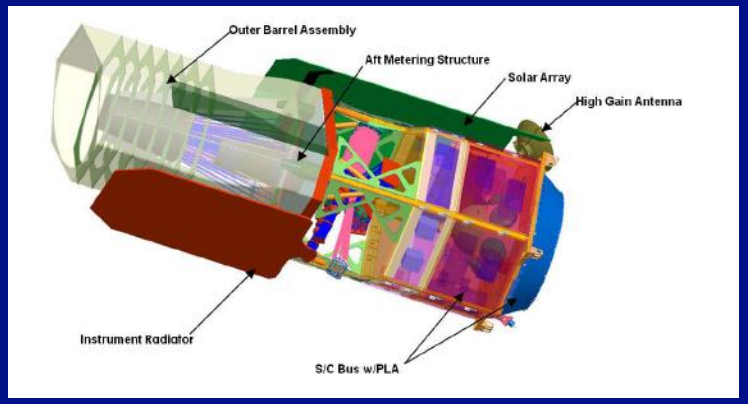
1. Wide Field InfraRed Survey Telescope (WFIRST)

1. Explorer Program Augmentation

2. Laser Interferometer Space Antenna (LISA)

3. International X-ray Observatory (IXO)

WFIRST - Science



Near infrared wide-field telescope with a *set* of key science objectives:

- Dark energy (part of a coherent ground-space strategy):
  - Baryon acoustic oscillations
  - Distant supernovae
  - Weak lensing
- Exoplanet statistics
  - Gravitational microlensing
- Guest investigator mode enabling survey investigations

Medium-Scale Space Program - Prioritized

1. New Worlds Technology Development Program

2. Inflation Technology Development Program

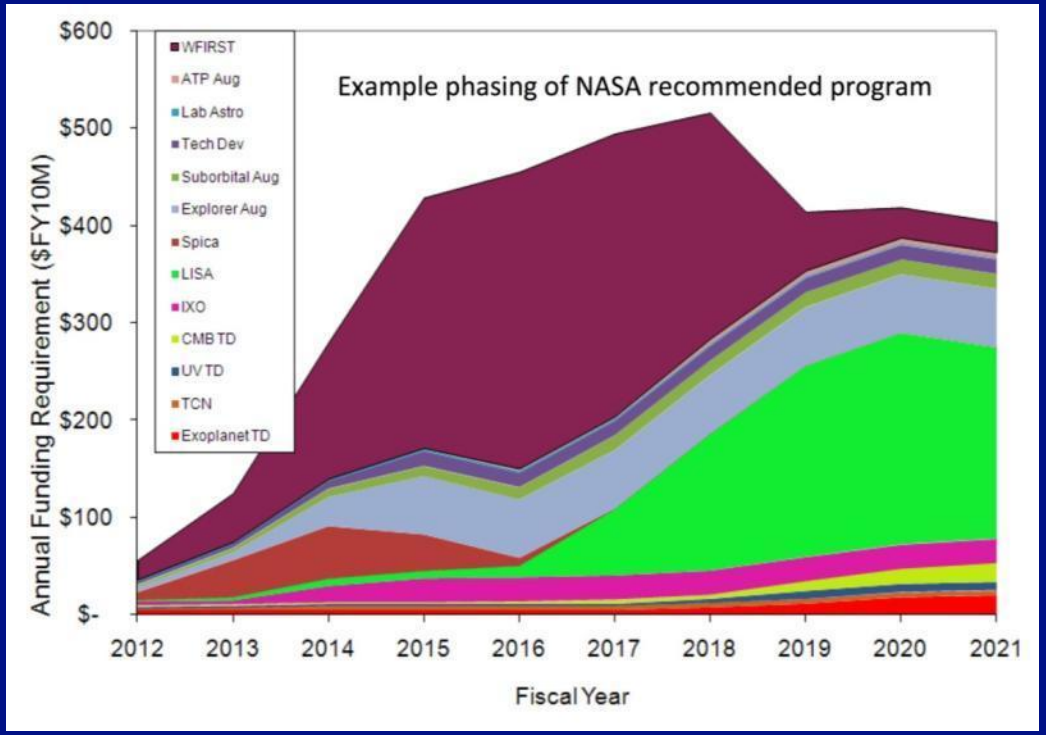
Small-scale Program (Ground and Space – not prioritized)

Program Augmentation	Agency
Advanced Technologies and Instrumentation	NSF
Astronomy and Astrophysics Grants (including Lab. Astro.)	NSF
Astrophysics Theory Program	NASA
Intermediate Technology Development	NASA
Laboratory Astrophysics	NASA
Sub-orbital Program	NASA
Telescope System Instrument Program	NSF

New Initiatives	Agency
Development of future UV-optical space capability	NASA
Leadership in Gemini international partnership (increment)	NSF
Participation in JAXA's SPICA mission	NASA
Theory and Computation Networks	NASA, NSF, DOE

NASA

- Expectation under survey's budget scenario:
  - launch WFIRST
  - augment Explorers
  - start LISA
  - timely contribution to SPICA
  - advance
    - IXO
    - Exoplanet and Inflation technology development
- Details depend upon ESA negotiations and decisions



SOFIA + HST decommission

- If budgets are lower, SPICA contribution dropped and
  - First priority: WFIRST, Explorer augmentation and small program
  - Second priority: New Worlds (Exoplanet) Technology Development, LISA and IXO Technology Development
  - Third priority: Inflation Technology Development

WFIRST – Program Details

- Discussions between NASA/DOE and ESA about mounting a joint mission could be a positive development if they lead to a timely execution of a program that fully supports all of the key science goals of WFIRST (planet microlensing, dark energy science, general investigations) and leads to savings overall.
- It is expected that the United States will play a leading role in this top-priority mission
- A minority role in a Euclid dark energy/cosmology mission does not appear among the NWNH recommendations

Summary of NASA response

- JWST replan (8.7B, 2018)
- WFIRST, Imp. Rec. Rev., SDT, Euclid
- Explorer - notional budget $M75pa, “on track”
- LISA, IXO teams disbanded
- R&A, Tech Dev
- Senior Review
- JAXA-Astro-H, SPICA. Earthquake!

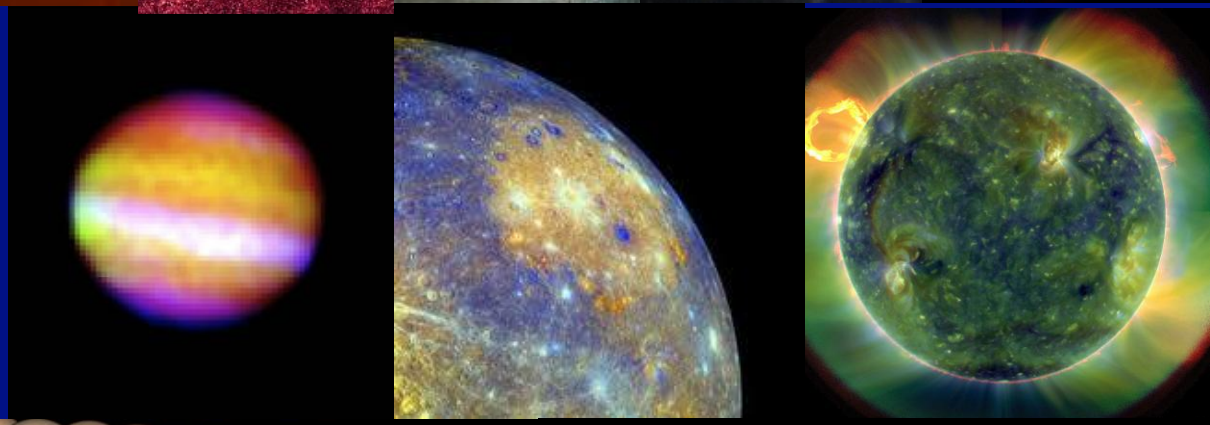
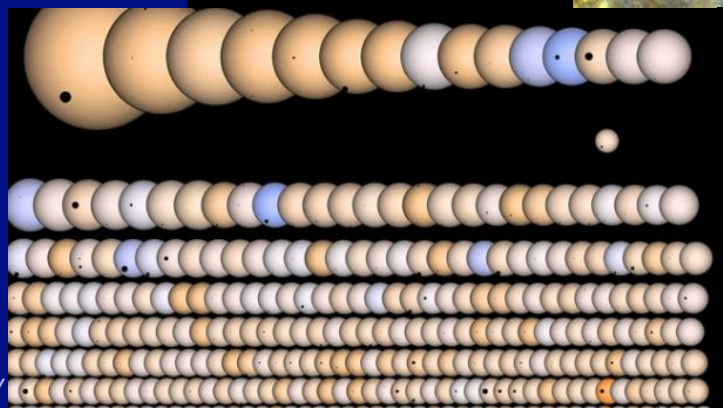
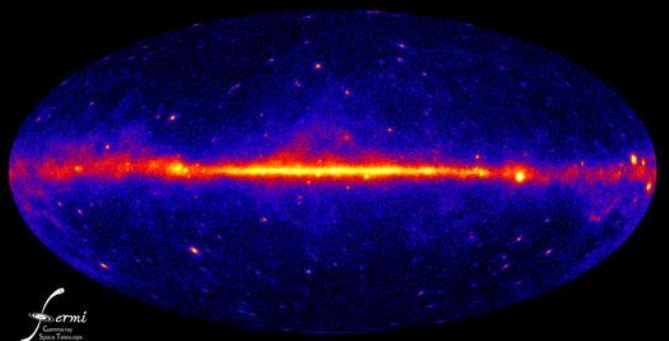
NRC Panel on Implementing NWNH

- Commissioned by OSTP
- Implement Astro2010 in effective and timely manner
  - Changes in NASA budgetary outlook
  - Status of NASA's implementation of WFIRST
  - Status of ESA-Euclid including partnership
  - Synergies and complementarities
- Outline pros and cons
- Workshop Nov 2010
- Letter report (Burrows)

Space Mission Discoveries!!

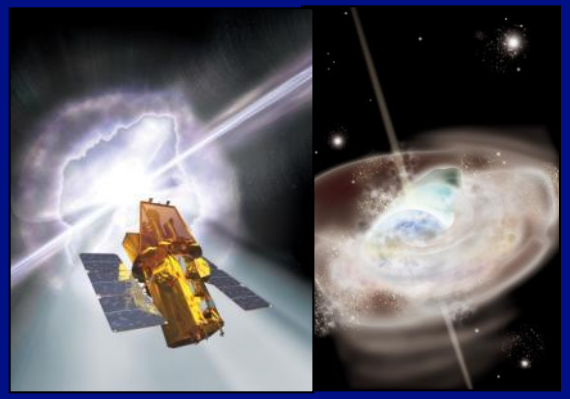
- HST/Chandra/Spitzer
- GALEX
- WISE
- Kepler
- Fermi
- Herschel/Planck
- SOFIA
- SDO
- Messenger

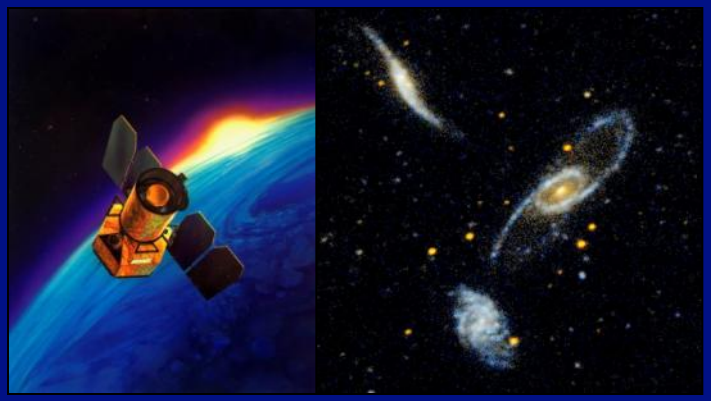


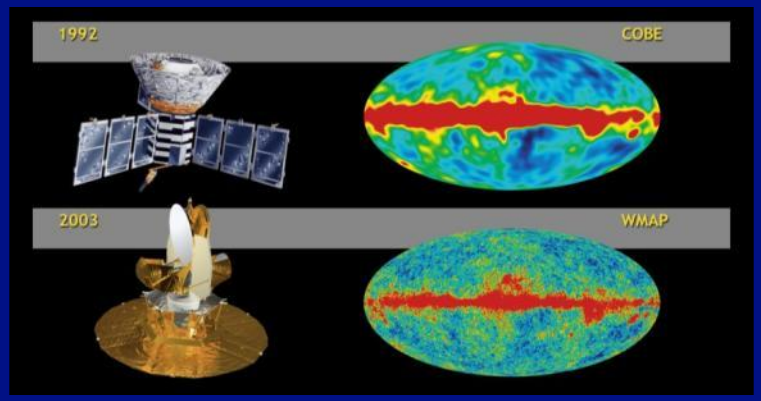




Explorer Program - Science

- Rapid, targeted, competed investigations
- Versatile program delivers high scientific return
- WMAP, Swift, GALEX, WISE… are extraordinarily successful past examples
- NuSTAR, GEMS, Astro-H very promising







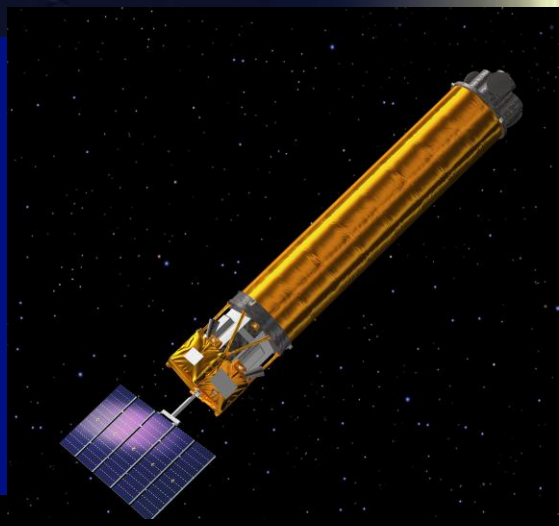
UPCOMING LAUNCHES

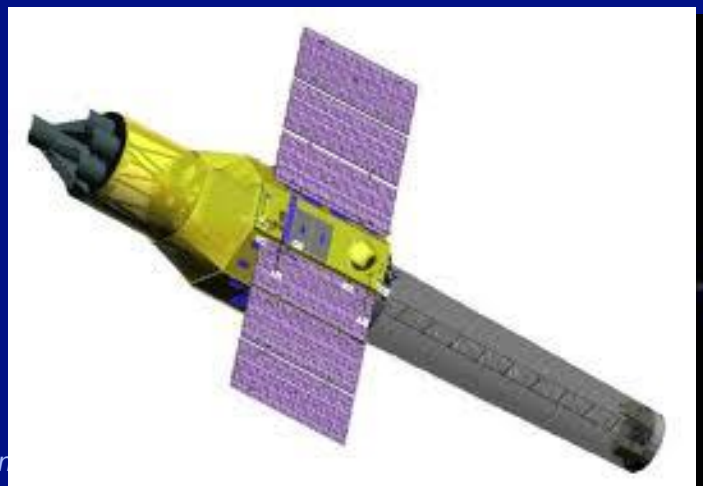
NuSTAR - SMEX 2012

Astro-H- MoO JAXA-led 2015

GEMS - SMEX 2014

JWST – “>=2018”





1. How would US participation in Euclid as a minor partner address the goals and priorities of NWNH?

- Quick access for the US science team to data that pertains to some of the highest-rated scientific objectives of NWNH
  - Implicit that US would be a leader in executing science
  - Cosmological studies primarily
  - Default access after 14 (quick), 26 (data products) months…
  - Some first authorships
  - Archival science!
- Improve Euclid through scientific contribution, hardware…
  - SWGs, WL, photoz's, IR detectors + expertise, reaction wheels…
- Microlensing, surveys, possible after 6.3yr
- Facilitate *complementarizing* WFIRST
  - Motivate future ESA contribution to WFIRST?

2. Based on the decadal survey and the implementation report, what are your recommendations for the committee's charge?

- WFIRST was top, large space recommendation of NWNH
  - 1995-exoplanets; 1998-acceleration - US strengths
  - Progress on both since NWNH but excitement sustained
  - Euclid impressive, but unlikely to meet NWNH goals; WFIRST better
- Personal view (based on today) is that given the financial situation, US should engage in Euclid as proposed and continue to develop WFIRST
  - Provide **some** high priority science from NWNH when other large missions (LISA, IXO) have been abandoned and other plans deferred
  - Negotiate with care, transparency, full acknowledgment of US contribution
  - Vital to engage CAA in any future escalation of the commitment to advise on balance against WFIRST development, explorers, small program, tech dev…
  - 2014 DSIAC study essential to address WFIRST planning and relationship to Euclid in the context of progress with JWST

GOOD LUCK!