Early Career
Focus Session

Decadal Surveys: What Are They and Why Do They Matter?

Marcia Rieke
Programs Subcommittee Chair
Astro2010

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What Are Decadal Surveys?

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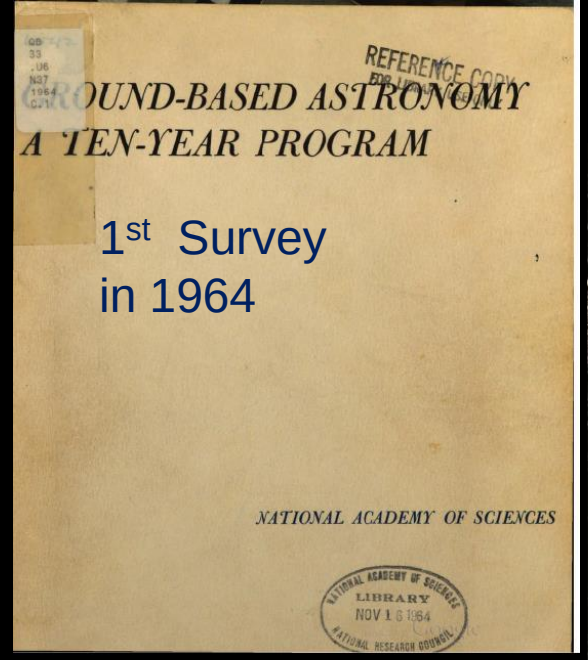
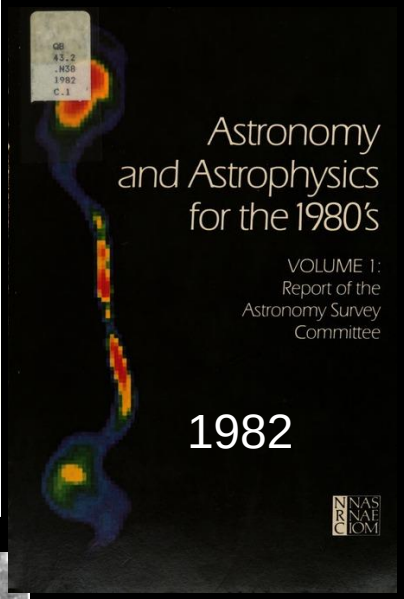
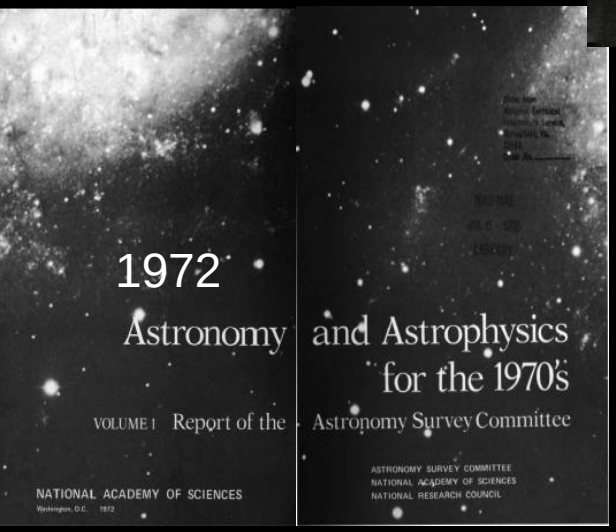
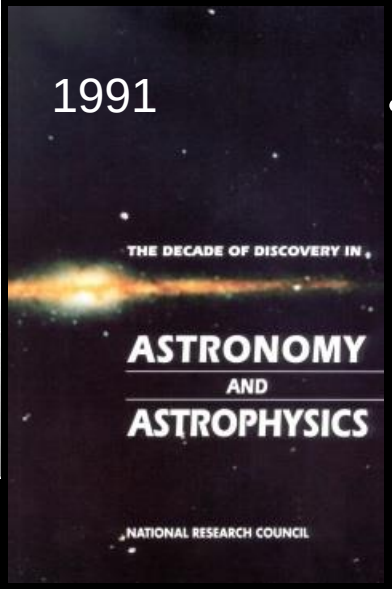


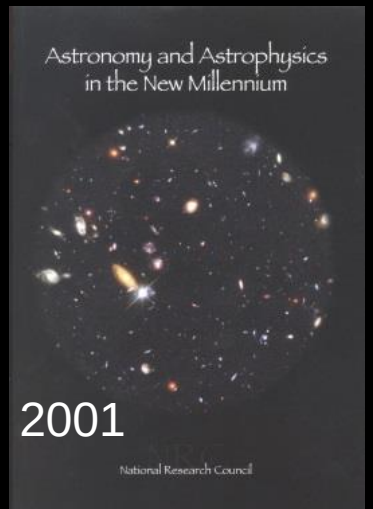
1st Survey in 1964

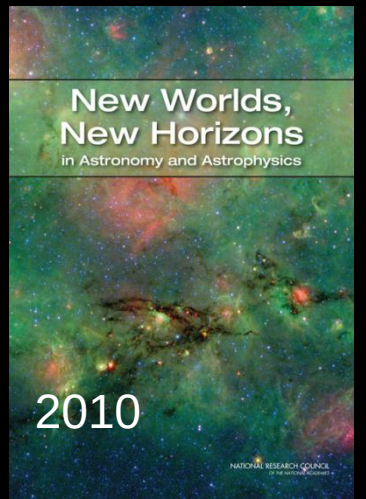


- In the 1960s, astronomers realized that their aspirations required so much federal funding that some type of assessment and recommendations were needed
- Initially only astronomers did this and now all of the disciplines in space science conduct surveys with some participation from other agencies
- Surveys and "CATE" are congressionally mandated









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U.S. Decadal Surveys -1

- **1964: Ground-based Astronomy: A Ten Year Program (Whitford)**

QSOs had just been discovered

-- resulted in construction of CTIO 4-meter

- **1972: Astronomy and Astrophysics for the 1970s (Greenstein)**

Astronomy satellites used to discover X-ray emission from stars

-- resulted in construction of the VLA, HEAOs, and development work for HST

- **1982: Astronomy and Astrophysics for the 1980s (Field)**

Many galaxies observed to produce large amounts of IR emission

-- resulted in construction of Chandra and VLBI

-- for future study: “Long-duration space flights of IR telescopes cooled to cryogenic temperatures”

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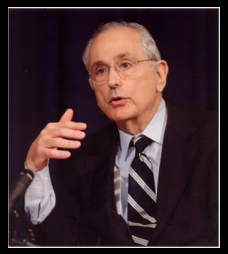
U.S. Decadal Surveys -2



- **1991: The Decade of Discovery in Astronomy and Astrophysics (Bahcall)**

  Existence of dark matter demonstrated

  -- resulted in construction of Spitzer, SOFIA, Gemini

- **2001: Astronomy and Astrophysics in the New Millennium (McKee-Taylor)**

  First exo-planets discovered, first evidence of dark energy seen

  -- resulted in development of JWST (and reassessment of how to execute decadal surveys)

- **2010: New Worlds, New Horizons ["Astro2010"] (Blandford)**

  First direct images of exo-planets, GRB afterglows observed, SMBHs in nuclei of virtually all galaxiex

  -- resulted in construction start for LSST, work on WFIRST

Astro2010 Executive Committee

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Why There Are Decadal Surveys

Astronomers want to do more than the federal budget can support:

Once this fact is acknowledged, then the discussion turns to who should decide what is to be done, what are the rules and criteria.

National Academy of Sciences is a logical choice as a body to oversee such a survey

-- Academy chartered to provide advice to the government on scientific matters

-- Academy itself does not receive funding to run any of the proposed projects

-- Academy has rigorous review rules and standards for development of recommendations

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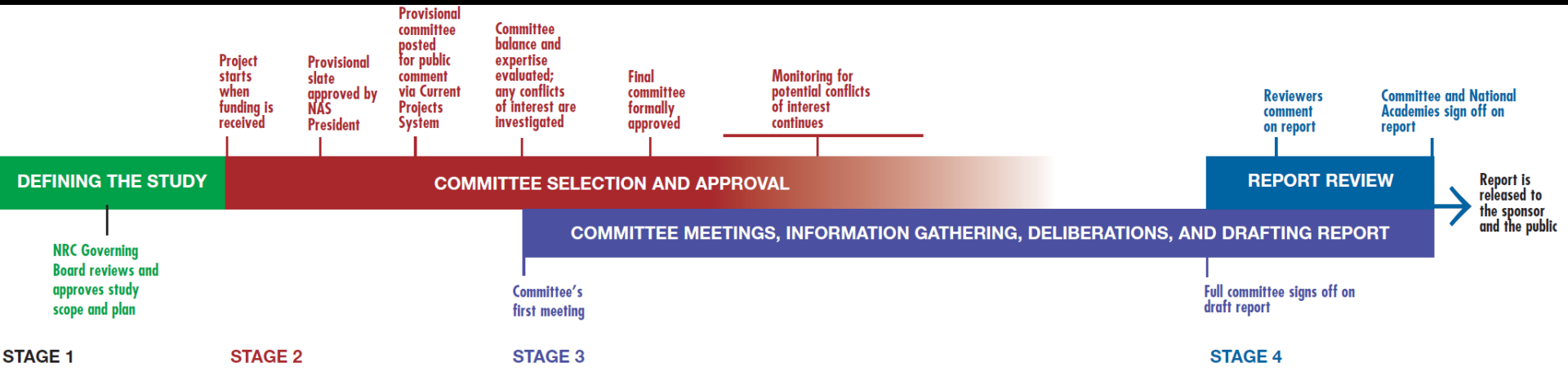
A Decadal Survey is a National Academies Report

A survey follows a process designed to ensure independence and objectivity. The review process checks that conclusions and recommendations are supported by the committee's information gathering and deliberations.



from http://www.nationalacademies.org/studyprocess

Reports have been successful because astronomers have made choices and prioritized so federal agencies and Congress have clear guidance.

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Who Charters and Uses the Survey?

- Congress and three federal agencies that fund astronomy (eg., NASA Astrophysics, NSF Division of Astronomical Sciences, DOE High Energy Physics) are the groups that rely on Decadal Surveys for science and activity guidance
- Congress can (and has) passed laws that define some Survey work such as the requirement for independent cost and technical evaluation
- The three agencies fund the Survey and negotiate the Statement of Task and report due date with the National Academies

Overview of the Survey Process

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- Federal agencies (NASA,NSF, DOE) work with the National Academies to define the survey task and time frame, typically more than two years before they want the report
- The National Academies then select a chair, refine the statement of task with the agencies, and select survey committee members
- Survey committee works for ~2 years to produce a prioritized list of projects
- Once report is final after passing through the review process, the survey chair makes presentations to the agencies and to Congress on the priorities
- Agencies largely accept Survey priorities as their priorities as does Congress

No One Way to Execute a Decadal Survey

Most of the examples in this presentation are drawn from Astro2010 but important to realize that there have been many approaches:

-- survey may be led by co-chairs or a single chair

-- number and types of panels has varied substantially

-- panel reports not always published separately

-- role of "state of the profession" activities has varied substantially

-- fidelity and style of cost estimates has varied

-- survey chair(s) play a large role in the structure and functioning of the survey committee

Astro2010 Charge aka Statement of Task

- The Astro2010 committee 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.

Astro 2010 Overview

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The three pillars of the survey

Astro2010: Science Frontiers

Astro2010: State of the Profession / Infrastructure

Astro2010: Activities / Program Prioritization

Some features of Astro2010

Unprecedented community buy in to process

Include unstarted projects from the previous survey, AANM

Improved assessment of technical readiness and risk, and cost drivers

Changing economic political background and increased international and private collaboration considered

Survey Committee Selection

- Followed NRC (now Academies) procedures
- Tried for "balance" across disciplines, across places of employment (eg. state versus private universities , companies, federal labs/observatories), geographic distribution, etc…
- Conflicts of interest (not in the financial sense which rarely affects astronomy decisions but in the "promoting a project" sense) were considered very carefully
  - 2000 Survey considered conflicts in the NRC sense of personal financial interests but was not as careful about institutional conflicts
  - Many knowledgeable people eliminated but process has been much less influenced by project advocates

Committee on Astro2010

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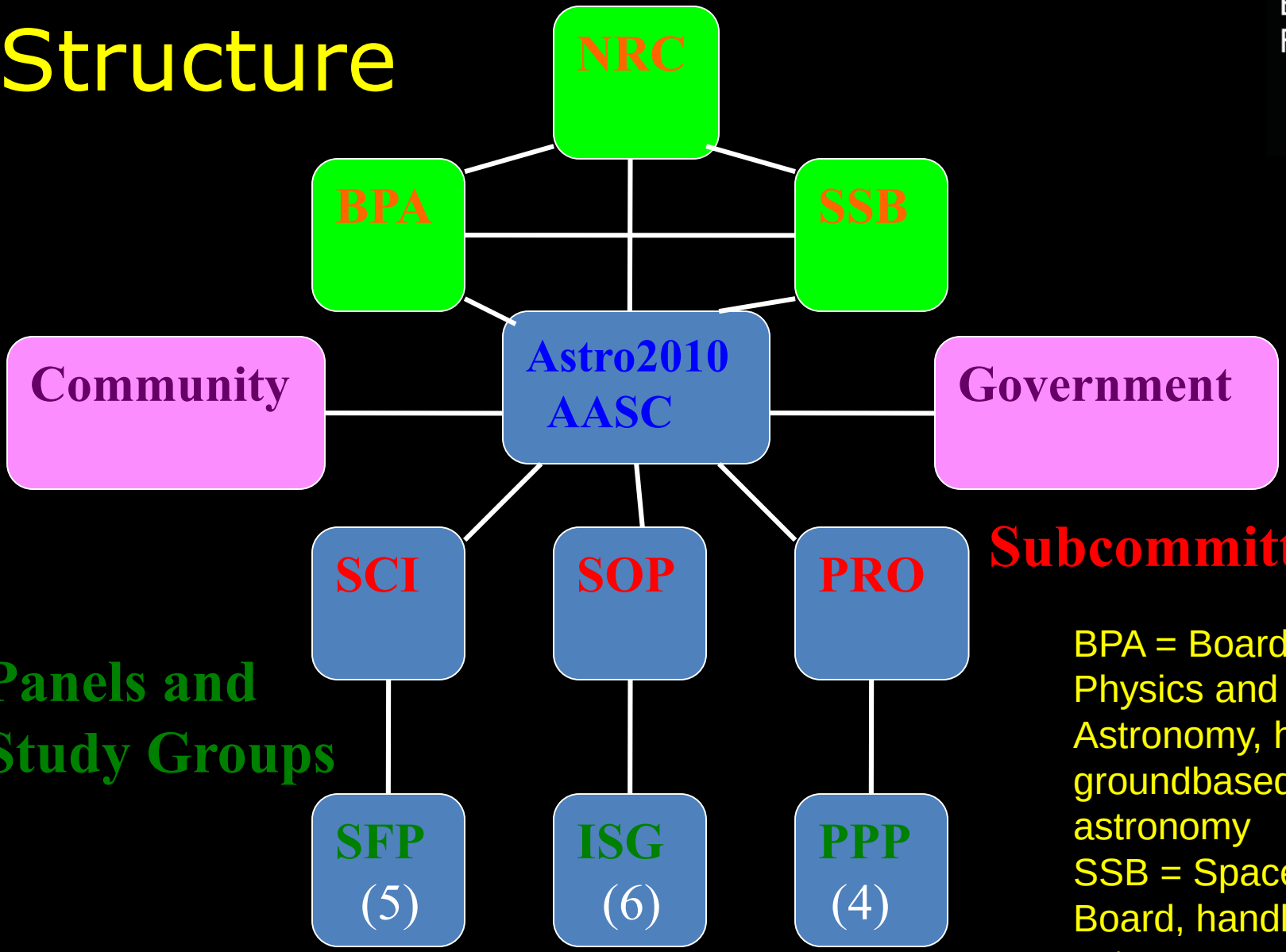
Roger Blandford, Chair, Stanford University
Lynne Hillenbrand, Executive Officer, California Institute of Technology

Subcommittee on Science
Martha P. Haynes, Vice Chair – Science Frontiers, Cornell University
Lars Bildsten, University of California, Santa Barbara
John E. Carlstrom, The University of Chicago
Fiona A. Harrison, California Institute of Technology
Timothy M. Heckman, Johns Hopkins University
Jonathan I. Lunine, University of Arizona
Juri Toomre, University of Colorado at Boulder
Scott D. Tremaine, Institute for Advanced Study

Subcommittee on State of the Profession
John P. Huchra, Vice Chair – State of the Profession, Harvard-University
Debra M. Elmegreen, Vassar College
Joshua Frieman, Fermi National Accelerator Laboratory
Robert C. Kennicutt, Jr., University of Cambridge
Dan McCammon, University of Wisconsin-Madison
Neil de Grasse Tyson, American Museum of Natural History

Subcommittee on Programs
Marcia J. Rieke, Vice Chair – Program Prioritization, University of Arizona
Steven J. Battel, Battel Engineering
Claire E. Max, University of California, Santa Cruz
Steven M. Ritz, University of California, Santa Cruz
Michael S. Turner, The University of Chicago
Paul Vanden Bout, National Radio Astronomy Observatory
A. Thomas Young, Lockheed Martin Corporation [Retired]

Structure



Subcommittees

Panels and Study Groups

BPA = Board on Physics and Astronomy, handles groundbased astronomy
SSB = Space Studies Board, handles space astronomy

Astro2010 Structure

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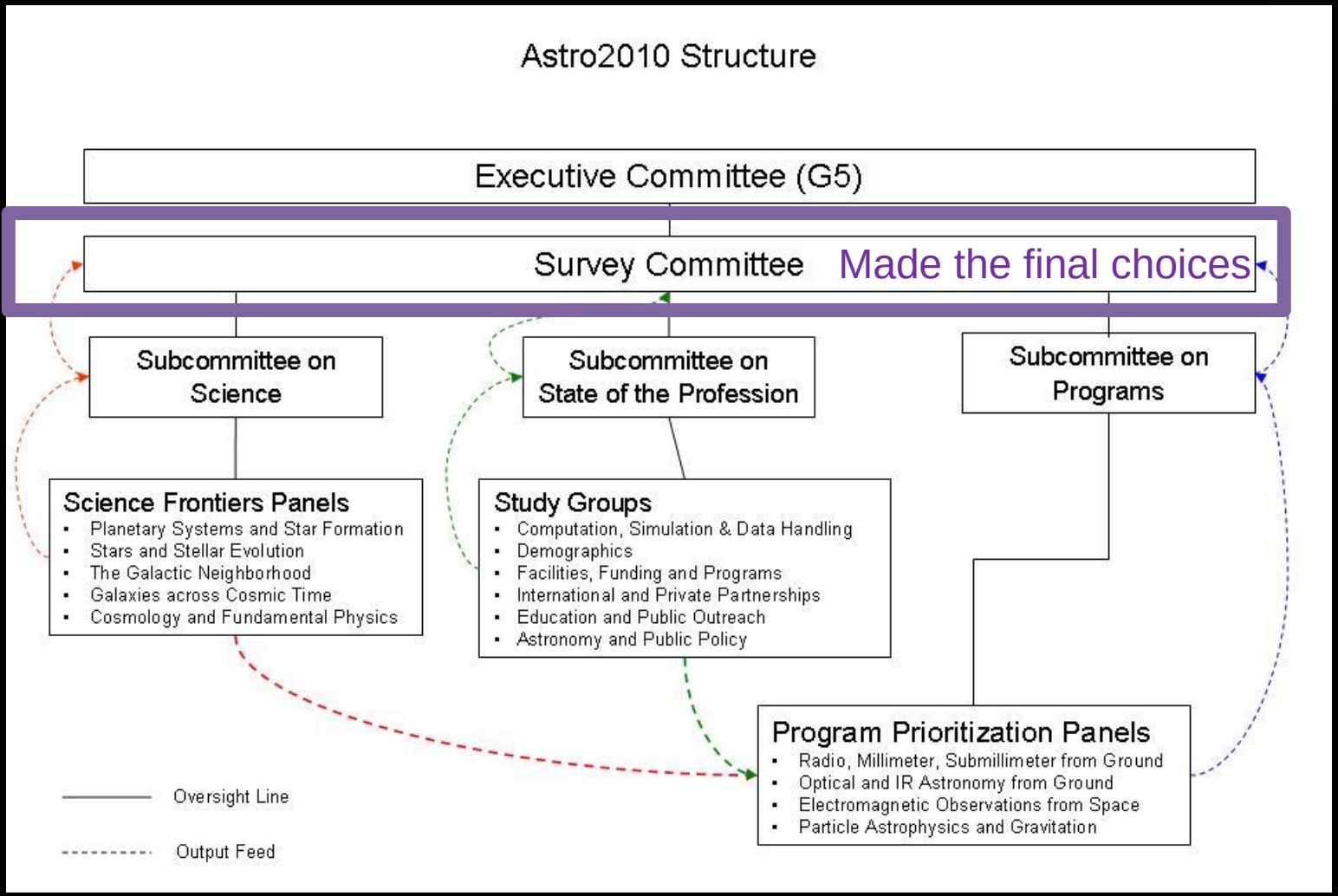

Astro2020 structure TBD now.

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New Features for Astro 2010

- Definition of science priorities was separated from mission or project prioritization
  - worked well once people bought into the idea
- No grandfathered projects – only projects in development exempt from review
  - IXO advocates didn't like this but without this stipulation, the astrophysics budget line would be fully subscribed well into the 2020s
- Projects were to be subjected to independent **c**ost **a**nd **t**echnical **e**valuation (Cost and Technical Evaluation = CATE)
  - A good idea given what happened in 2000 but process needs further tuning (eg. what is adequately "independent")
- From the charge "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."
  - This led to the Survey Committee spending time trying to see how projects would fit into various future budget projections, might be better to advise future surveys to look more at whether a suite of programs match the likely funding totaled over the decade and to consider whether there are phasing issues but not be driven to match a particular profile

Comments in yellow are MJR opinions

Why the Emphasis on Cost, Readiness, and Risk?

Look at the recommendations from the 2000 Survey:

	2000 Cost	2010 Cost
Top ranked Space Mission: JWST	$1B	$5B

Outcome: started but won't launch until ~~mid-2014~~*, no room in NASA Astrophysics Budget to do much else

* Now late 2020 and $9B

Top ranked Groundbased

Project: GSMT	$300M	$700M-$1B

Outcome: two types of giant segmented mirror telescopes are in development but construction has only started on one of them and costs have risen since 2010

No Grandfathers

- Projects that are not officially started by the agencies must be reviewed again in competition with new ideas even if they were ranked in the previous decadal survey {this was a change from pre-2010 surveys}
- Projects in this category included

  Groundbased:

  LSST GSMT SKA FASR

  (an advanced solar telescope was going to be included but got a start at the NSF before the Survey did much work)

  Spacebased:

  ConX=IXO LISA SIM EXIST TPF SAFIR

Subcommittee on Science

Early Career Focus Session

- Vice-Chair: Martha Haynes

  -- Bildsten, Carlstrom, Harrison, Heckman, Lunine, Toomre, Tremaine

- The Committee developed:

  -- An integrated scientific program of observational, experimental, and theoretical research using the science frontiers panel reports

- Five Science Frontiers Panels (SFP)

  -- NRC committees

  -- Write independent, externally reviewed panel reports

  -- Four central questions

  -- One area of unusual discovery potential

Science Frontier Panels

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Planetary Systems and Star Formation (PSF) - Lee Hartmann

Solar system bodies (other than the Sun) and extrasolar planets, debris disks, exobiology, formation of individual stars, protostellar and protoplanetary disks, molecular clouds and the cold ISM, dust, and astrochemistry.

Stars and Stellar Evolution (SSE) - Roger Chevalier

The Sun as a star, stellar astrophysics, structure and evolution of single and multiple stars, compact objects, supernovae, gamma-ray bursts and solar neutrinos. Extreme physics on stellar scales.

The Galactic Neighborhood (GAN) - Mike Shull

Structure and properties of nearby galaxies including the Milky Way and their stellar populations, interstellar media, star clusters. Evolution of stellar populations.

Galaxies across Cosmic Time (GCT) - Meg Urry

Formation and evolution of galaxies and galaxy clusters, active galactic nuclei and QSOs, mergers, star formation rate, gas accretion, global properties of galaxies and galaxy clusters, supermassive black holes.

Cosmology and Fundamental Physics (CFP) - David Spergel

Early universe, microwave background, reionization and galaxy formation up to virialization of protogalaxies. Large scale structure, intergalactic medium, determination of cosmological parameters, dark matter, dark energy. High energy physics using astronomical messengers, tests of gravity, physical constants as determined astronomically.

Subcommittee on State of Profession

- Vice-Chair: John Huchra

  Elmegreen, Friemann, Kennicutt, McCammon, Tyson
- The Committee considered:

  State of field - How to maintain and improve it

  Infrastructure and policy issues
- Six Infrastructure Study Groups (ISG)
  - Consultants to the survey
  - Primarily fact-finding and verification
  - Produce graphical and tabular data
  - Chairs continue to consult with committee

Because the ISGs were not fully vetted NRC committees and because the results did not meet NRC rigorous criteria for statistical data, the ISG reports were not published.

Infrastructure Study Groups

Early Career Focus Session

Computation, Simulation, & Data Handling (CDH) – Robert Hanisch & Lars Hernquist

Computational resources and support for analysis and archiving of astronomical data; resources and support available for astrophysical and cosmological simulation; major challenges and changes in computing environments and software; expected availability of computing capability over the next decade.

Demographics (DEM) – James Ulvestad

Numbers of astronomers and astrophysicists working in different environments and subfields; diversity, geography and student populations; breakdown of resource allocation by field, discipline and cost category where possible; subscription rates for programs; publication rates.

Facilities, Funding and Programs (FFP) – J. Craig Wheeler

List major operational public and private facilities, their capabilities, ages, and proposal pressure; budgets for all agency programs; infrastructure issues such as support for laboratory astrophysics and technology development and theory.

International and Private Partnerships (IPP) – Eugene Levy & Robert Dickman

Lessons learned; scope and current status of relevant major projects in development; summarize lessons learned to promote successful collaborations.

Education & Public Outreach (EPO) – Lucy Fortson & Chris Impey

Public communication programs; astronomy in K-12 and college education; professional education for astronomers, journalists and science policy experts.

Astronomy & Public Policy (APP) – Daniel Lester

Benefits to the nation that accrue from federal investment; contributions made to important research of societal importance; current structure of committees and reporting lines that are used to provide advice to the federal government.

Subcommittee on Programs

Early Career Focus Session

- Vice-Chair: Marcia Rieke

  Battel, Max, Ritz, Turner, Vanden Bout, Young

- The Committee will Develop:

  A prioritized, cost-constrained and balanced program for next decade developed from the reports of the programmatic prioritization panels.

  -- With input from independent contractors for major contenders on technical readiness, construction and full running costs, schedule, risk.

  A program of research technology development to enhance existing capabilities and enable missions starting in the following decade

- Four Programmatic Prioritization Panels (PPP)

  NRC committees

  Write panel reports

  Prioritize within the programmatic area assigned

  Mesh scientific priorities from SFPs with technical capabilities

Programmatic Prioritization Panels

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- Radio, Millimeter and Submillimeter from the Ground (RMS) - Neal Evans
  - Observatories and telescopes that observe primarily in these wavebands
- Optical and Infrared Astronomy from the Ground (OIR) - Pat Osmer
  - Observatories and telescopes that observe primarily in these wavebands
- Electromagnetic Observations from Space (EOS) - Alan Dressler
  - All space-based astronomical projects observing the electromagnetic spectrum.
- Particle Astrophysics and Gravitation (PAG) - Jackie Hewitt
  - All projects exploring areas at the interface of physics and astronomy such as gravitational radiation, TeV gamma-ray astronomy, and free-flying space missions testing fundamental gravitational physics.

Use of Community Input

- As the Survey was in its initial phase (and before program panel members were selected), call for brief project descriptions was made
  - Over 170 responses to this initial request
  - In retrospect, we should have found a way to adjust the relative workloads of the four program panels as the Electromagnetic Observations from Space Panels had as many responses as the other three panels combined
- The initial information request was followed by a more detailed request which asked project advocates for enough information that led to invitations to present in person

Overall this process dispelled the feelings from 2000 that implied that the 2000 Survey made decisions in “smoke-filled rooms”. The Astro2010 process was more transparent.

Calls for Input

Early Career Focus Session

(1)The Astro2010 Survey Committee, through its Subcommittees, issued a series of calls for information from the community. Received were (all publicly available):

- Notice of Interest from Activities (170+)
- Science White Papers (320+ papers)
- State Of The Profession Position Papers (69 papers)
- White Papers on Technology Development, Theory, Computation and Laboratory Astrophysics : (70 papers, mostly for tech dev)
- Request for Information from Activities: (100+ responses from activities)

(2) Unsolicited input was welcome at any time by email

All of this input was good for the quality of the Survey but represents a large effort, both on the part of the community and by the committee. Need to think about whether this could be streamlined in some way.

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Science White Papers

- Addressed how understanding of astronomical frontiers may be advanced
- Were addressed to one or more panels
- Multiple submissions were allowed
- Asked to identify critical questions and specific opportunities
- Theory, experiment, and observation
- Scope of science panels is inclusive, connections to other areas of science are important

- Over 320 papers submitted and are now available at http://www.nationalacademies.org/astro2010

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State of the Profession Position Papers

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- The State of the Profession Subcommittee invited position papers to be submitted to inform the work of the Infrastructure Study Groups as well as the broader work of the Astro2010 Committee.
- Papers focused on broad general themes related to the state of the profession, such as:
  - data and information on the need for broad support for theory, for laboratory astrophysics, computation;
  - generic technology development;
  - training of observers and instrument builders,
  - relevance of public outreach and astronomy education
  - support both general and specific areas in astronomy and astrophysics,
  - national facilities and any other topic covered in the six broad areas being studied by the infrastructure study groups.

- 69 papers submitted and are now available at
  http://www.nationalacademies.org/astro2010

Community Town Halls

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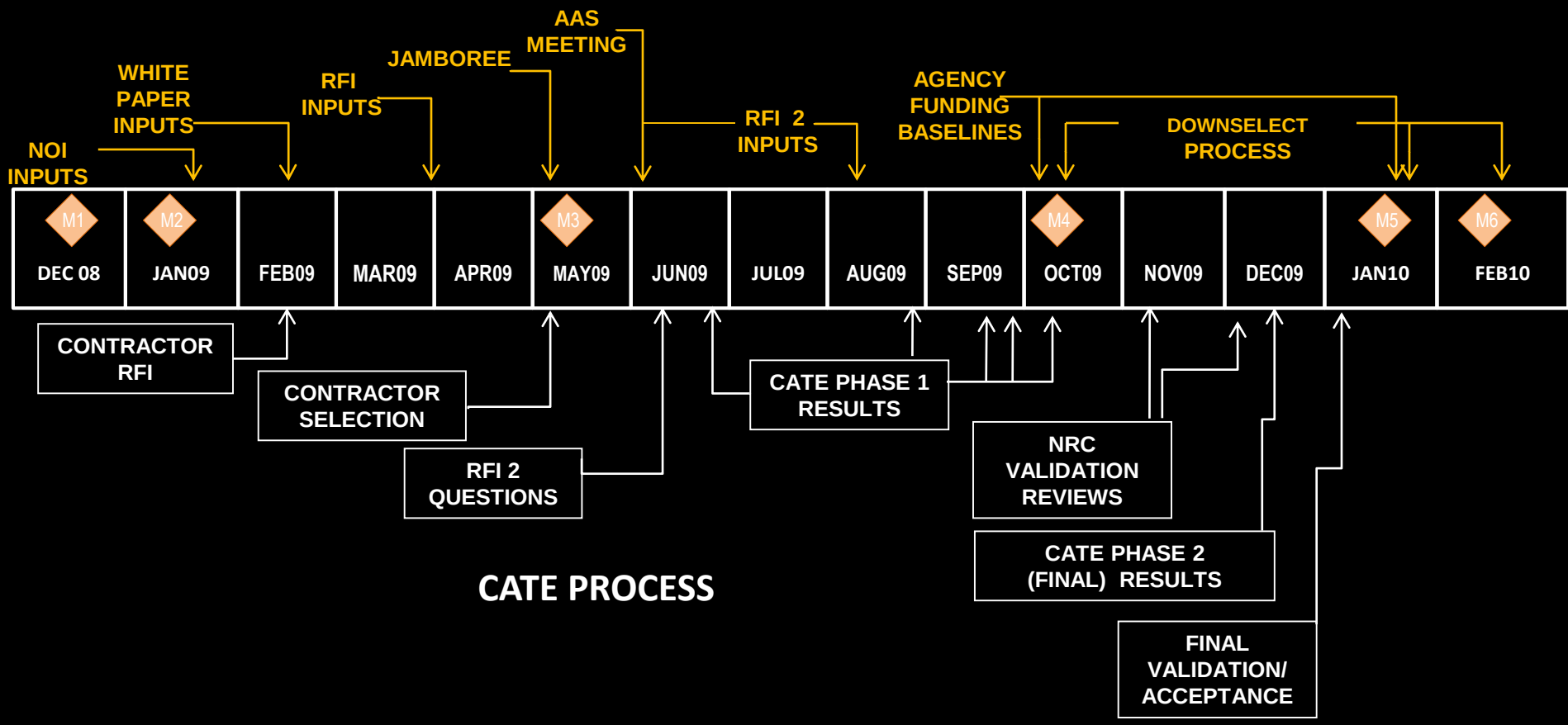
Early Career Focus Session

Astro 2010 Committee Process

Astro2020 process not yet defined.



CATE PROCESS

DATA GATHERING AND EVALUATION PROCESS FLOW

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Connecting Science to Activities

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An essential part of a program panel's work was relating science questions and opportunities to potential missions.

TABLE 6.2 The Questions Posed by the Astro2010 Science Frontiers Panels, Correlated with the Activities Recommended by the EOS Panel

Science Frontiers Panel Question/Discovery Area		WFIRST	IXO	EXO-PLANET	BLISS SPICA	UV-Optical Telescope
PSF-1	How do stars form?					■
PSF-2	How do circumstellar disks evolve and form planetary systems?	■		■	■	■
PSF-3	How diverse are planetary systems?	■		■		■
PSF-4	Do habitable worlds exist around other stars, and can we identify the telltale signs of life on an exoplanet?	■		■		■
PSF-D	Identification and characterization of nearby habitable exoplanets			■		■
SSE-1	How do rotation and magnetic fields affect stars?		■			
SSE-2	What are the progenitors of Type Ia supernovae and how do they explode?	■	■			
SSE-3	How do the lives of massive stars end?	■	■			■
SSE-4	What controls the mass, radius, and spin of compact stellar remnants?	■	■			
SSE-D	Time-domain surveys	■	■			■

Sample from the EOS panel report.

Request for Information

- The Subcommittee on Programs issued a open Request for Information (RFI) on Activities. The 100+ submitted responses to the RFI were preceded in most cases by submitted Notices of Intent.
- Activities are missions, telescopes, laboratories, specific technology development programs, etc.
- The RFI requested information needed for the prioritization process. The responses to the RFI were used by the PPPs to make an evaluation of each proposed activity's state of maturity and scale. The RFI responses helped guide the selection of activities for more detailed scrutiny.
- Activity teams not selected for detailed scrutiny were continued to be considered throughout the entire survey process on the basis of RFI responses.
- For sufficiently mature projects, the process included assessment of the costs of construction and full operations, including the support of the science, and the identification of technical risk. The panels and committee were assisted by independent contractors and consultants in this assessment process.

2nd Request for Information

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After an initial round of deliberations, the Survey Committee chose activities to be subjected to a more detailed cost and risk assessment

-- because an outside group of costing experts were hired and because the Survey had limited funding, not all activities were subjected to this step

Project teams had to prepare a substantial package to satisfy the Survey's risk and cost evaluation process

-- all space missions got the same request but the requests were more tailored for groundbased activities

RFI Section	Page Allocation
Executive Summary & Science Overview	6 pages
Technical Implementation	12 pages
Enabling Technology	3 pages
Operations Development	3 pages
Programmatics & Schedule	5 pages
Cost Section	Unlimited
Changes since Previous NRC Recommendation (if applicable)	4 pages

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Some of the guidance and requested information

Item	Value	Units
Type of instrument		
Number of channels		
Size/dimensions (for each instrument)		m x m x m
Instrument mass **without** contingency (CBE*)		Kg
Instrument mass contingency		%
Instrument mass **with** contingency (CBE+Reserve)		Kg
Instrument average payload power **without** contingency		W
Instrument average payload power contingency		%
Instrument average payload power **with** contingency		W
Instrument average science data rate^ **without** contingency		kbps
Instrument average science data^ rate contingency		%
Instrument average science data^ rate **with** contingency		kbps
Instrument Fields of View (if appropriate)		degrees
Pointing requirements (knowledge)		degrees
Pointing requirements (control)		degrees
Pointing requirements (stability)		deg/sec

Program Evaluation Parameters

These parameters were used by the Survey Committee when assessing the Program and Science Panel results

Most important: Direct mapping to SFP question(s)/discovery area(s)

Other parameters:

A. Other science return
B. Value to the health of the overall community and to the discipline
C. Value as a precursor activity
D. Technical readiness
E. Cost
F. Risks: scientific and technical
G. Value to the nation

Technology Development White Papers

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- The Subcommittee on Programs invited interested parties from the broad community to submit white papers focusing on how developing technologies in the upcoming decade will enable advances in astronomy in the future.

- White papers were submitted to one of the four discipline PPPs or to the Subcommittee on Programs for technologies relevant to more than one area or to very broad areas.

- White paper authors were asked to address specifically and succinctly how the suggested technology studies in the decade 2010-2020 will facilitate future astronomical discoveries.

- ~ 60 papers submitted and are now available at
  http://www.nationalacademies.org/astro2010

Theory, Computation, and Laboratory Astrophysics White Papers

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- The Subcommittee on Programs solicited white papers identifying areas or research problems in theoretical, computational, or laboratory astrophysics that would benefit from targeted investments, including investments on scales larger than normally possible through existing grants programs.

- White papers were submitted to one of the four discipline PPPs or in the case of ideas that may benefit several areas, to the Subcommittee on Programs

- ~ 10papers submitted and are now available at
  http://www.nationalacademies.org/astro2010

International Matters

- There are many other national strategic plans
  - Studied by the committee
  - Addressing similar science questions
- Most large projects under consideration by Astro2010 were already international
- International collaboration can:
  - Enable expensive projects (eg ALMA)
  - Use complementary skills and experience (eg Fermi)
  - Involve a large suite of telescopes in follow up
  - Share infrequently used, expensive instruments
  - Facilitate even better education and public outreach

But a failing of Astro2010 process was not developing a joint mission rather than ESA pursuing Euclid and the US pursuing WFIRST. There also were disconnects with ESA on LISA and IXO.


Technical Readiness and Cost Data
SFP Questions & Reports
SOP Findings & Reports
PPP Priorities & Reports
A Miracle Happens
Report

Decadal Lessons

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- Consider what "independent cost estimate" really means -- NASA had costing done almost in parallel with Astro2010
- Need to recognize that different communities develop missions in different ways (compare astrophysics to planetary) -- astro culture means that aspirations of young instrumentalists drives missions coming from the community, not the Survey committee.
- How to parse the budget info given by NASA -- example of Astrophysics including augmentation of explorer line in the run out, and which Astro2010 wished to include but obviously not all of the Astro2010 increase needed to come out of the pool for new things.
- Preparing of the next decadal -- how to foster combined mission ideas like WFIRST?
- Need to note that science priorities can also change in response to new discoveries -- need to be careful if looking at missions that may offer a broad range of capabilities (eg. an observatory)
- How to handle overarching missions that serve large constituencies

What's Happening Now?

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- NASA is developing WFIRST as recommended in New Worlds, New Horizons
- NSF has started construction of LSST as recommended in New Worlds, New Horizons
- NASA has started a community-based process to look at what missions should be considered for the next decadal survey. Reports on these missions will be delivered to Astro2020.

- Far-IR Surveyor – Visionary Roadmap **=> Origins Space Telescope (OST)**
- Gravitational Wave Surveyor – 2010 Decadal Survey and Visionary Roadmap; to be implemented as US contribution to ESA L3 mission
- Habitable-Exoplanet Imaging Mission – 2010 Decadal Survey **=> HabEx**
- UV/Optical/IR Surveyor – 2010 Decadal Survey and Visionary Roadmap; science case assumes successful JWST and WFIRST missions **=> LUVOIR**
- X-ray Surveyor – Visionary Roadmap; science case assumes successful ESA Athena (2010 Decadal Survey) mission **=> LYNX**

Preparing for the 2020 Decadal Survey
Large Mission Concepts

- The 2020 Decadal Survey will prioritize large space missions to follow JWST and WFIRST.
  - To enable this prioritization, NASA needs to provide information on several candidate large space mission concepts for consideration by the 2020 Decadal Survey Committee.
- What information needs to be provided to the Decadal Survey committee to enable prioritization of large missions
  - Science case
  - Strawman design reference mission with strawman payload
  - Technology development needs
  - Cost requirements assessment
- NASA needs to initiate technology development for candidate large missions so that technology will be ready when needed.
  - Technology needs to be sufficiently mature when it is time to start the highest priority large mission in the 2020 Decadal Survey.
  - The next large mission after WFIRST could be started when funding becomes available as WFIRST approaches launch in the early or mid-2020s.

From Hertz presentation to AAS

Other NASA-Related Preparations

Probe Class (meaning < $1B total cost) Studies

PI	Affiliation	Short title
Jordan Camp	NASA GSFC	Transient Astrophysics Probe
Asantha Cooray	Univ. California, Irvine	Cosmic Dawn Intensity Mapper
Bill Danchi	NASA GSFC	Cosmic Evolution through UV Spectroscopy Probe
Jason Glenn	Univ. of Colorado	Galaxy Evolution Probe
Shaul Hanany	Univ. of Minnesota	Inflation Probe
Richard Mushotzky	Univ. of Maryland	High Spatial Resolution X-ray Probe
Angela Olinto	Univ. of Chicago	Multi-Messenger Astrophysics Probe
Peter Plavchan *	Missouri State Univ.	Precise Radial Velocity Observatory
Paul Ray	Naval Research Lab	X-ray Timing and Spectroscopy Probe
Sara Seager *	MIT	Starshade Rendezvous Mission

* Partial Selections

These studies were chosen via a competitive proposal process; survey will accept any ideas even if not selected by a NASA process.

Early Career Focus Session

Astro2020 Givens

- Adhere to National Academies policies and procedures as well as the negotiated Statement of Task
- A science-driven process that defines priorities for federal funding of astronomy
- Independent, with minimization of biases
- Strive to be inclusive and involve as diverse a population of astronomers as possible consistent with the needs for scientific and technical expertise

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Consultation Group

The Consultation Group (CG) works closely with National Academies staff by assisting with the drafting of the statement of task and prospectus for the next decadal survey of astronomy and astrophysics, Astro2020. The CG will meet primarily by teleconference but will have the option of holding one in-person meeting in Washington, DC. The CG's work is likely to include interaction with the survey's potential federal government sponsors. A well-developed draft of the survey statement of task and prospectus will be made available to the CAA and the survey's potential sponsors. The CG's work will conclude upon the receipt of funding for the survey from the agencies.

- Neta Bahcall, NAS Section 12 Chair
- Alan Dressler, Survey of Surveys Chair, NAS
- Debra Elmegreen, OIR System Study Chair
- Wendy Freedman, BPA member, NAS
- Sarah Gibson, CSSP Co-Chair and SSB XCOM member
- Fiona Harrison, SSB Chair, NAS
- Chryssa Kouveliotou, SSB XCOM member, NAS
- Avi Loeb, BPA Vice-Chair
- Marcia Rieke, CAA Co-Chair, NAS
- Steve Ritz, CAA Co-Chair, BPA member

NAS=National Academy of Sciences
BPA=Board on Physics and Astronomy
CSSP=Committee on Solar and Space Physics
CAA=Committee on Astronomy and Astrophysics
SSB=Space Studies Board

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