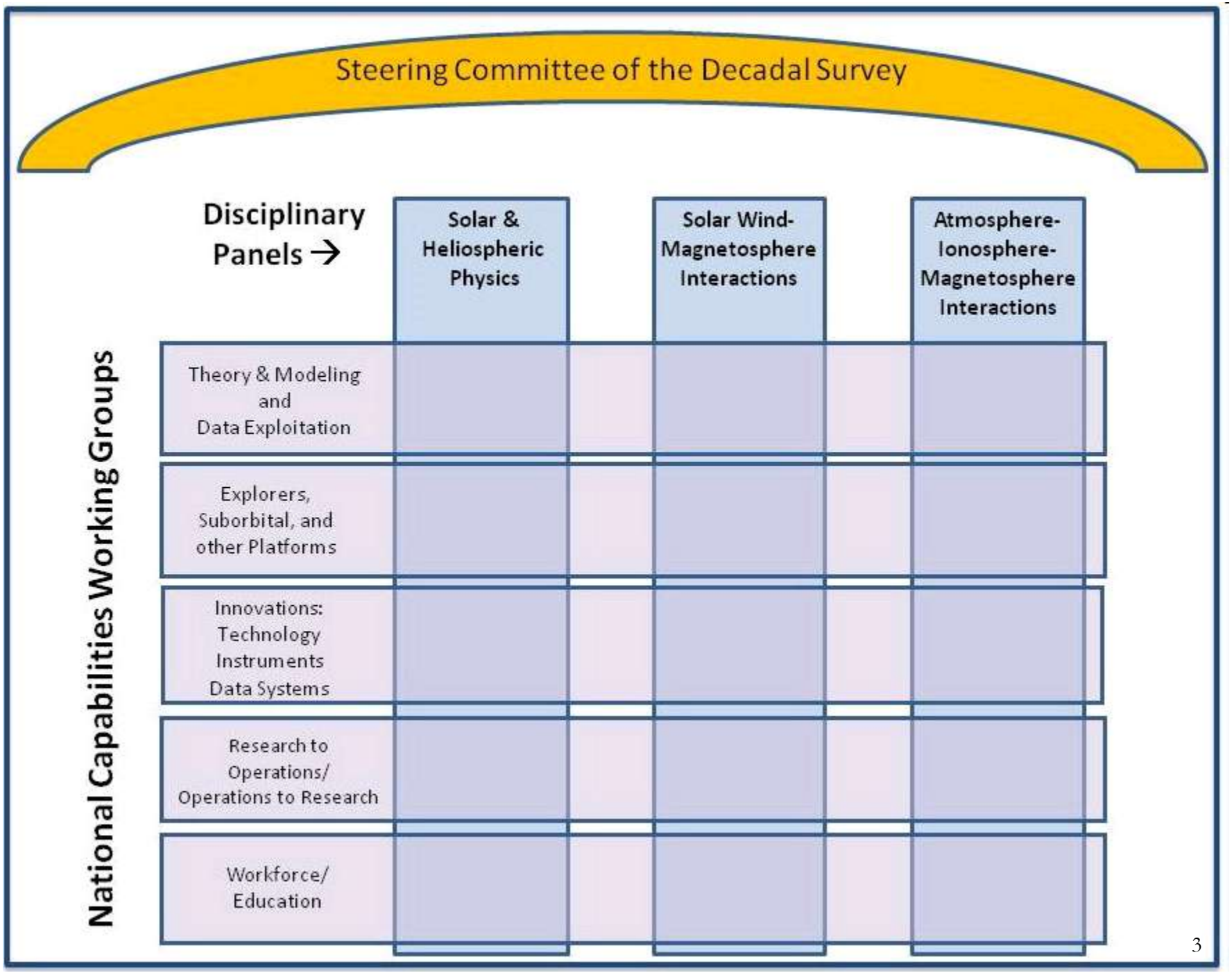
The 2013-2022 NRC Decadal Survey for Solar and Space Physics

Daniel N. Baker, Chair (Univ. of Colorado, Boulder)
Thomas Zurbuchen, Vice-Chair (Univ. of Michigan)

Staff:
Arthur Charo, Study Director
Abigail Sheffer, Associate Program Officer

Agenda

- Overview
  - Dan Baker, Univ. of Colorado, Survey Chair
  - Thomas Zurbuchen, Univ. of Michigan, Survey Vice-Chair and Session Moderator
- Panel on Atmosphere-Ionosphere-Magnetosphere Interactions
  - James Clemmons, Aerospace Corp., Panel Vice-Chair
- Panel on Solar Wind-Magnetosphere Interactions
  - Michael Wiltberger, NCAR, Panel Vice-Chair
- Panel on Solar and Heliospheric Physics
  - Spiro Antiochos, NASA GSFC, Panel Vice-Chair
- A Systems View of Solar and Space Physics
  - Ramon Lopez, University of Texas, Arlington
- Questions and Answers


Steering Committee of the Decadal Survey
Disciplinary Panels →
Solar & Heliospheric Physics
Solar Wind-Magnetosphere Interactions
Atmosphere-Ionosphere-Magnetosphere Interactions
National Capabilities Working Groups
Theory & Modeling and Data Exploitation
Explorers, Suborbital, and other Platforms
Innovations: Technology Instruments Data Systems
Research to Operations/ Operations to Research
Workforce/ Education

Steering Committee

***Chair*: Daniel Baker**, NAE
University of Colorado, Boulder

Brian H. Anderson
Johns Hopkins University Applied Physics Laboratory

Steven J. Battel
Battel Engineering

James F. Drake, Jr.
University of Maryland, College Park

Lennard A. Fisk, NAS
University of Michigan

Marvin Geller
State University of New York at Stony Brook

Sarah Gibson
National Center for Atmospheric Research

Michael A. Hesse
NASA Goddard Space Flight Center

J. Todd Hoeksema
Stanford University

David L. Hysell
Cornell University

***Vice Chair*: Thomas H. Zurbuchen**
University of Michigan

Mary K. Hudson
Dartmouth College

Thomas Immel
University of California, Berkeley

Justin Kasper
Harvard-Smithsonian Center for Astrophysics

Judith L. Lean, NAS
Naval Research Laboratory

Ramon E. Lopez
University of Texas, Arlington

Howard J. Singer
NOAA Space Weather Prediction Center

Harlan E. Spence
University of New Hampshire

Edward C. Stone, NAS
California Institute of Technology

Decadal Survey Purpose & OSTP* Recommended Approach

"Decadal Survey benefits:

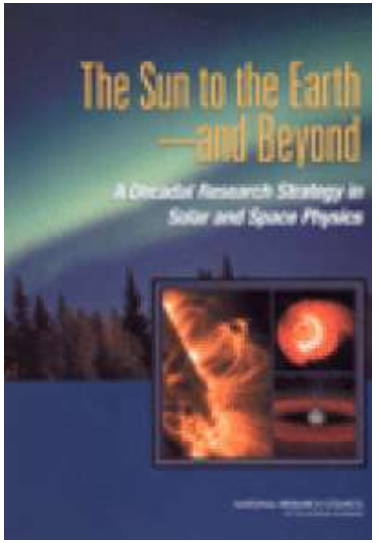
- **Community-based documents offering consensus of science opportunities to retain US scientific leadership**
- **Provides well-respected source for priorities & scientific motivations to agencies, OMB, OSTP, & Congress"**

"Most useful approach:

- **Frame discussion identifying key science questions**
  - **Focus on what to do, not what to build**
  - **Discuss science breadth & depth (e.g., impact on understanding fundamentals, related fields & interdisciplinary research)**
- **Explain measurements & capabilities to answer questions**
- **Discuss complementarity of initiatives, relative phasing, domestic & international context"**

*From "The Role of NRC Decadal Surveys in Prioritizing Federal Funding for Science & Technology," Jon Morse, Office of Science & Technology Policy (OSTP), NRC Workshop on Decadal Surveys, November 14-16, 2006

Context



- *The Sun to the Earth—and Beyond: A Decadal Research Strategy in Solar and Space Physics*
  - Summary Report (2002)
  - Compendium of 5 Study Panel Reports (2003)

- First NRC "decadal survey" in Solar and Space Physics
  - Community-led
  - Integrated plan for the field
  - Prioritized recommendations
  - Sponsors: NASA, NSF, NOAA, DoD (AFOSR and ONR)

Survey's Task Summary

- **Provide an overview of the science and a broad survey of the current state of knowledge in the field**, including a discussion of the relationship between space- and ground-based science research and its connection to other scientific areas;

- **Identify the most compelling science challenges** that have arisen from recent advances and accomplishments;

- **Identify the highest priority scientific targets** for the interval 2013-2022 (having considered scientific value, urgency, cost category and risk, and technical readiness).

- **Develop an integrated research strategy** that will present means to address these targets

Note:

1. NASA missions not yet in formulation or development will be reprioritized;
2. Reference missions can be proposed by White Paper. No grandfathered missions.

Community Input

- 288 white papers submitted to the survey!
- Town Hall Meetings/Outreach Events:
  - University of California, Los Angeles
  - University of California, Berkeley
  - University of Maryland
  - National Center for Atmospheric Research
  - University of New Hampshire
  - University of Michigan
  - Arecibo Observatory
  - Southwest Research Institute
  - University of Texas, Dallas
  - NSF Upper Atmosphere Facilities Fall 2010 Meeting

Survey Schedule

- June 8, 2010: Study approved by National Research Council
- Sept. 1-3, 2010: Steering Committee Meeting 1
- Oct. 2010: Regional Town Halls (UNH, UMD, UM, UCLA, +other events)
- Nov. 12, 2010: Deadline for Community White Papers
- Nov. 2010: Each of the 3 study panels holds first meeting
- Jan. 2011: Each of the 3 study panels holds second meeting
- Feb. 1-3, 2011: Steering Committee Meeting 2
  - Initial selection of ideas for further study by costing and technical evaluation groups
- April 12-14, 2011: Steering Committee Meeting 3
  - Selection of ideas that need to undergo independent cost and technical evaluation
  - Mid-April – June 2011: Aerospace Corp. cost and technical evaluation
- June 2011: Panels hold 3rd and final meeting
- June 2011: Steering Committee holds Meeting 4
- September 2011: Steering Committee holds 5th and final meeting
- December 31: Draft ready for NRC review
- March 31, 2012: Pre-publication version of report delivered to sponsors.

Panel on Atmosphere-Ionosphere-Magnetosphere Interactions

***Chair*: Jeffrey M. Forbes**
University of Colorado, Boulder

Odile de la Beaujardiere
Air Force Research Laboratory

John Evans, NAE
COMSAT Corporation [Ret.]

Roderick Heelis
The University of Texas at Dallas

Thomas Immel
University of California, Berkeley

Janet Kozyra
University of Michigan

William Lotko
Dartmouth College

***Vice Chair*: James H. Clemmons**
The Aerospace Corporation

Gang Lu
National Center for Atmospheric Research

Kristina Lynch
Dartmouth College

Jens Oberheide
Clemson University

Larry Paxton
Johns Hopkins University Applied Physics Laboratory

Robert Pfaff
NASA Goddard Space Flight Center

Joshua Semeter
Boston University

Jeffery Thayer
University of Colorado, Boulder

Panel on Atmosphere-Ionosphere-Magnetosphere Interactions: Science Themes From White Papers

- Atmosphere-Ionosphere-Magnetosphere Interactions
  - How is electromagnetic energy in the magnetosphere converted to heat and momentum drivers for the AIM system?
- Multi-Scale Global Response of the Ionosphere-Thermosphere
  - How does the AIM system respond over global, regional, and local scales to changes in magnetospheric inputs?
- Plasma-Neutral Coupling in a Magnetic Field
  - How do neutrals and plasmas interact to produce multi-scale structures in the AIM system?
- Meteorological Driving of the AIM System
  - What is the role of waves in controlling the mean state and variability of the AIM system?
- Planetary Change
  - How is our planetary environment changing over multi-decadal scales, and what are the underlying causes?

Panel on Solar Wind-Magnetosphere Interactions

***Chair*: Michelle Thomsen**
Los Alamos National Laboratory

Joseph Borovsky
Los Alamos National Laboratory

Joseph Fennell
The Aerospace Corporation

Jerry Goldstein
Southwest Research Institute

Janet Green
National Oceanic and Atmospheric Administration

Donald Gurnett, NAS
University of Iowa

Lynn Kistler
University of New Hampshire

Michael Liemohn
University of Michigan

***Vice Chair*: Michael Wiltberger**
National Center for Atmospheric Research

Robyn Millan
Dartmouth College

Donald G. Mitchell
Johns Hopkins University Applied Physics Laboratory

Tai D. Phan
University of California, Berkeley

Michael Shay
University of Delaware

Harlan Spence
University of New Hampshire

Richard Thorne
University of California, Los Angeles

Panel on Solar Wind-Magnetosphere Interactions: Science Themes from White Papers

- Expanding understanding through comparative magnetospheres
- Determination of global structures, forcing and feedback of the magnetosphere
- Sources and sinks of plasma and energetic particles
- Science enabling space weather prediction
- Cross-scale coupling and key processes in space plasmas

Panel on Solar and Heliospheric Physics

***Chair*: Richard Mewaldt**
California Institute of Technology

***Vice Chair*: Spiro Antiochos**
NASA Goddard Space Flight Center

Timothy Bastian
National Radio Astronomy Observatory

Joe Giacalone
University of Arizona

George Gloeckler, NAS
University of Michigan

Jack Harvey
National Solar Observatory

Russell Howard
U.S. Naval Research Laboratory

Justin Kasper
Harvard-Smithsonian Center for Astrophysics

Robert Lin, NAS
University of California, Berkeley

Glenn Mason
Johns Hopkins University, Applied Physics Laboratory

Eberhard Moebius
University of New Hampshire

Merav Opher
Boston University

Jesper Schou
Stanford University

Nathan Schwadron
Boston University

Amy Winebarger
NASA Marshall Spaceflight Center

Daniel Winterhalter
Jet Propulsion Laboratory

Thomas Woods
University of Colorado, Boulder

Panel on Solar and Heliospheric Physics

- Held first meeting 11/29 – 12/1
- Reviewed ~ 2/3 of ~150 concept papers related to SH Panel
- Concentrated on space missions/ground-based projects (~30), read by entire Panel
- Missions/projects encompass broad set of science themes
  - Range over physical domains: from studies of solar interior to structure of Heliosheath
  - Range over physics domains: from global structure of ICMEs to micro-scale mechanisms for particle acceleration
- At next meeting: 01/10 – 01/12 will hear presentations from number of concept paper authors
  - One challenge is uncertainty in present program (Solar Orbiter and Solar-C)
  - Select set of mission/project concepts for consideration by Steering Committee and prepare presentations
- Review remaining concept papers
  - Continue developing strategy for non-mission areas of SH science program: e.g., theory/modeling/data, instrument development, infrastructure, etc
  - Coordinate this with Working Groups and other Panels

National Capabilities Working Groups

- Theory, Modeling, and Data Exploitation
  - Jim Drake, University of Maryland
  - Jon Linker, Predictive Science, Inc
- Explorers, Suborbital, and other Platforms
  - Kristina Lynch, Dartmouth College
  - Brian Anderson, Johns Hopkins University Applied Physics Laboratory
- Innovations: Technology, Instruments, Data Systems
  - Andy Christensen, Dixie State University
  - Stuart Bale, University of California, Berkeley

National Capabilities Working Groups – Con't

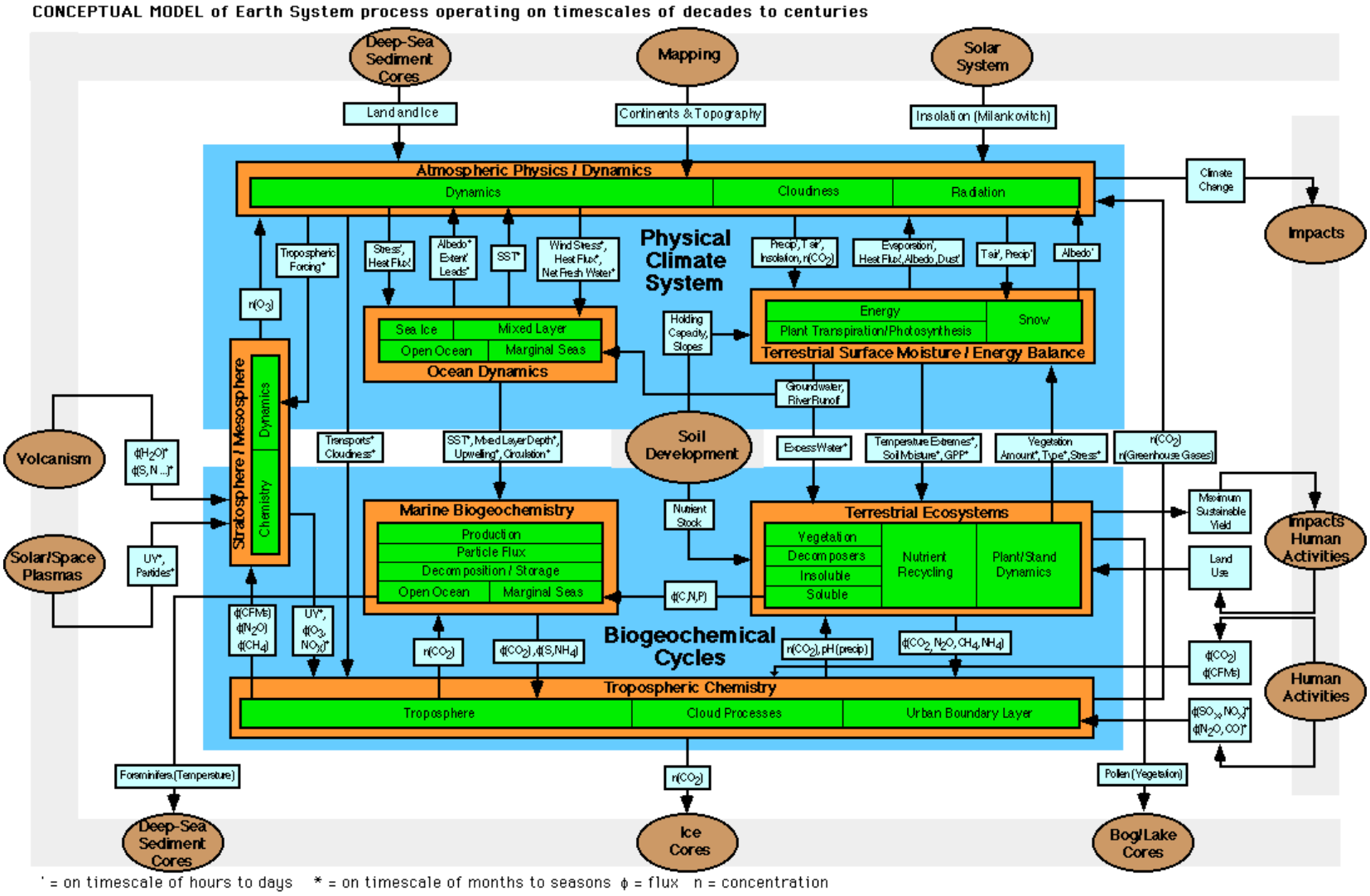
- Research to Operations/Operations to Research
  - Michael Hesse, NASA Goddard Space Flight Center
  - Ron Turner, ANSER Inc.

- Workforce and Education
  - Mark Moldwin, University of Michigan
  - Cherilynn Morrow, Georgia State University

Soliciting Community Input: Systems Diagrams for Solar and Space Physics

- Cherilynn Morrow, Georgia State University
- Len Fisk, University of Michigan
- Judith Lean, Naval Research Laboratory
- Thomas Immel, University of California, Berkeley
- Ramon Lopez, University of Texas, Arlington

Bretherton Diagram



Link coming in SPA news with details

Questions?

Please Visit The Survey Website At:

http://sites.nationalacademies.org/SSB/CurrentProjects/SSB_056864

Additional questions may be directed to:

heliophysics_decadal@nas.edu

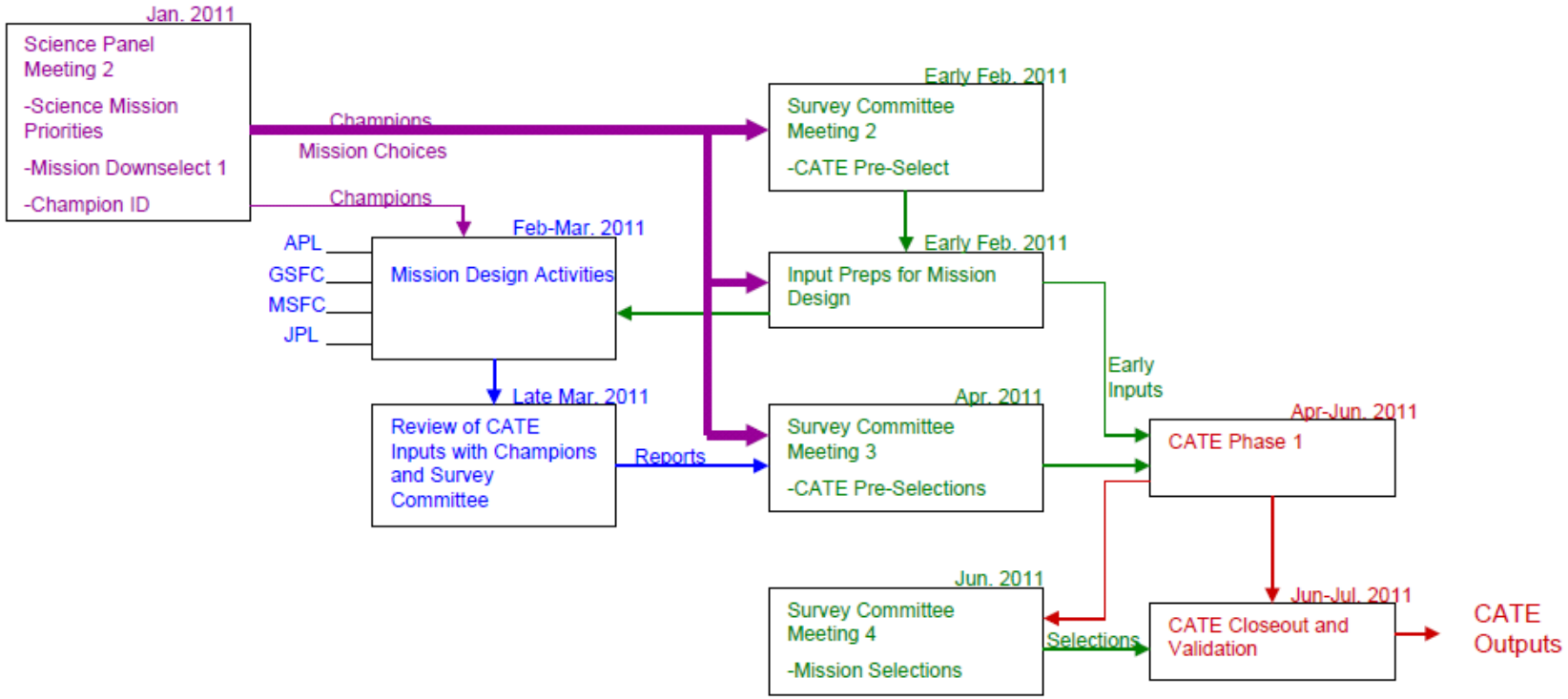
Backup Slides

Survey Organization

- **Steering Committee** – Appointed by the NRC and responsible for the final report and its recommendations
  - Nineteen members representing the broad solar and space physics community; includes representatives from the 3 study panels

- **Disciplinary Study Panels** – Appointed by the NRC; provides written input to the steering committee and informs steering committee's deliberations:
  - **Atmosphere-Ionosphere-Magnetosphere Interactions**
  - **Solar Wind-Magnetosphere Interactions**
  - **Solar and Heliospheric Physics**

- **"National Capabilities" Working Groups** – Informal groups drawn from survey members and from the community
  - Will address important cross-disciplinary issues and opportunities


Jan. 2011
Science Panel Meeting 2
-Science Mission Priorities
-Mission Downselect 1
-Champion ID
Champions
Mission Choices
Champions
Feb-Mar. 2011
APL
GSFC
MSFC
JPL
Mission Design Activities
Late Mar. 2011
Review of CATE Inputs with Champions and Survey Committee
Reports
Early Feb. 2011
Survey Committee Meeting 2
-CATE Pre-Select
Early Feb. 2011
Input Preps for Mission Design
Apr. 2011
Survey Committee Meeting 3
-CATE Pre-Selections
Early Inputs
Apr-Jun. 2011
CATE Phase 1
Jun. 2011
Survey Committee Meeting 4
-Mission Selections
Selections
Jun-Jul. 2011
CATE Closeout and Validation
CATE Outputs

Key Steps

- Assess the current status of the science disciplines
  - Look closely at basic research aspects
  - Consider the “applied” side of the field
  - Evaluate where the greatest progress can be made; Where can progress occur soonest?
  - Begin integrating best ideas from community (white papers, Working Groups, etc.)
  - Establish disciplinary “game plan”

A Systems View of Solar and Space Physics