NASA Strategic Planning
The Roadmapping Process

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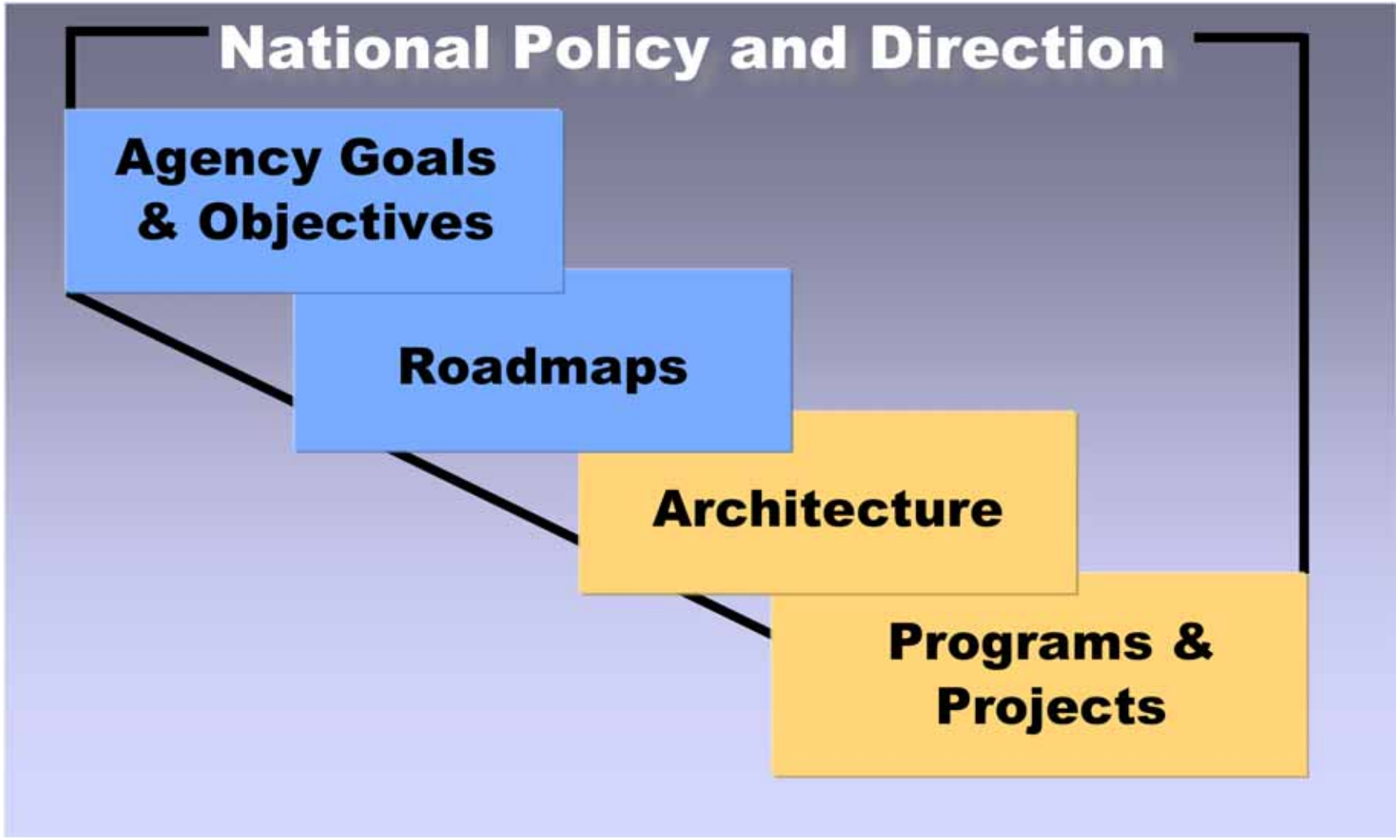
AIAA Space Exploration Conference
February 1, 2005

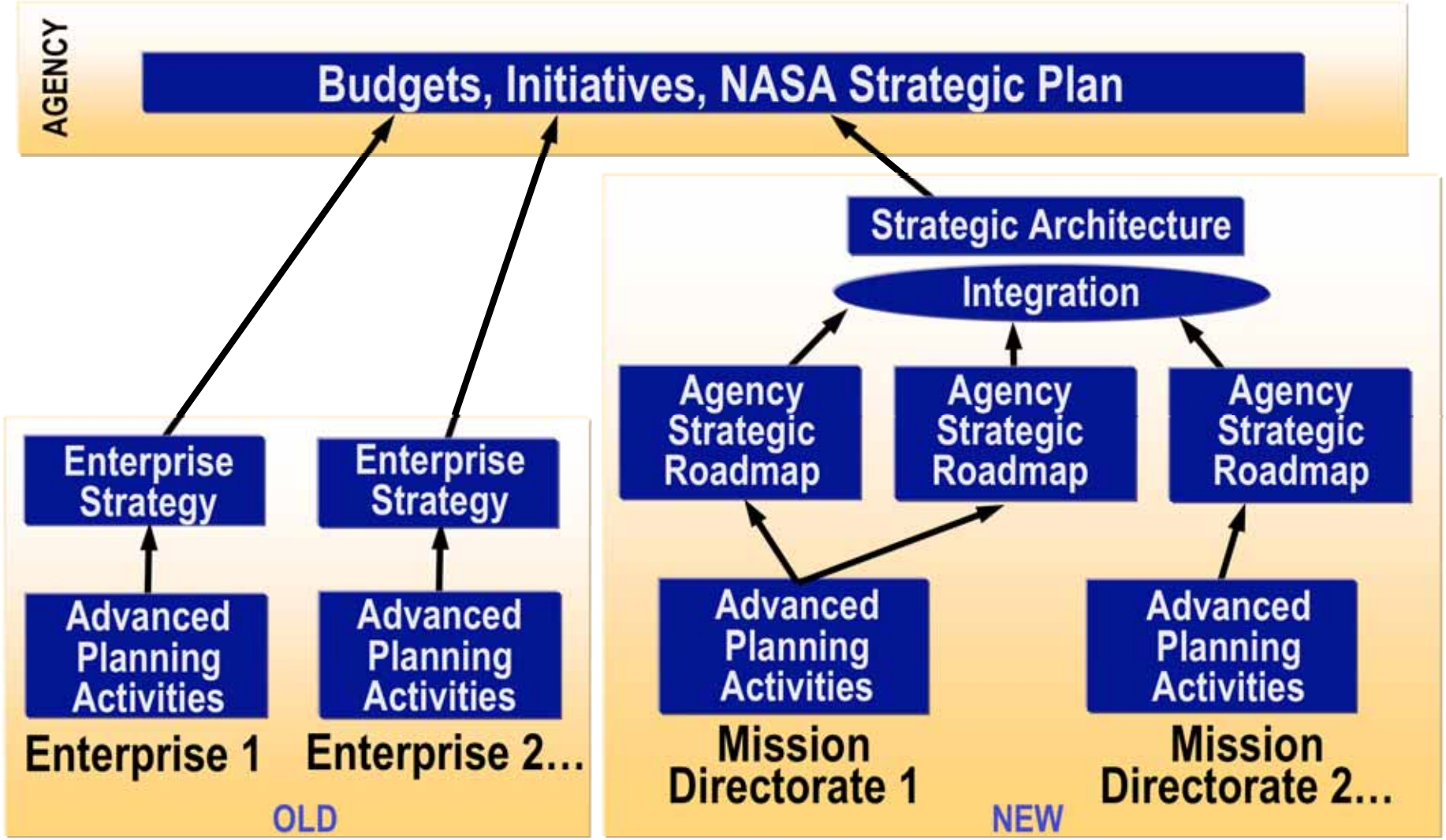
Strategic Planning Framework



Strategic Planning to Achieve the Vision for Space Exploration

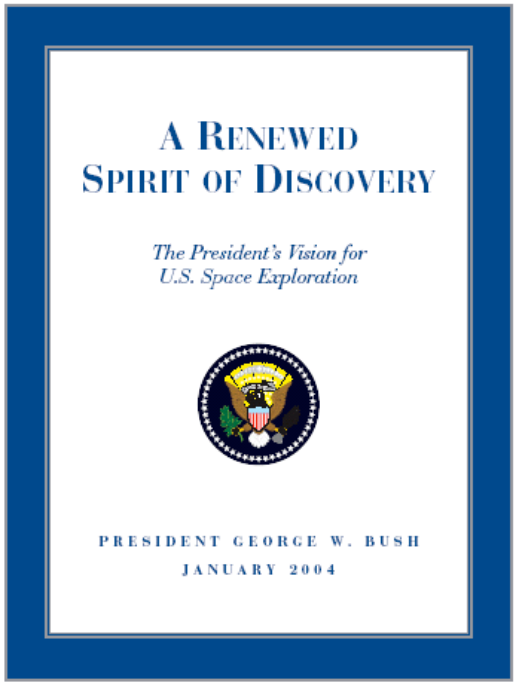
- **NASA is adopting a single unifying construct, linking implementation activities (programs, projects, R&D) to strategic planning objectives**
- **Process will help align and focus and clarify decision making at all levels**

Strategic Planning Paradigm–
Old vs. New



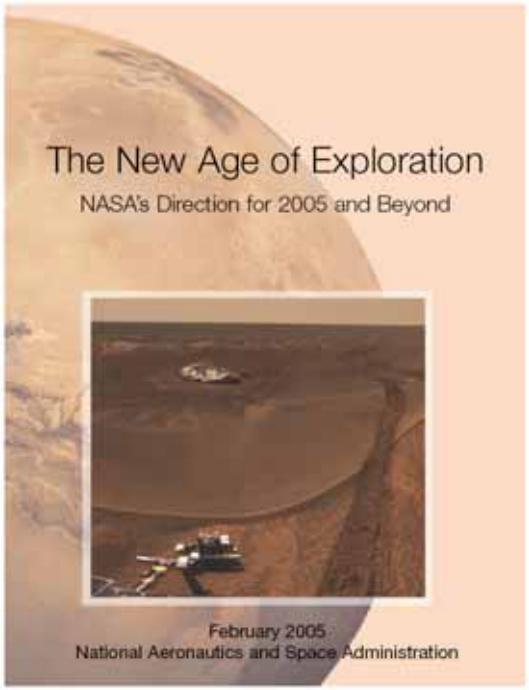
The Vision for Space Exploration

The fundamental goal of this vision is to advance U.S. scientific, security, and economic interest through a robust space exploration program



- Implement a sustained and affordable human and robotic program to explore the solar system and beyond
- Extend human presence across the solar system, starting with a human return to the Moon by the year 2020, in preparation for human exploration of Mars and other destinations;
- Develop the innovative technologies, knowledge, and infrastructures both to explore and to support decisions about the destinations for human exploration; and
- Promote international and commercial participation in exploration to further U.S. scientific, security, and economic interests.
- Study the Earth system from space and develop new space-based and related capabilities for this purpose

Vision for Space Exploration
Key Presidential Direction



1. **Return the Shuttle…..**
2. **Use Shuttle to …**
3. **Retire the Shuttle …**
4. **Focus ISS research …**
5. **Meet foreign commitments**
6. **Undertake lunar exploration …**
7. **Series of robotic missions to Moon …**
8. **Expedition to lunar surface as early ….**
9. **Use lunar activities to further science, …**
10. **Conduct robotic exploration of Mars ….**
11. **Conduct robotic exploration ….**
12. **Conduct advanced telescope searches ….**
13. **Demonstrate power, propulsion, ….**
14. **Conduct human expeditions to Mars …**
15. **Develop a new Crew Exploration Vehicle…**
16. **Separate cargo from crew as soon as …**
17. **Pursue international participation**
18. **Pursue commercial opportunity …..**

Achieving the NASA Objectives

- **Develop roadmaps as strategies to guide achievement of the Strategic Objectives**
  - **Foundation for mission/program architectures**
  - **Emphasize national/community input, with NASA guidance**
  - **Involve industry, academia, other government agencies**
  - **Enlist the aid of the National Academies of Science, Engineering and Institute of Medicine through reviews by the National Research Council**

Strategic Roadmap: A coordinated and comprehensive longitudinal strategy, with key achievements, options, and decision points identified, that provides a foundation for NASA's long-term priorities and investments

Thirteen strategic roadmaps translate to eighteen NASA strategic objectives

Implementation of the Strategy

- **Develop capabilities to implement the strategies**
  - **Assess the state of the art**
  - **Engage broad community in the effort to project capability needs forward**
- **As recommended in the report of the President's Commission (Aldridge Report)**

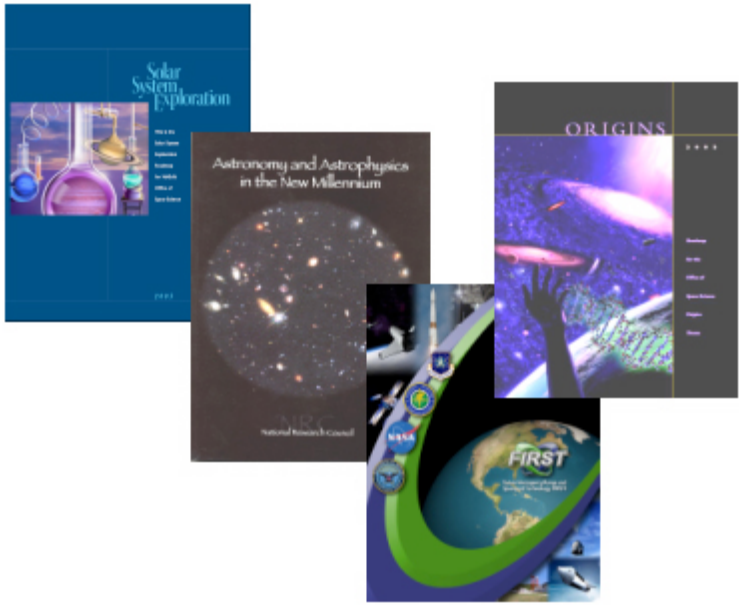
"Successful development of identified enabling technologies will be critical to attainment of objectives within reasonable schedules and affordable costs."

Capability Roadmap: A description of the developments (including alternate paths and options) required to achieve the capability

Fifteen roadmaps based on Aldridge Commission recommendations and tied to strategic roadmaps

Anatomy of a Roadmap

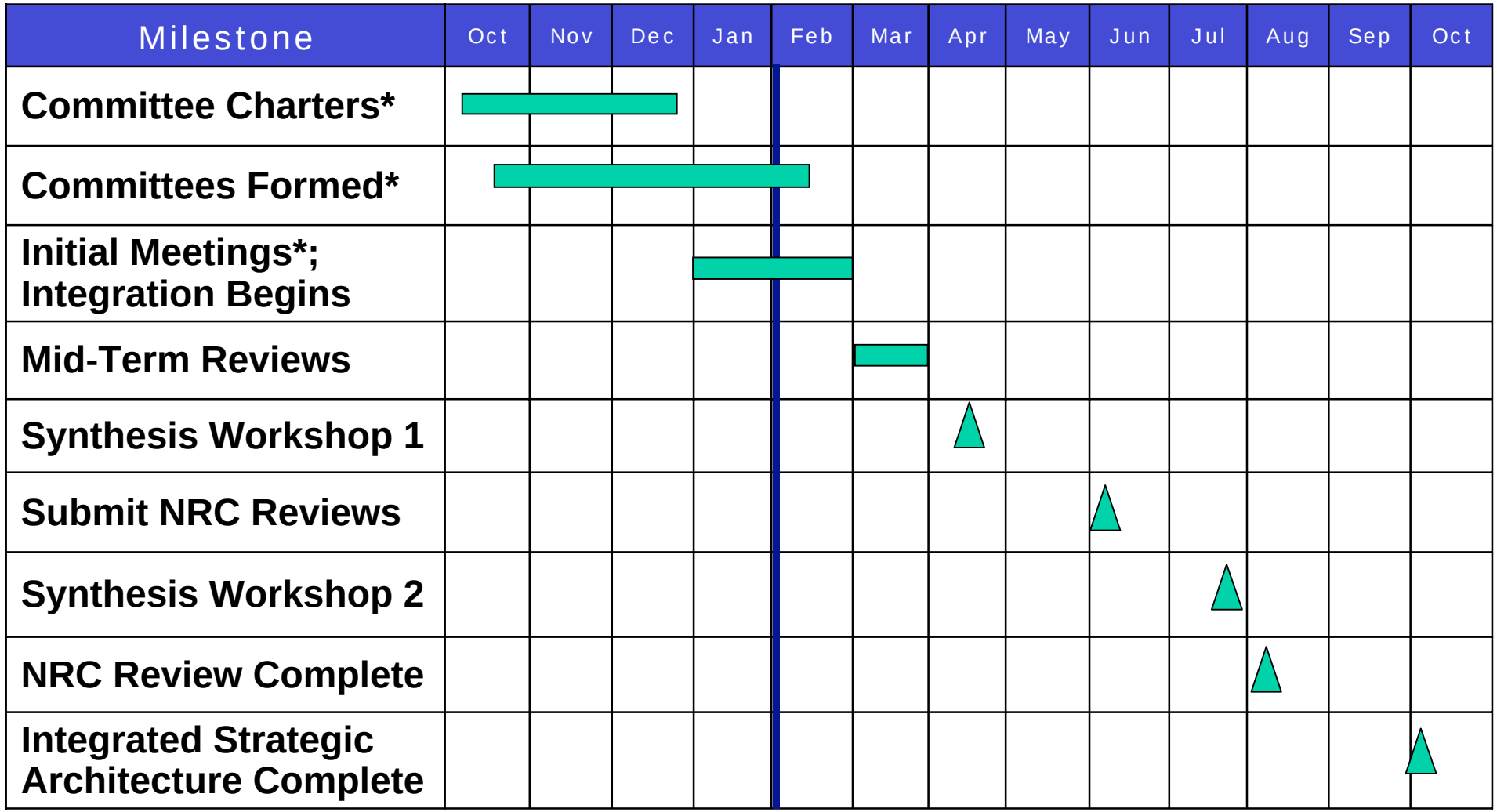
- **Broad scientific and exploration objectives, priorities**
- **Possible pathways or decision points**
- **Timeline**
- **Critical sequences and path**
- **Qualitative risk assessments**
- **ROM phased cost plan**
- **Interdependencies**
- **Capabilities, facilities and infrastructure needs**
- **Implementation approaches**
- **High-level mission pipeline**



Broad Community Involvement

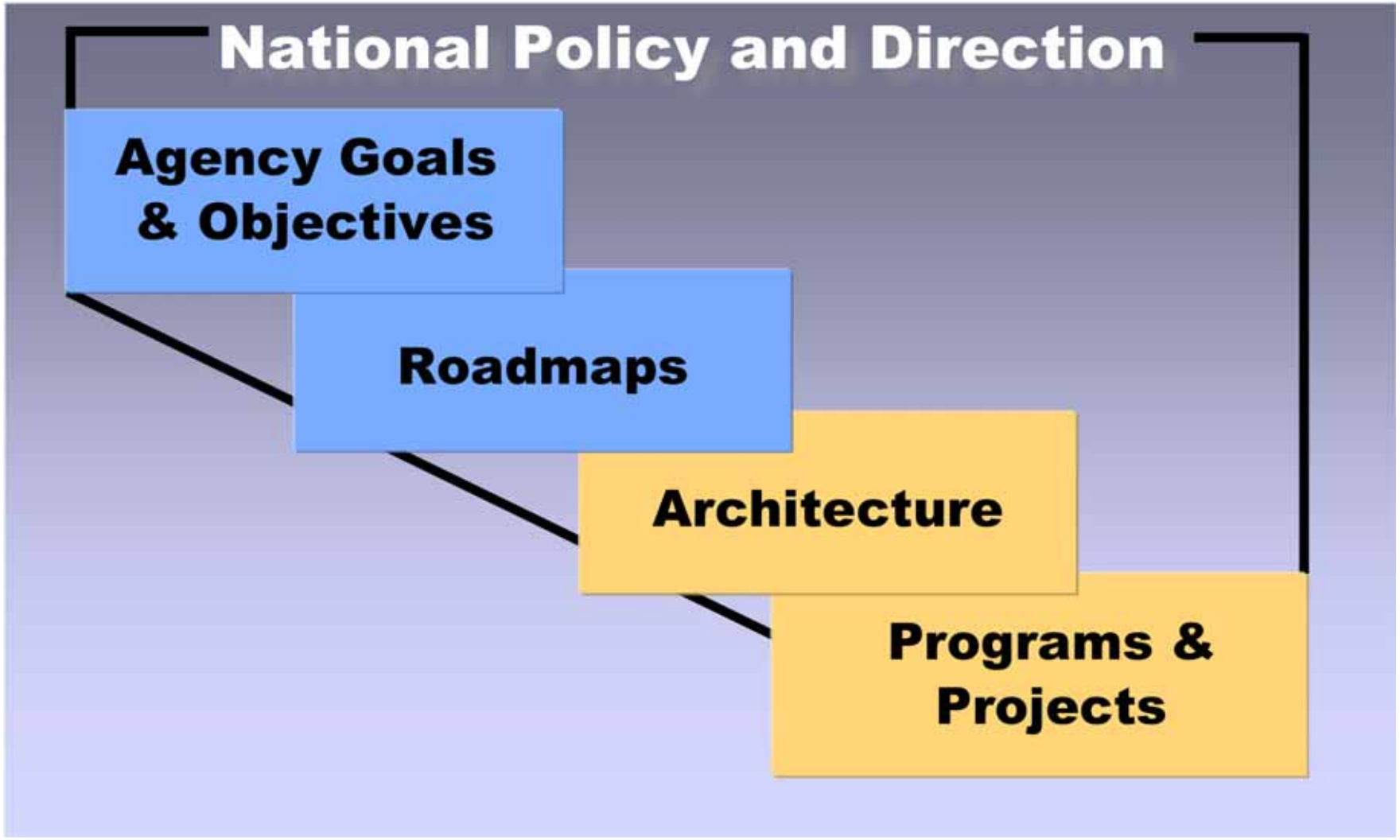
- **Objective is to obtain a National perspective**
- **Balanced roadmap committee membership: NASA, industry, academia and other government.**
  - **External co-chairs are nationally recognized leaders**
  - **NASA co-chairs are typically Associate Administrator or Center Director level**
- **Request for Information released in Federal Register announcing public capability roadmaps workshop and requesting strategic and capability white paper submissions**
  - **475 Capability and 348 Strategic White Papers**
- **Selected white paper authors and other experts asked to brief roadmap committees**
- **More than 500 attended Public Capability Workshop, November 30, 2004**

Strategic Roadmaps Schedule Overview



* Phased – different milestones for different committees

Strategic Planning Framework



BACK-UP

Capability Roadmaps

Capability	Responsible Mission Directorate
High-energy power and propulsion	Exploration
In-space transportation	Exploration
Advanced telescopes and observatories	Science
Communication and navigation	Space Ops
Robotic access to planetary surfaces	Science
Human planetary landing systems	Exploration
Human health and support systems	Exploration
Human exploration systems and mobility	Exploration
Autonomous systems and robotics	Science
Transformational spaceport/range technologies	Space Ops
Scientific instruments and sensors	Science
In situ resource utilization	Exploration
Advanced modeling, simulation, analysis	Science
Systems engineering cost/risk analysis	Exploration
Nanotechnology	Science

Strategic Roadmaps

1. Robotic and human lunar expeditions
2. Sustained, long-term robotic and human exploration of Mars
3. Sustained program of solar system exploration
4. Advanced telescope searches for Earth-like planets and habitable environments
5. Develop an exploration transportation system
6. Complete assembly of the International Space Station and focus utilization
7. Safely transition from Space Shuttle to new exploration-focused launch systems*
8. Explore the origin, evolution, structure, and destiny of the Universe
9. Determine how living Earth system is affected by internal dynamics, and understand implications for life
10. Explore Sun-Earth system to understand effects on Earth and implications for human exploration
11. Transform air transportation and enable the next generation of atmospheric vehicles
12. Educate students and public, and expand national technical skills and capabilities
13. Comprehensive national plan for utilization of nuclear systems

Strategic Roadmaps (page 1 of 3)

Roadmap	Chairs (HQ Directorate, Center)	External chair
Robotic and Human Lunar Exploration	**Adm. (Ret.) Craig Steidle (HQ/ESMD) and William Readdy (HQ/SOMD)** **Gen. (Ret.) Jefferson Howell (JSC)**	**Gen. (Ret.) Tom Stafford**
Robotic and Human Exploration of Mars	**Al Diaz (HQ/SMD)** **Dr. Charles Elachi (JPL)**	**Tom Young (Lockheed Martin, Ret.)**
Solar System Exploration	**Orlando Figueroa (HQ/SMD)** **Scott Hubbard (ARC)**	**Dr. Jonathan Lunine (Uni. of Arizona)**
Search for Earth-Like Planets	**Dr. Ghassem Asrar (HQ/SMD)** **Dr. Charles Beichman (JPL)**	**Dr. Adam Burrows (Uni. of Arizona)**

** Leverages off Integrated Space Operations Summit, (ISOS) process until Return To Flight (RTF)*

Strategic Roadmaps (page 2 of 3)

Roadmap	Chairs (HQ Directorate, Center)	External chair
Earth Science and Applications from Space	**Orlando Figueroa (HQ/SMD)** **Dr. Diane Evans (JPL)**	**Dr. Charles Kennel (UCSD/Scripps)**
Exploration Transportation System	**Adm. (Ret.) Craig Steidle (HQ/ESMD)** **Jim Kennedy (KSC)**	**Gen. (Ret.) Charles Bolden**
International Space Station	**Mark Uhran (HQ/SOMD)** **Bob Cabana (JSC)**	**Adm. (Ret.) Tom Betterton**
Space Shuttle	***Deferred***	***Deferred***
Universe Exploration	**Dr. Anne Kinney (HQ/SMD)** **Dr. Nick White (GSFC)**	**Dr. Kathy Flanagan (MIT)**

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Strategic Roadmaps (page 3 of 3)

Roadmap	Chairs (HQ Directorate, Center)	External Chair
Sun-Solar System Connection	**Al Diaz (HQ/SMD)** **Dr. Franco Einaudi (GSFC)**	**Dr. Timothy Killeen (NCAR)**
Aeronautical Technologies	**Terry Hertz (HQ/ARMD)**	**James Jamieson (Boeing)**
Education	**Dr. Adena Loston** **(HQ/Office of Education)** **Dr. Julian Earls (GRC)**	**Dr. France Cordova** **(Uni. of Cal., Riverside)**
Nuclear Systems	**Adm. (Ret.) Craig Steidle (HQ/ESMD)** **Chris Scolese (GSFC)**	**Dr. John Ahearne** **(Duke Uni.)**

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Capability Roadmaps (page 1 of 2)

Capability	NASA chair	External chair
High-Energy Power and Propulsion	**Joe Nainiger (GRC)**	**Dr. Tom Hughes (Penn State Uni.)**
In-Space Transportation	**Paul McConnaughey (MSFC)**	**Col. Joe Boyle (US Air Force SMC)**
Advanced Telescopes and Observatories	**Lee Feinberg (GSFC)**	**Dr. Howard MacEwen (SRS Technologies)**
Communication and Navigation	**Bob Spearing (HQ/SOMD)**	**Michael Regan (DoD)**
Robotic Access to Planetary Surfaces	**Mark Adler (JPL)**	**Dr. Robert Braun (Georgia Tech)**
Human Planetary Landing Systems	**Robert Manning (JPL)**	**Dr. Harrison Schmitt**
Human Health and Support Systems	**Dennis Grounds (JSC)**	**Al Boehm (Ret, Hamilton-Sundstrand)**
Human Exploration Systems and Mobility	**Chris Culbert (JSC)**	**Dr. Jeff Taylor (Uni. of Hawaii)**

Capability Roadmaps (page 2 of 2)

Capability	NASA chair	External chair
Autonomous Systems and Robotics	**Dr. Steve Zornetzer (ARC)**	**Doug Gage (Ret. DARPA)**
Transformational Spaceport/Range	**Karen Poniatowski (HQ/SOMD)**	**Gen. (Ret.) Jimmy Morrell** **Col. Dennis Hilley (OSD)**
Scientific Instruments/Sensors	**Rich Barney (GSFC)**	**Dr. Maria Zuber (MIT)**
In Situ Resource Utilization	**Jerry Sanders (JSC)**	**Dr. Mike Duke (Colorado School of Mines)**
Advanced Modeling, Simulation, Analysis	**Dr. Erik Antonsson (JPL)**	**Dr. Tamas Gombosi (Uni. Of Michigan)**
Systems Engineering Cost/Risk Analysis	**Steve Cavanaugh (LaRC)**	**Dr. Alan Wilhite (Georgia Institute of Technology)**
Nanotechnology	**Dr. Murray Hirschbein (HQ/ARMD) and** **Dr. Minoo Dastoor (HQ/ESMD)**	**Dr. Dimitris Lagoudas (Texas A&M)**