NASA and Earth Science Enterprise Overview

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NASA's Vision and Mission

Vision

To improve life here,
To extend life to there,
To find life beyond.

Mission Statement

To understand and protect our home planet,
To explore the universe and search for life,
To inspire the next generation of explorers
…as only NASA can.

Earth Science Mission Statement

To understand and protect our home planet by using our view from space to study the Earth system and improve prediction of Earth system change

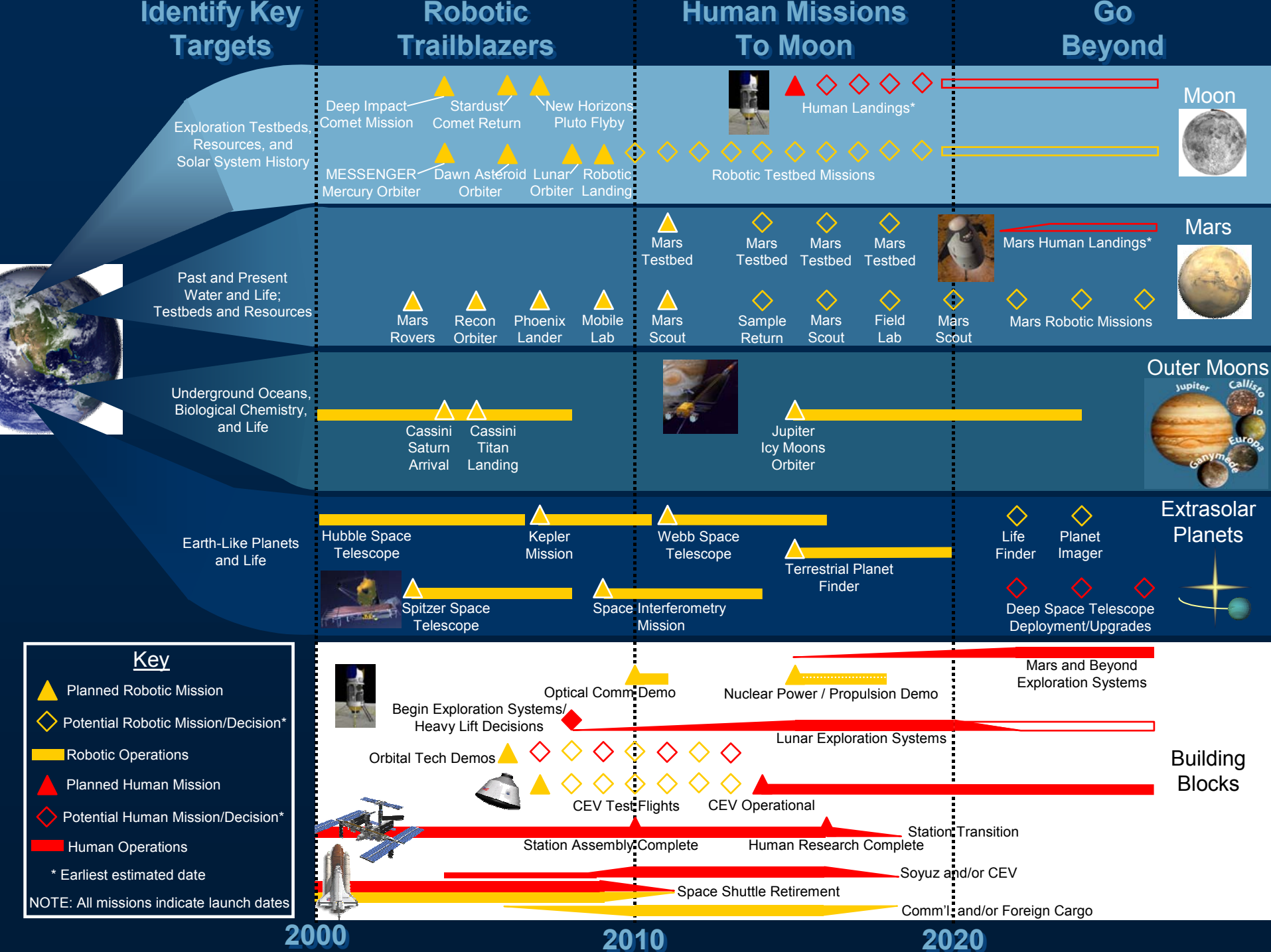
NASA's Vision for Space Exploration

Key Elements of New Space Policy

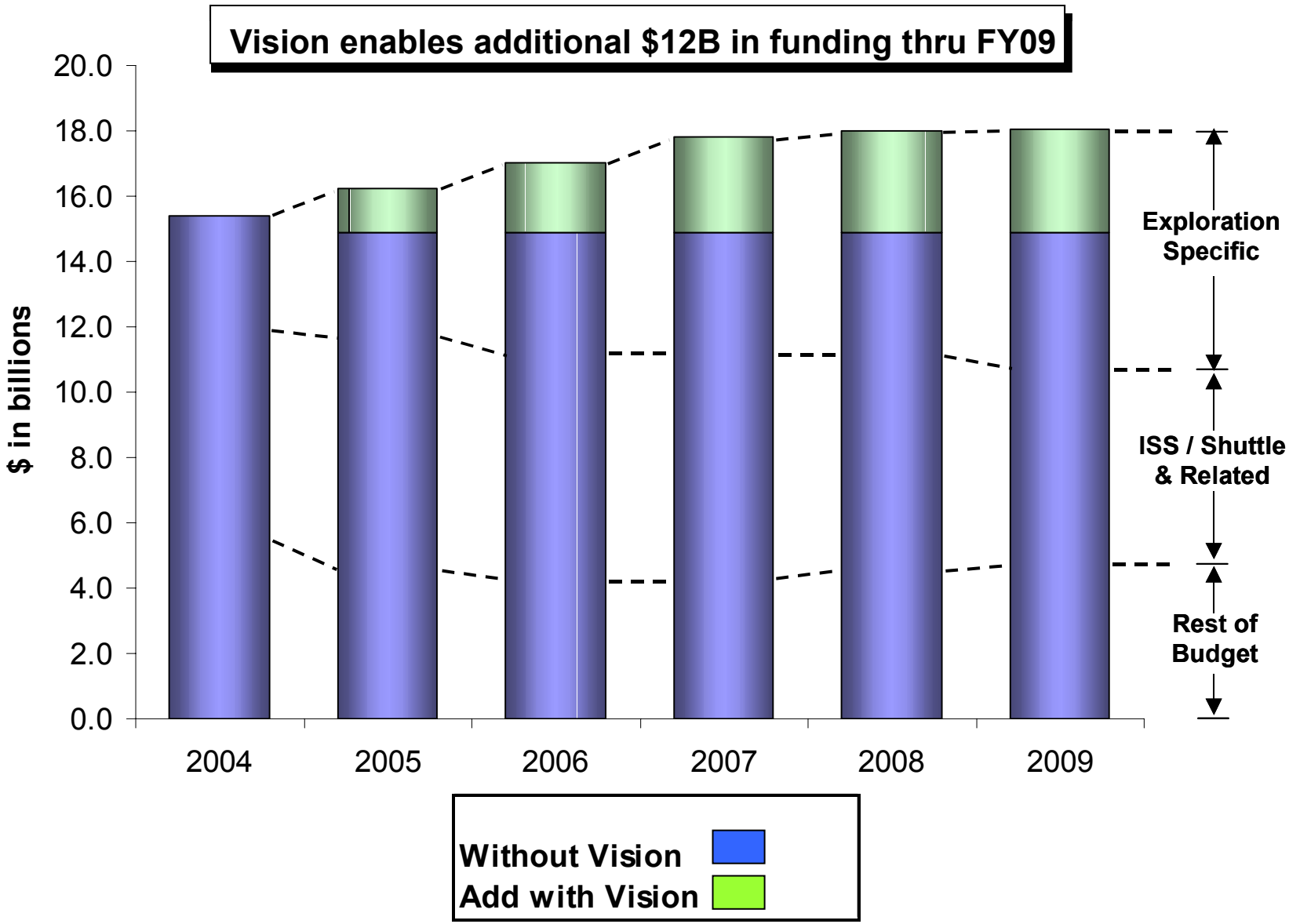
- **Space Shuttle**
  - Return the Space Shuttle to flight and plan to retire it, following the completion of its role in the construction of the International Space Station by the end of this decade
- **International Space Station**
  - Complete assembly,
  - Refocus research to exploration factors affecting astronaut health, and
  - Acquire crew and cargo systems, as necessary, during and after availability of Shuttle.
- **Crew Exploration Vehicle**
  - Develop a CEV to travel beyond low Earth orbit, the first new U.S. human space flight vehicle since the 1980s.
  - Undertake first automated test flight by the end of this decade in order to provide an operational capability to support human exploration missions no later than 2014.
- **Lunar Exploration**
  - Begin a series of robotic missions to the Moon by 2008, followed by a period of evaluating lunar resources and technologies for exploration.
  - Begin human expeditions to the Moon in the 2015 – 2020 timeframe.

Key Elements of New Space Policy (cont.)

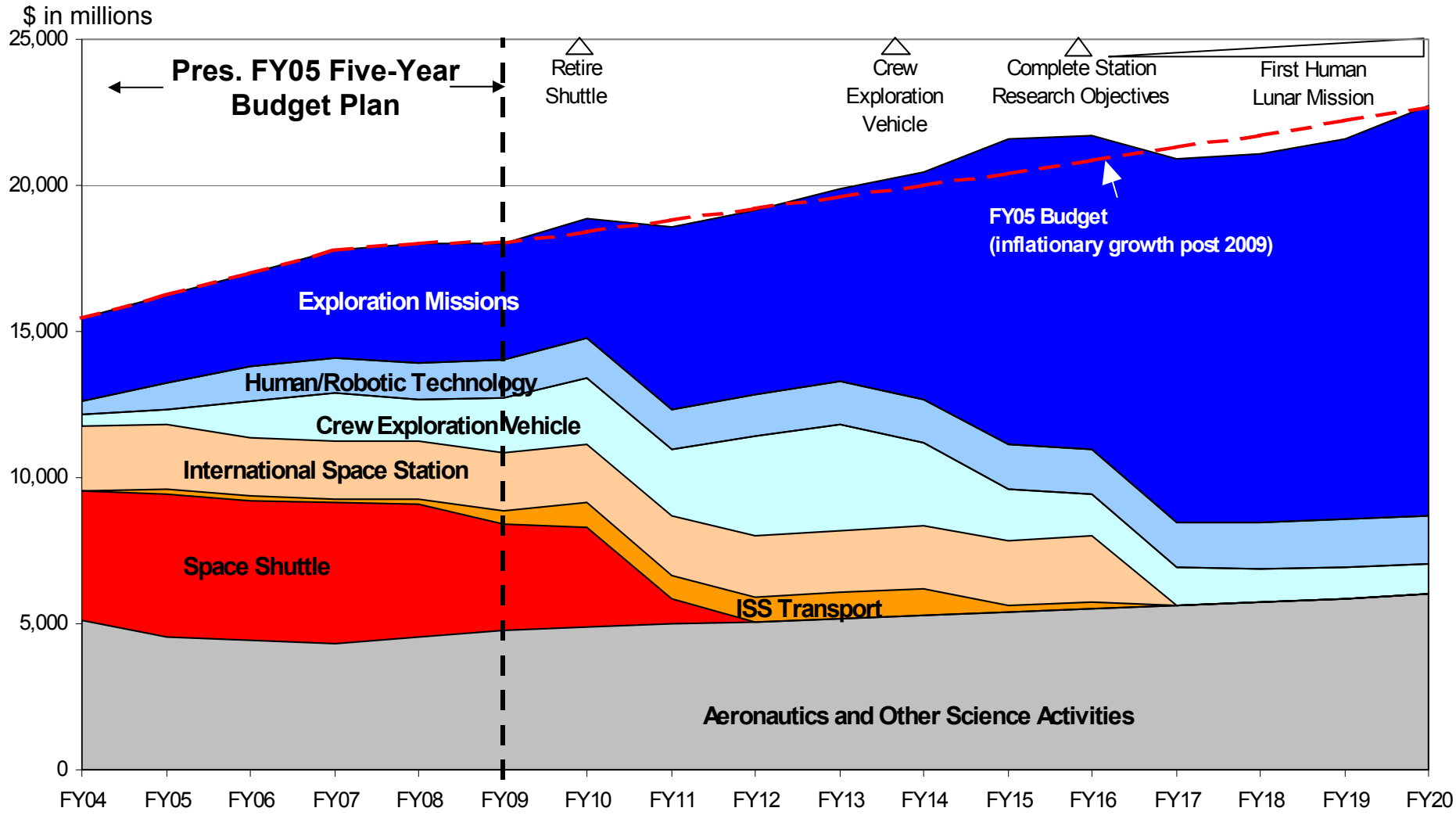
- **Mars Exploration**
  - Conduct robotic exploration of Mars to search for evidence of life, to understand the history of the solar system, and to prepare for future human exploration.
  - Timing of human missions to Mars based on available budget, experience and knowledge gained from lunar exploration, discoveries by robotic missions at Mars and other solar system locations, and development of required technologies and know-how.
- **Other Solar System Exploration**
  - Conduct robotic exploration across the solar system for scientific purposes and to support human exploration.
  - In particular, explore Jupiter's moons, asteroids and other bodies to search for evidence of life, to understand the history of the solar system, and to search for resources;
- **Exploration Beyond**
  - Conduct advanced telescope searches for Earth-like planets and habitable environments around other stars;
- **Enabling Capabilities**
  - Develop and demonstrate power generation, propulsion, life support, and other key capabilities required to support more distant, more capable, and/or longer duration human and robotic exploration of Mars and other destinations.
  - Separate to the maximum practical extent crew from cargo launches


Identify Key Targets
Robotic Trailblazers
Human Missions To Moon
Go Beyond
Exploration Testbeds, Resources, and Solar System History
Deep Impact Comet Mission
Stardust Comet Return
New Horizons Pluto Flyby
MESSENGER Mercury Orbiter
Dawn Asteroid Orbiter
Lunar Orbiter
Robotic Landing
Human Landings*
Robotic Testbed Missions
Moon
Past and Present Water and Life; Testbeds and Resources
Mars Rovers
Recon Orbiter
Phoenix Lander
Mobile Lab
Mars Scout
Mars Testbed
Mars Testbed
Mars Testbed
Mars Testbed
Mars Human Landings*
Sample Return
Mars Scout
Field Lab
Mars Scout
Mars Robotic Missions
Mars
Underground Oceans, Biological Chemistry, and Life
Cassini Saturn Arrival
Cassini Titan Landing
Jupiter Icy Moons Orbiter
Outer Moons
Earth-Like Planets and Life
Hubble Space Telescope
Kepler Mission
Webb Space Telescope
Terrestrial Planet Finder
Spitzer Space Telescope
Space Interferometry Mission
Life Finder
Planet Imager
Deep Space Telescope Deployment/Upgrades
Extrasolar Planets
Key
Planned Robotic Mission
Potential Robotic Mission/Decision*
Robotic Operations
Planned Human Mission
Potential Human Mission/Decision*
Human Operations
* Earliest estimated date
NOTE: All missions indicate launch dates
Optical Comm Demo
Nuclear Power / Propulsion Demo
Mars and Beyond Exploration Systems
Begin Exploration Systems/ Heavy Lift Decisions
Lunar Exploration Systems
Orbital Tech Demos
CEV Test Flights
CEV Operational
Building Blocks
Station Assembly Complete
Human Research Complete
Station Transition
Soyuz and/or CEV
Space Shuttle Retirement
Comm'l and/or Foreign Cargo
2000
2010
2020

Budget with Approved Exploration Vision



Strategy Based on Long-Term Affordability



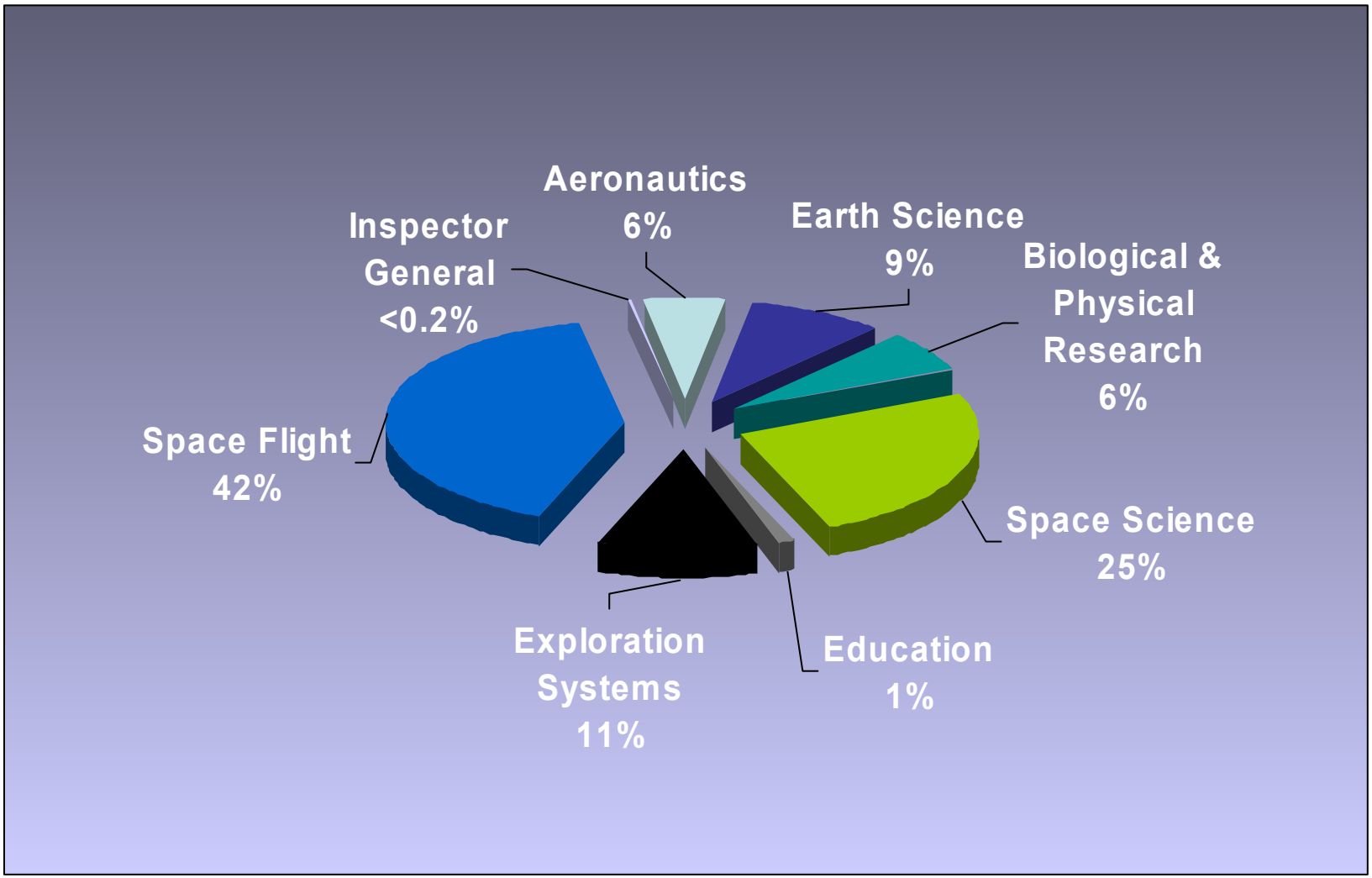
NOTE: Exploration missions – Robotic and eventual human missions to Moon, Mars, and beyond
Human/Robotic Technology – Technologies to enable development of exploration space systems
Crew Exploration Vehicle – Transportation vehicle for human explorers
ISS Transport – US and foreign launch systems to support Space Station needs especially after Shuttle retirement

Agency Budget Summary

$ In Millions	FY 2004 *	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Exploration, Science & Aeronautics	**7,544**	**7,760**	**7,869**	**8,320**	**8,900**	**9,091**
Space Science	3,943	**4,138**	4,404	4,906	5,520	5,561
Earth Science	1,526	**1,485**	1,390	1,368	1,343	1,474
Biological & Physical Research	965	**1,049**	950	938	941	944
Aeronautics	946	**919**	957	938	926	942
Education	164	**169**	169	171	170	170
Exploration Capabilities	**7,420**	**8,456**	**9,104**	**9,465**	**9,070**	**8,911**
Exploration Systems	1,563	**1,782**	2,579	2,941	2,809	3,313
Space Flight	5,857	**6,674**	6,525	6,524	6,261	5,598
Inspector General	**27**	**28**	**29**	**30**	**31**	**32**
Earmarks	388					
TOTAL NASA	**15,378**	**16,244**	**17,002**	**17,815**	**18,001**	**18,034**
year to year growth		5.6%	4.7%	4.8%	1.0%	0.2%

* - FY 2004 budget displays enacted less earmarks

NASA Budget by Discipline FY05



FY05 NASA Budget: $16.244 B

Earth Science Budget

The President's budget request for FY05 includes:

- $560 million for research, 7% above FY04, allowing research on data from **80 sensors on 18 operating satellites**
- $240 million for missions in formulation, a 37% increase from FY 2004, including such missions as Orbiting Carbon Observatory, Aquarius, HYDROS and others.
- $141 million for development of the NPOESS Preparatory Project (NPP), 36% above FY04
- $54 million for the Climate Change Research Initiative, making NASA the largest contributor to the interagency Climate Change Science Program (CCSP)
- $42 million to maintain critical work on Landsat continuity

$ In Millions	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Earth Science	**1,526**	**1,485**	**1,390**	**1,368**	**1,343**	**1,474**
Earth System Science	1,451	1,409	1,313	1,290	1,266	1,397
Earth Science Applications & Education	74	77	77	77	77	77

Earth Science Budget

- **Research increases commensurate with availability of new data from recently launched missions**
- **Continues development of NPP, Ocean Surface Topography, Landsat data continuity, CloudSat, CALIPSO, OCO, and Aquarius**
- **Defers Global Precip. Mission two years**

	FY04 ($M)	FY05 ($M)
Research	**523.4**	**560.0**
Observing & Info Systems	**875.3**	**789.0**
Advanced Technology	**78.9**	**59.0**
Applications & Education	**74.8**	**77.0**
Total	**$1552***	**$1485**

* - FY 2004 budget includes earmarks

Strategic Alignment of Sponsored Research

- **In the last year or so, the Research Program has issued NRAs resulting in grants totaling about $170M, or about one-third of the program. Increasingly, these are align with the six Science Focus Areas:**
  - Climate Variability and Change
  - Carbon Cycle and Ecosystems
  - Earth Surface and Interior
  - Atmospheric Composition
  - Weather
  - Water & Energy Cycle

- **Recent NRAs include:**
  - New Investigator Program – integration of Earth system science research and education by scientists and engineers at the early stage of their professional careers (59)
  - EOS Recompetition – refined algorithms and innovative approaches to making scientific use of the data (192)
  - Interdisciplinary Science (IDS) - cross-cutting, interdisciplinary research spanning and integrating across discipline areas addressed by the Enterprise (31)
  - Tropical Cloud System Processes – investigations of hurricanes, impact of cirrus on water & energy cycles, and radiative, compositional and dynamic feedbacks between upper tropo / lower strat.
  - Oceans & Ice - innovative investigations that utilize NASA's observational data for investigations of ocean, ice and climate processes.
  - Carbon Cycle - improve understanding of changes in the distribution and cycling of carbon among the active land, ocean, and atmospheric reservoirs.

Earth Science National Applications

- **Expand and accelerate economical and societal benefits of Earth science information and technology:**

  - **Carbon Management** – terrestrial and marine biomass productivity
  - **Public Health** – modeling weather, climate and environment for disease vectors
  - **Renewable Energy** – extended weather forecasts and climate prediction
  - **Aviation** – weather nowcasting, monitoring volcanic aerosols
  - **Water Management** – improved models of water transport, storage & quality
  - **Homeland Security** – observations and modeling of atmospheric transport
  - **Coastal Management** – measurement and modeling of SST, winds, color, salinity
  - **Disaster Management** – topographic change & crustal strain, severe storms forecast
  - **Agricultural Efficiency** – seasonal temperature, precip forecasts and soil moisture
  - **Invasive Species** – observing and modeling land cover change and biomass
  - **Ecological Forecasting** – obs of land cover change, vegetation structure and biomass
  - **Air Quality** – measurement of aerosols, CO, & CO_2 and modeling of transport

NASA Earth Science Information Partners

- **REASoN – Research, Education and Applications Solutions Network**
  - A distributed network of data and information providers for Earth science, applications and education projects
  - 42 awards to government (21), university (16), commercial (3), and non-profit organizations (2)
  - These projects unite previously disparate NASA Earth Science activities and programs

- **Federation of Earth Science Information Partners – ESIPFed**
  - Establish and continuously improve science-based end-to-end processes that increase the quality and value of Earth science products and services
  - Composed of 50+ agencies, universities, commercial companies, and non-profit organizations – many of the REASoNs are joining
  - Federation brings together scientists and organizations that historically have not worked together for the common good

Status of Selected Missions

- **Aura planned for launch 19 June 2004**
  - Suite of instruments to measure atmospheric trace gases, aerosols, ozone and other constituents that play important role in atmospheric air quality and chemistry
- **CloudSat and CALIPSO launches are planned for the 2nd quarter of CY2005.**
  - Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) Payload shipped to the spacecraft manufacturing facility, Alcatel Space, in Cannes, France, in February, 2004.
  - CloudSat bus ready; instrument high voltage power supply requires redesign of two subassemblies through June
- **NPOESS Preparatory Project on track for late 2006 launch**
- **Nearing completion of programmatic arrangements to add wide-swath capability to the Ocean Surface Topography Mission**
  - Wide-swath enables daily observations instead of once per 10 days
- **Orbiting Carbon Observatory, Aquarius, and HYDROS authorized to enter into formulation phase**

ESE Budget Summary

- **Preserving a robust Earth Science program**
  - Completing EOS first series and implementing continuity missions with partners; mission development budget ramps down accordingly
  - Missions in formulation (Ocean Surface Topography, OCO, Aquarius, etc.) beginning to ramp up
  - EOSDIS becoming more efficient with EOSDIS Maintenance & Development contract
  - Research program growing commensurate with availability new data from new missions
  - Applications program level funded beyond FY05
  - Continuing commitments to Climate Change Science Program, international GEO and related cooperative programs
- **Contributing to NASA's Exploration Vision**
  - Financially: $1.1 billion over FY05-09
  - Expertise in studying planetary systems, managing large data volumes, integration of diverse data types, creating new instrument technologies, formation flying of multiple satellites