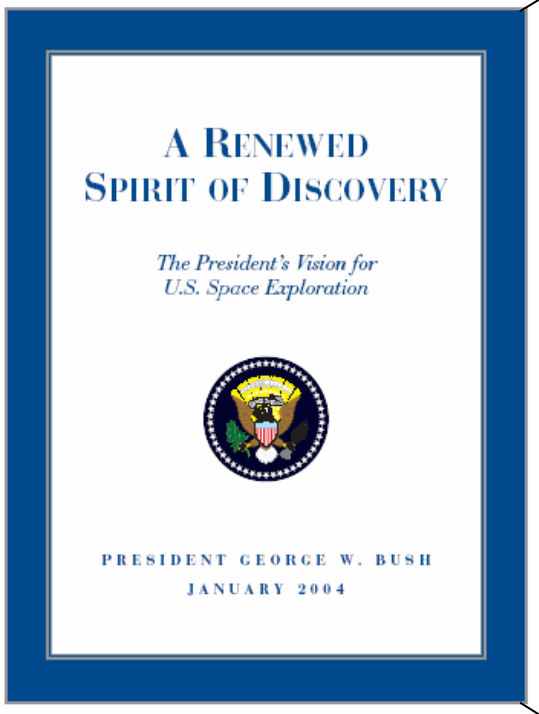
41st Space Congress

The Future of Space Exploration

Gary Martin, Space Architect
April 27, 2004

National 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.

A Nation of Explorers

It's about destiny, not destination

Lifts the national spirit

- The spirit of discovery – a part of the fabric of our nation
- In every field of human endeavor, leaders do what others regard as impossible
- Pushing the limits of human understanding – our origins, life beyond Earth, human survival on other worlds

Improves the quality of life on Earth

- Space exploration delivers enormous benefits – advances in medicine, weather forecasting, communications, computers, materials, etc...
- Space exploration has led to unprecedented advances in public safety and environmental, economic, and national security
- The next phase of exploration will have even more of an impact – driving breakthroughs in science, mathematics, engineering, and technology

Inspires future generations

- Exploration of the solar system and beyond will be guided by compelling questions of scientific and societal importance
- Exploration requires the best ideas, talents, and skills of our nation
- Inspires our youth to challenging pursuits; allowing them to boldly dream
- Lifts our capabilities as a nation to new heights

Realizing the Future

Earth, Moon, Mars, and Beyond

Foster and sustain the exploration culture across generations

- Compelling missions that continually open new frontiers
- A shared journey, inspiring present and future generations
- A constant impetus to educate and train the workforce to realize these bold exploration goals

Identify, develop, and apply advanced technologies to…

- Travel to distant worlds
- Enable exploration and discovery
- Encompass humans and robots in pursuit of compelling destinations
- Involve the public in the excitement of exploration and discoveries
- Translate the benefits of these technologies to improve life on Earth

Harness the brain power

- Engage the nation's science and engineering talent
- Motivate successive generations of students to pursue science, math, engineering and technology
- Create the tools to facilitate broad national technical participation

One Step at a Time

It is affordable and sustainable

- Paced by experience, technology readiness and flexibility
- Establish Stepping Stones – the right destinations, in the right order, at the right time
- Develop Building Blocks –technology to enable each successive step
- Employ New Approaches – spiral development – build and test
- Fiscal Management – smart decisions to prioritize internal programs and be an informed buyer

It is focused and achievable

- Responds to the nation's call for a long term space vision
- We have an integrated agency approach
- We have the talent, experience and leadership – recent successes and demonstrated management reforms
- We have the passion and commitment to succeed

NASA's Next Steps

Systems

- Build spaceships to send robotic and human explorers into deep space
- Protect astronauts from the hazards of space flight and sustain human life on other worlds
- Design and build safe and efficient power and propulsion
- Optimize human and robotic partnerships in both engineering and science

Workforce and facilities

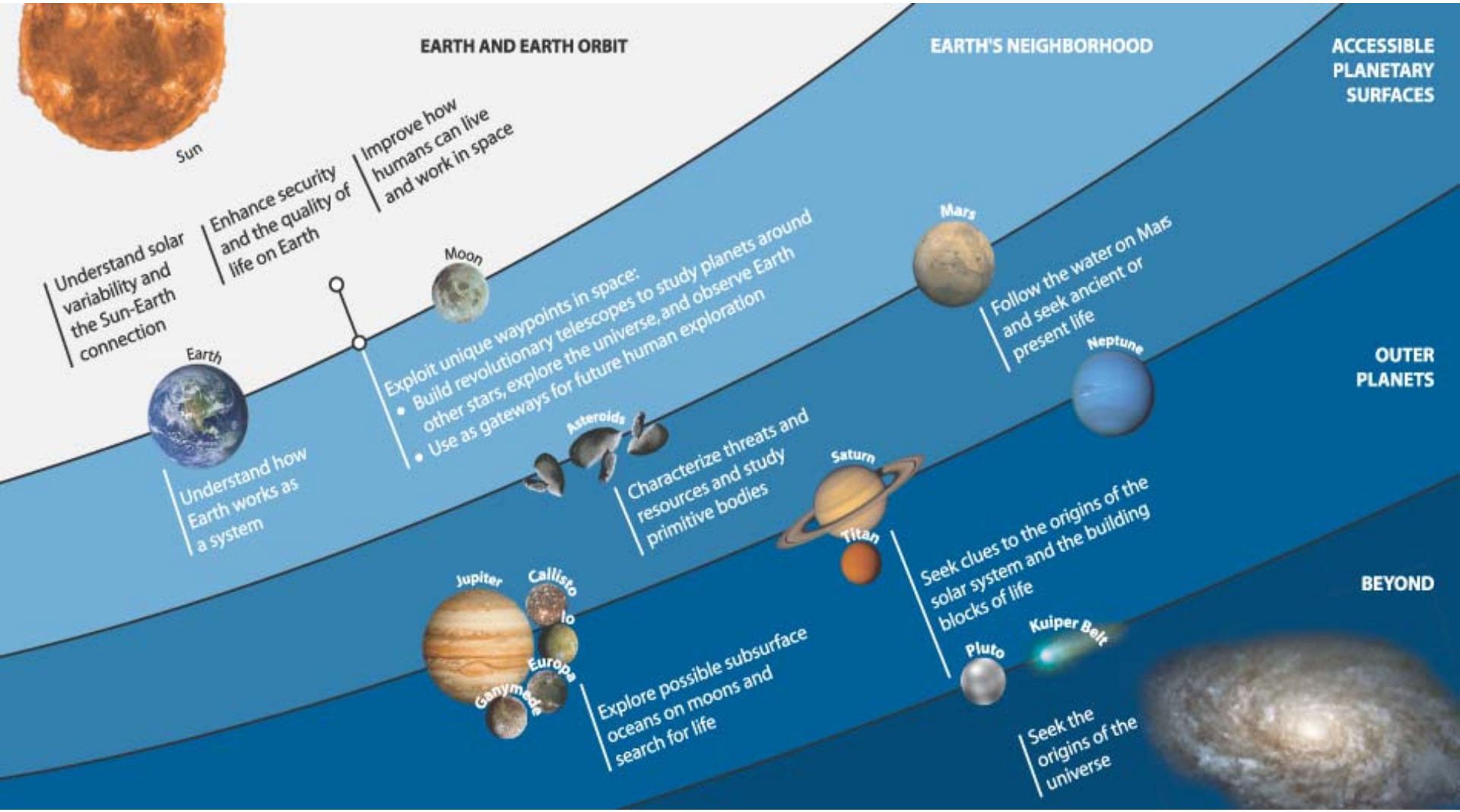
- Create the right skill mix
- Attract and train the workforce – inspire, engage, and educate a diverse next generation of explorers
- Assure critical capabilities and institutional capacity

Partnerships

- Expand cooperation with government agencies
- Leverage industry and academia capabilities
- Identify innovative opportunities for commercial participation
- Engage other nations to further exploration goals

"Let us continue the Journey…" George W. Bush January 14, 2004

Stepping Stone Strategy



Identify Key Targets

Robotic Trailblazers

Human Missions To Moon

Go Beyond

Exploration Testbeds, Resources, and Solar System History

Past and Present Water and Life; Testbeds and Resources

Underground Oceans, Biological Chemistry, and Life

Earth-Like Planets and Life

Moon

Mars

Outer Moons

Extrasolar Planets

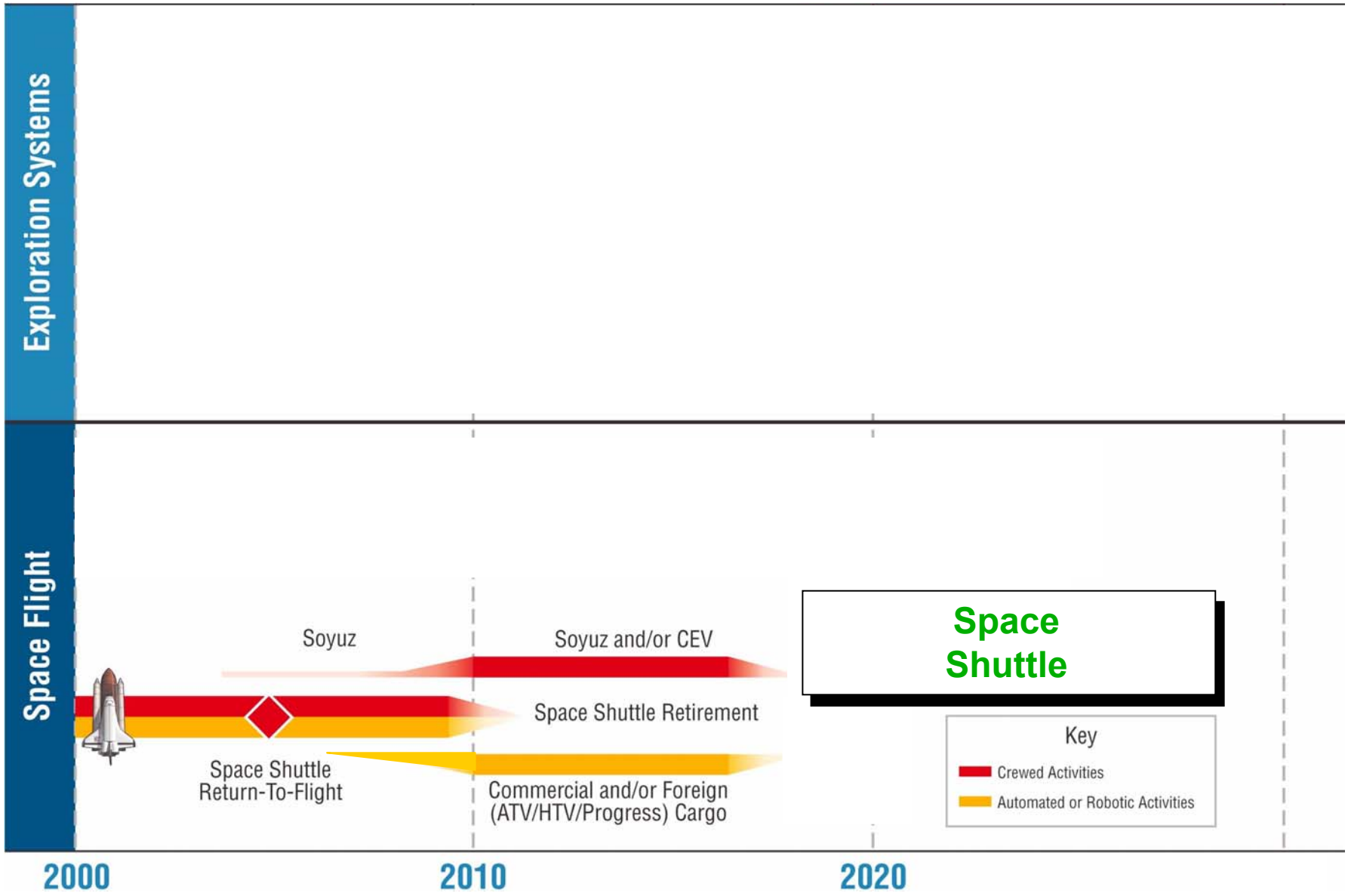
Building Blocks

2000

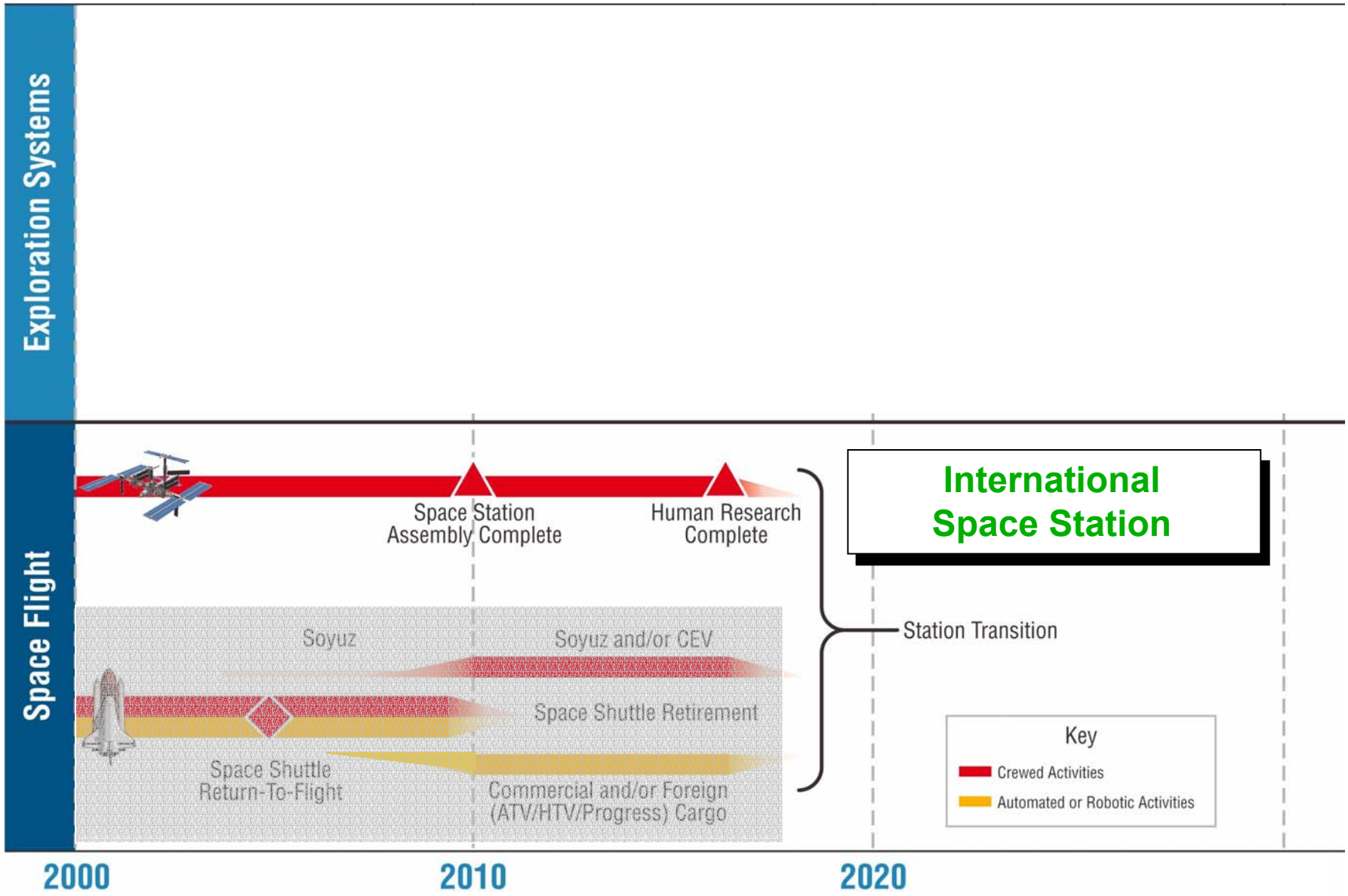
2010

2020

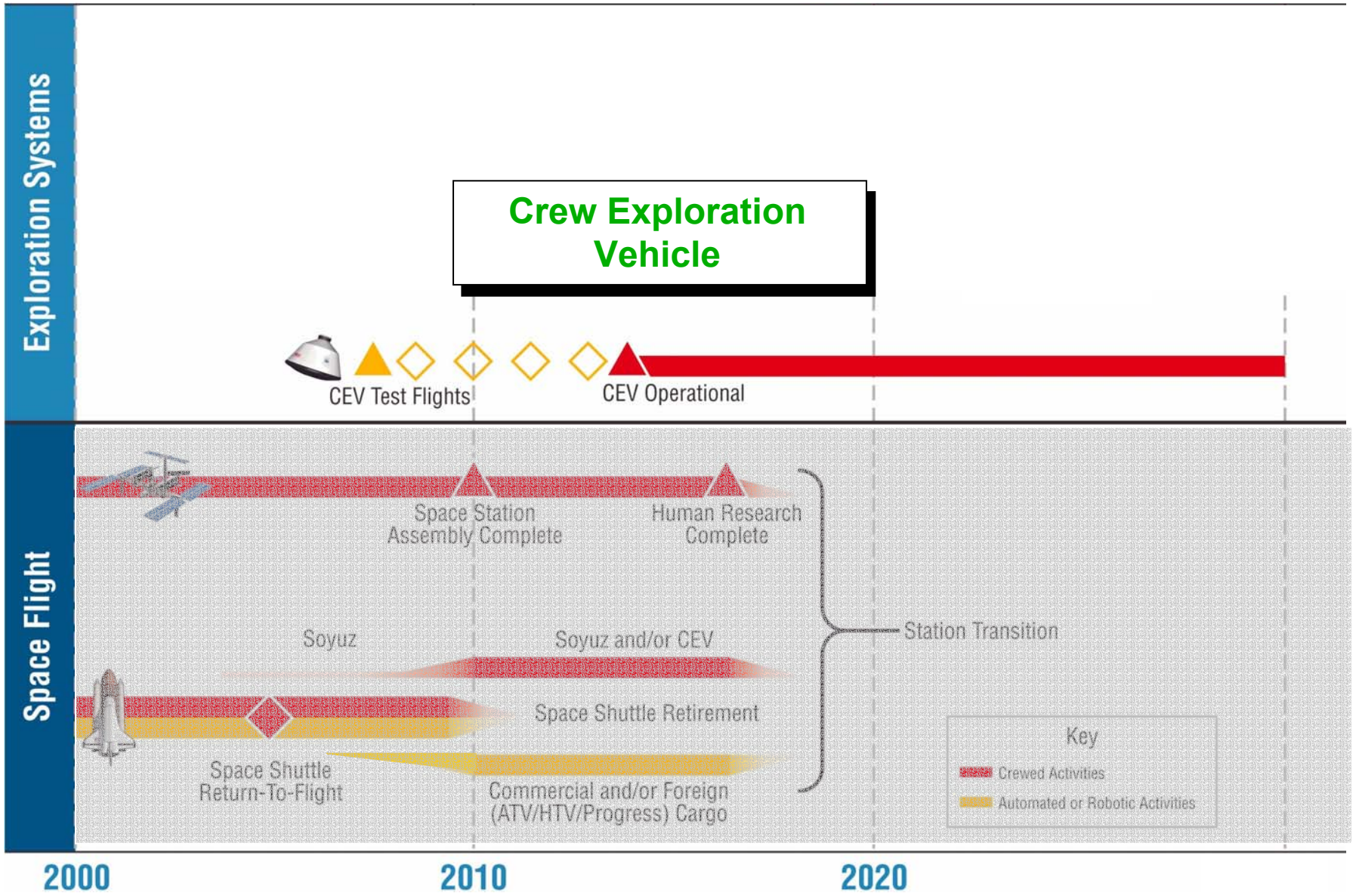
Key Building Blocks to Vision



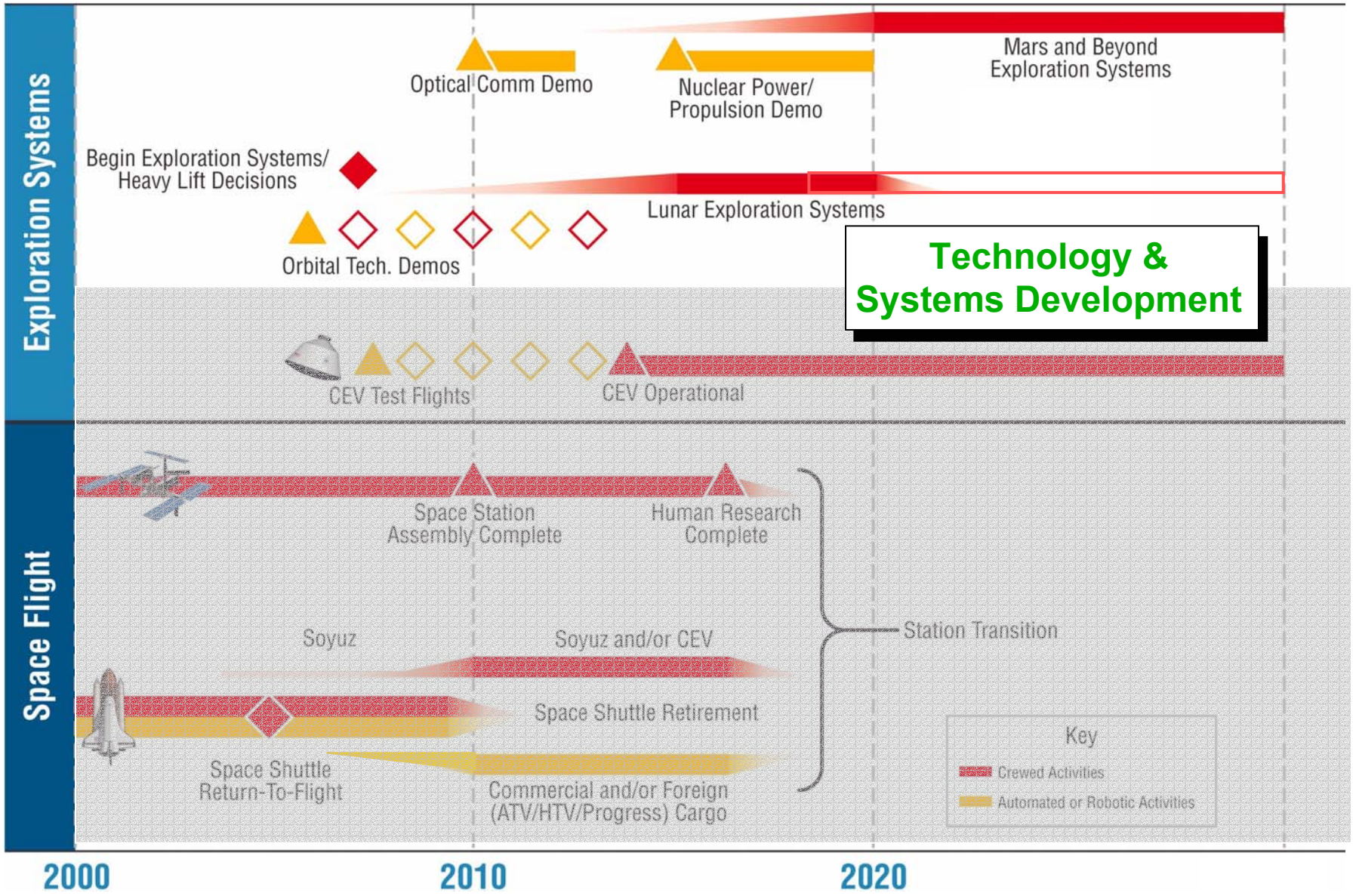
Key Building Blocks to Vision

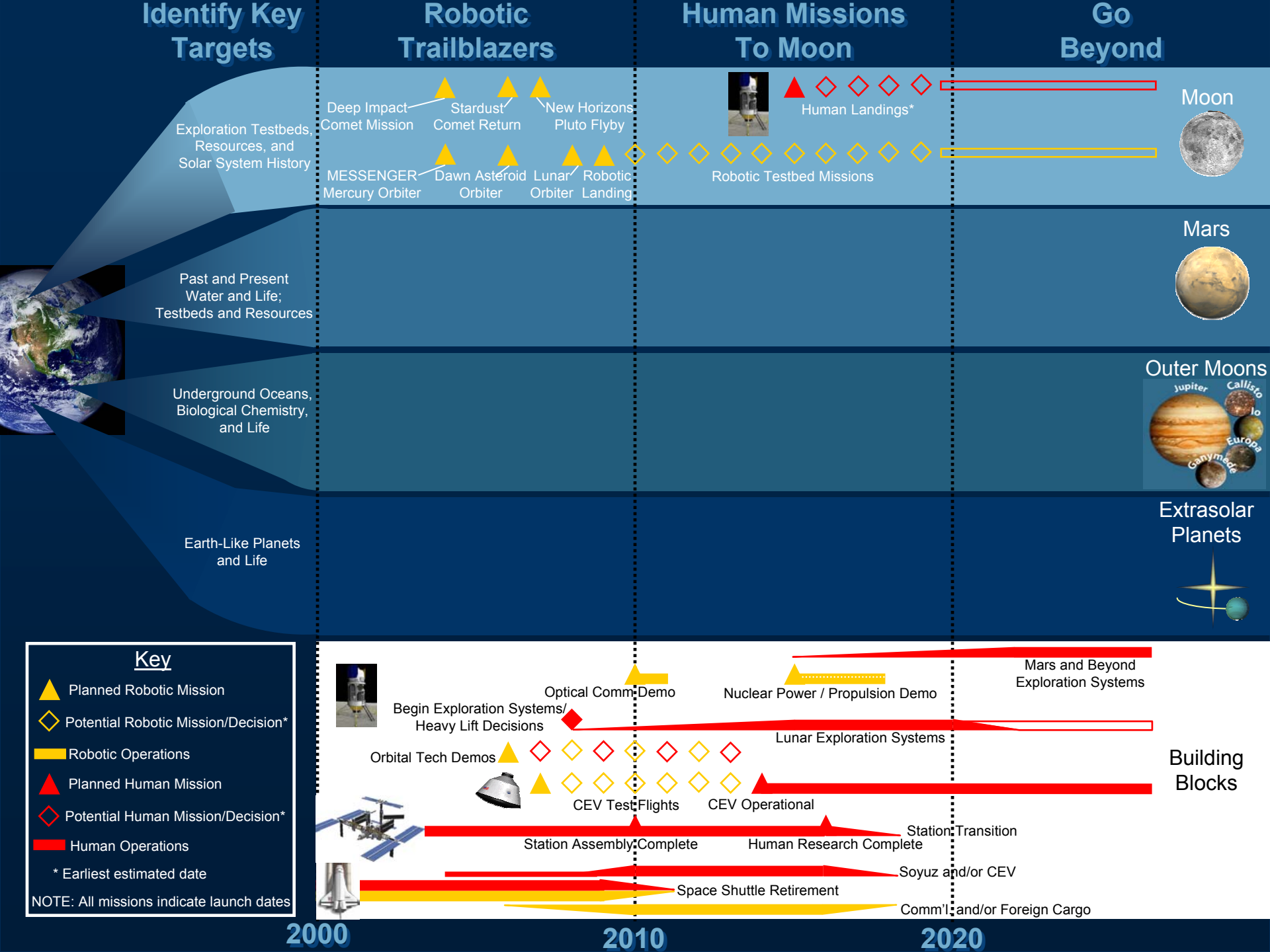


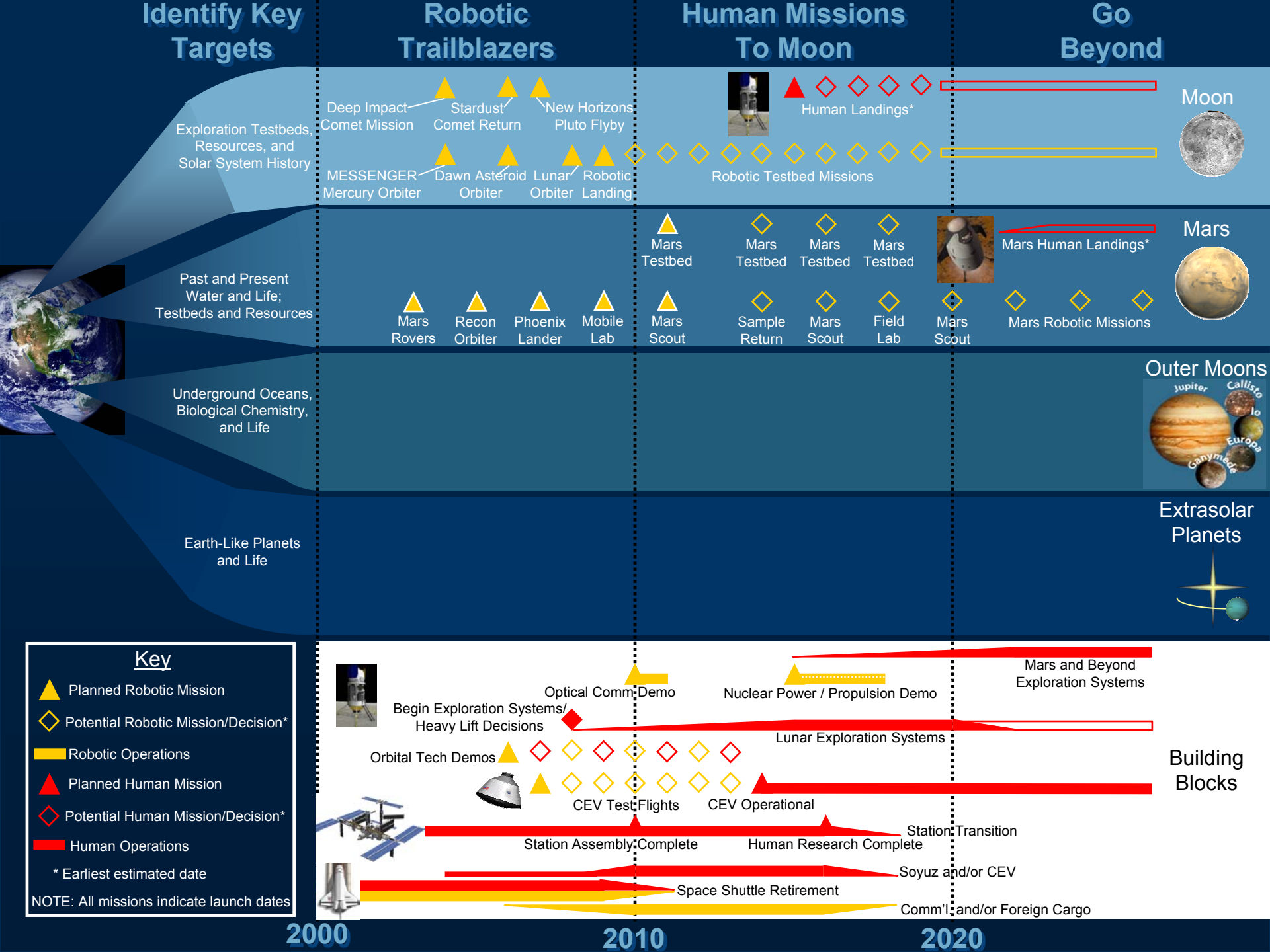
Key Building Blocks to Vision

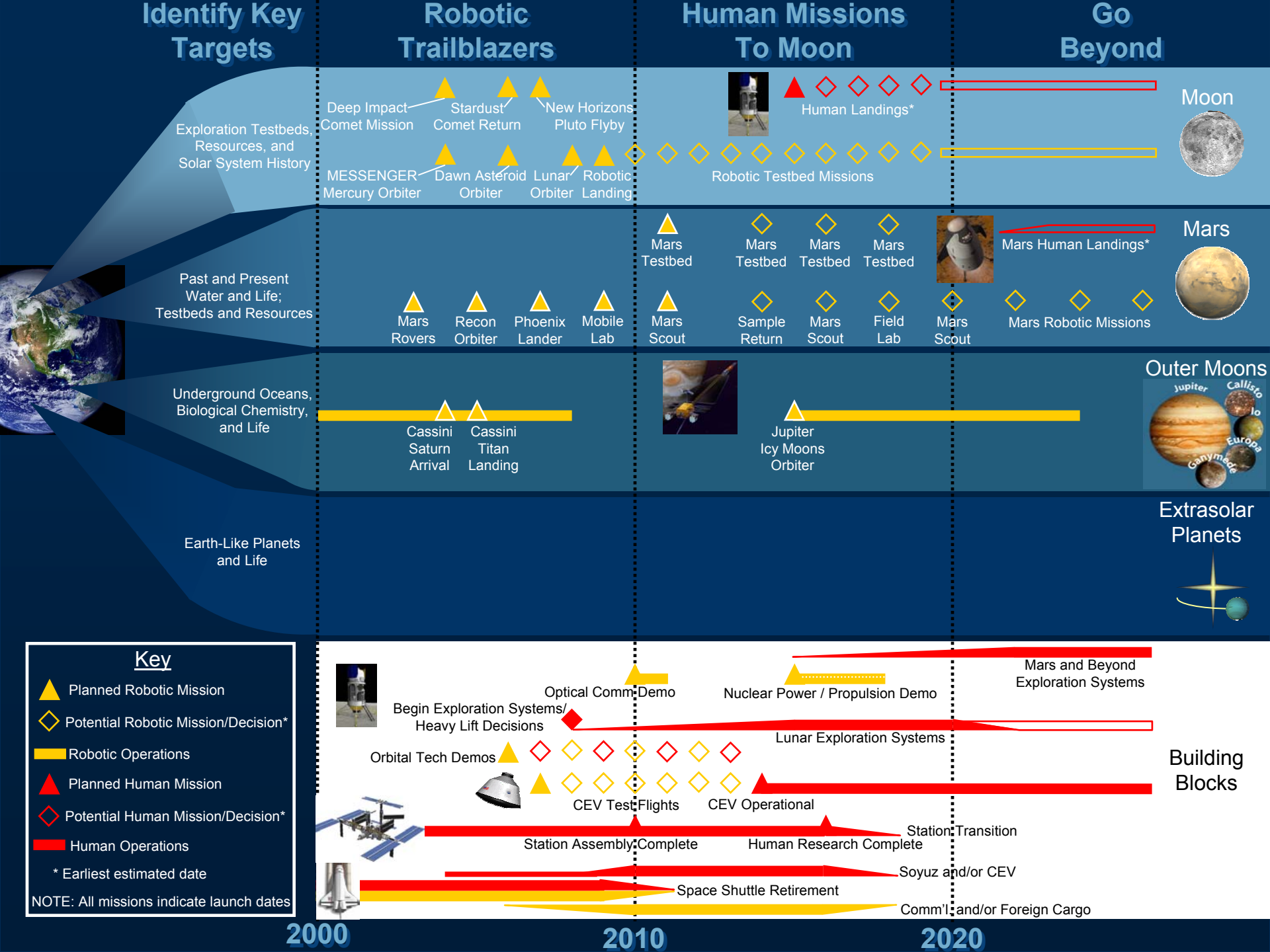


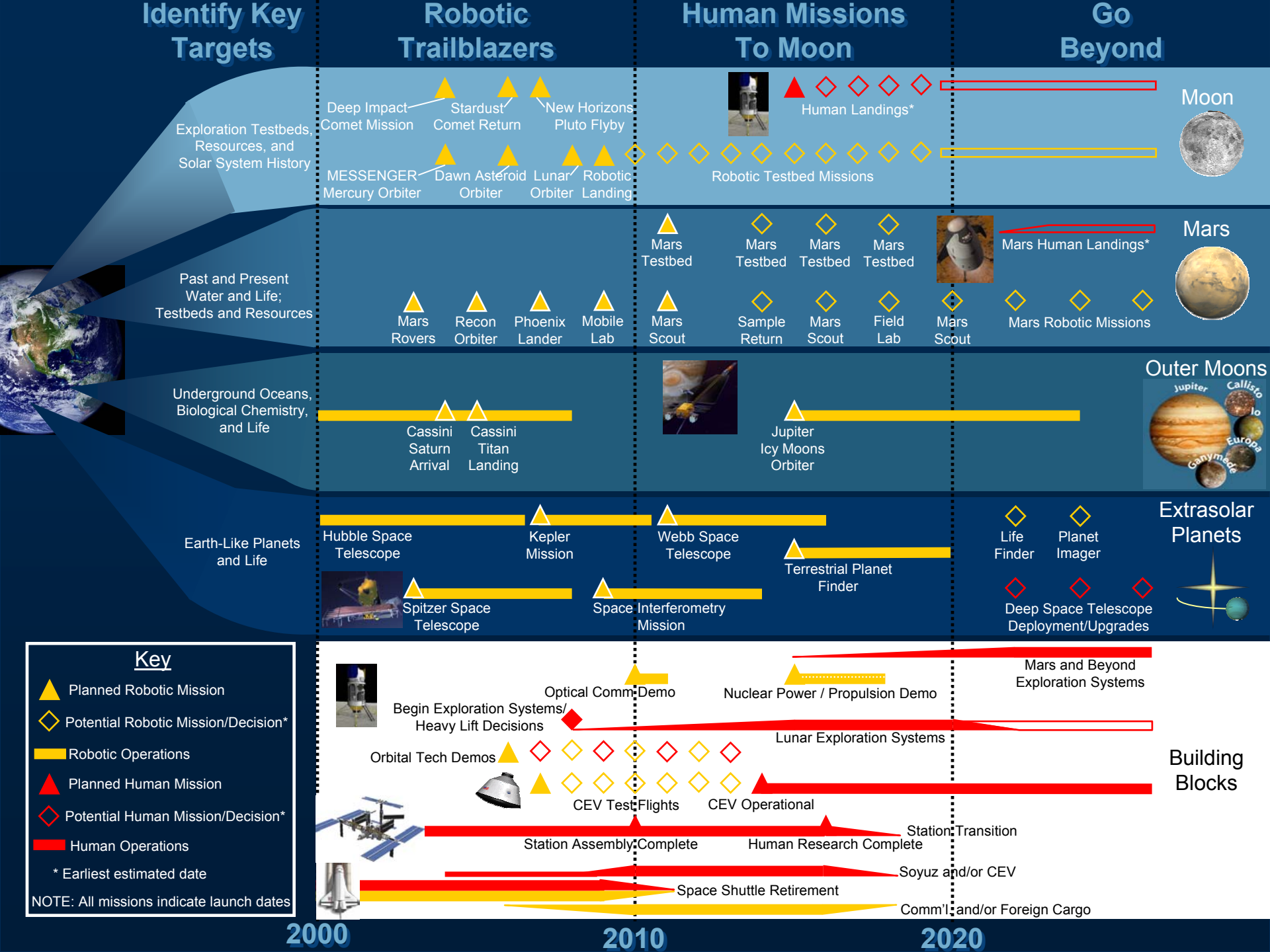
Key Building Blocks to Vision




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
Human Landings*
Moon
MESSENGER Mercury Orbiter
Dawn Asteroid Orbiter
Lunar Orbiter
Robotic Landing
Robotic Testbed Missions
Past and Present Water and Life; Testbeds and Resources
Mars
Underground Oceans, Biological Chemistry, and Life
Outer Moons
Jupiter
Callisto
Io
Europa
Ganymede
Earth-Like Planets and Life
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
Building Blocks
CEV Test Flights
CEV Operational
Station Transition
Station Assembly Complete
Human Research Complete
Soyuz and/or CEV
Space Shuttle Retirement
Comm'l and/or Foreign Cargo
2000
2010
2020


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
Robotic Testbed Missions
Human Landings*
Moon
Past and Present Water and Life; Testbeds and Resources
Mars Rovers
Recon Orbiter
Phoenix Lander
Mobile Lab
Mars Scout
Mars Testbed
Sample Return
Mars Scout
Mars Testbed
Field Lab
Mars Testbed
Mars Scout
Mars Human Landings*
Mars Robotic Missions
Mars
Underground Oceans, Biological Chemistry, and Life
Outer Moons
Jupiter
Callisto
Io
Europa
Ganymede
Earth-Like Planets and Life
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


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
Robotic Testbed Missions
Human Landings*
Moon
Past and Present Water and Life; Testbeds and Resources
Mars Rovers
Recon Orbiter
Phoenix Lander
Mobile Lab
Mars Scout
Mars Testbed
Sample Return
Mars Scout
Field Lab
Mars Scout
Mars Robotic Missions
Mars Human Landings*
Mars
Underground Oceans, Biological Chemistry, and Life
Cassini Saturn Arrival
Cassini Titan Landing
Jupiter Icy Moons Orbiter
Outer Moons
Jupiter
Callisto
Io
Europa
Ganymede
Earth-Like Planets and Life
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


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
Sample Return
Mars Scout
Field Lab
Mars Scout
Mars Human Landings*
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

ONE STEPPING STONE AT A TIME.

NASA has a new focus, and a new mission: to help America take the right steps, in the right order, and at the right time, so that mankind can one day take the biggest step of all, and walk on new worlds.

We will go boldly, but logically, with each launch and each project bringing us one step closer to our goal.

The mission will require the best ideas, talents and skills that our nation, our people, and our industry can muster.

But if history is any guide, it will also yield breathtaking benefits: Leaps in technology, science, and commerce that we can only imagine today, but which will advance all of humankind in the decades ahead.