

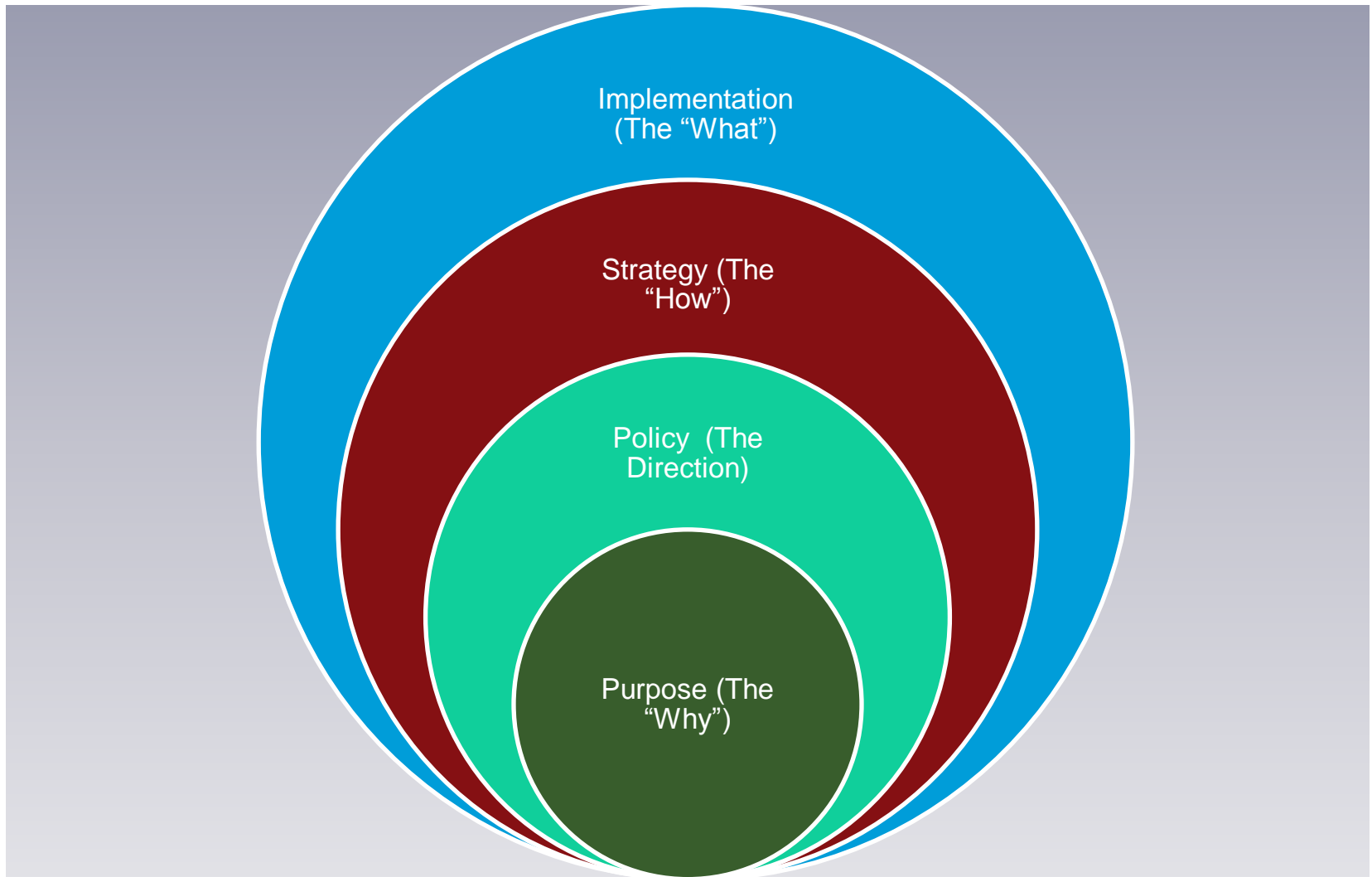


# **Presentation to the Committee on NASA's Strategic Direction National Academies**

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# From Purpose to Implementation





# NASA “Policy Map” based on the 1958 Space Act

- **Stimulate Innovation**: “Stimulate innovation in basic and applied research, technology development and prototype demonstration” for “space and aeronautical activities” **Sec 314(a)**
- **2010 National Space Policy**
  - “Cultivate increased technological innovation and entrepreneurship in the commercial space sector” and “actively explore the use of inventive, nontraditional arrangements for acquiring commercial space goods and services” *Page 10*
- **2006 National Aeronautics Policy**
  - “Identify and promote innovative policies and approaches that complement and enhance Federal aeronautics R&D investment” *Page 15*
  - “Provide long-term stability and focus in innovative research that leads to groundbreaking ideas, concepts, approaches, technologies, and capabilities” *Page 8*
- **Fiscal Year 2012 NASA Presidential Budget Request**
  - “Drive innovation in the aerospace industry” through “public and private partnerships, collaborations with Federal agencies and other nations, and Federal grant awards to innovators at U.S. universities and research centers” *SUM-2*
  - “Inspire the next generation of scientists and engineers” and “increase focus on attracting new talent in the early stages of their careers” *SUM-4 & 7*
  - “Engage the creativity and problem-solving nature of the Nation’s brightest minds” *SUM-5*
  - “Encourage creativity and innovation in companies that might not otherwise be drawn to NASA and space exploration” *SUM-5*
- **2011 NASA Strategic Plan**
  - Overarching Strategy: “Investing in next-generation technologies and approaches to spur innovation”
  - Strategic Goal 3: Create the innovative new space technologies for our exploration, science, and economic future.



# NASA “Policy Map” based on the 1958 Space Act

- **Commercial Space:** "Seek and encourage, to the maximum extent possible, the fullest commercial use of space," including "provide for Federal Government use of commercially provided space services and hardware" *Section 102(c), Sec 203 (a)(5)*
- **2010 National Space Policy**
  - "Encourage an innovative and entrepreneurial commercial space sector," including "space-related industrial capabilities in support of critical government functions" *Page 5*
  - "Seek [private sector]partnerships to enable safe, reliable, and cost-effective commercial spaceflight capabilities and services for the transport of crew and cargo to/from the ISS" *Page 11*
  - "Purchase and use commercial space capabilities and services to the maximum practical extent" and "refrain from conducting U.S. Government space activities that preclude, discourage, or compete with U.S. commercial space activities" *Page 10*
- **2006 National Aeronautics Policy**
  - "Cultivate an R&D environment that enables a globally competitive U.S. aeronautics enterprise, and encourages industry investment" and "refrain from activities that preclude, deter, or compete with U.S. commercial aeronautics activities" *Page 8 & 11*
- **2010 NASA Authorization Act**
  - "Support the existing Commercial Orbital Transportation Services program" *Sec 401*
  - "Continue the Commercial Crew Development program" *Sec 402(a)*
  - Provide "a framework that allows partnering, leveraging and stimulations of the existing and emerging commercial efforts" and "make use of U.S. commercially provided ISS crew transfer and crew rescue services to the maximum extent practicable" *Sec 2(10-11)*
- **Fiscal Year 2012 NASA Presidential Budget Request**
  - "Stimulate a competitive commercial market" and "the development of commercial crew and cargo transportation systems to the ISS and other future destinations" *SUM-2, 5 & 6*
- **2011 NASA Strategic Plan**
  - Outcome 1.2: "Develop competitive opportunities for the commercial community to provide best value products and services to low Earth orbit and beyond."
  - Outcome 3.4: "Facilitate the transfer of NASA technology and engage in partnerships with other government agencies, industry, and international entities to generate U.S. commercial activity and other public benefits."



# NASA “Policy Map” based on the 1958 Space Act

- **Expansion of Human Knowledge:** “Plan, direct and conduct aeronautical and space activities” and contribute materially to “the expansion of human knowledge of the Earth and of phenomena in the atmosphere and space” *Sec 102(d)(1) , Sec 102(d)(4), Sec 203 (a)(1)*
- **2010 National Space Policy**
  - “Set far-reaching exploration milestones. By 2025, begin crewed missions beyond the Moon, including sending humans to an asteroid. By the mid-2030s, send humans to orbit Mars and return them safely to Earth” page 11
  - “Continue a strong program of space science for observations, research, and analysis of our Sun, solar system, and universe” *Page 12*
  - “Continue the operation of the ISS, likely to 2020 or beyond, and expand efforts to: utilize the ISS for scientific, technological, commercial diplomatic and educational purposes” page 11
- **2010 NASA Authorization Act\*\***
  - “Maximize the role that human exploration of space can play in advancing overall knowledge of the universe” and “inspiring young people in their educational pursuits” *Sec 202(b)*
  - “Expand permanent human presence beyond low-Earth Orbit”
- **Fiscal Year 2012 NASA Presidential Budget Request**
  - “Expand human scientific understanding of the Earth, the Sun, the solar system and the universe” by “pursuing the answers to humankind’s most profound scientific questions” *SUM-2 & 4*
  - Strengthen “partnerships with national, state, and local education providers” *SUM-6*
- **2011 NASA Strategic Plan**
  - Overarching Strategy: “Inspiring students to be our future scientists, engineers, explorers, and educators through interactions with NASA’s people, missions, research, and facilities”
  - Strategic Goal 2: “Expand scientific understanding of the Earth and the universe in which we live.”



# NASA “Policy Map” based on the 1958 Space Act

- **Aeronautical and Space Vehicles**: “Contribute materially” to “the development and operation of vehicles capable of carrying instruments, equipment, supplies, and living organisms through space” and improve the “usefulness, performance, speed, safety, and efficiency of aeronautical and space vehicles” *Sec 102(d)(2) & (3)*
- **2010 National Space Policy**
  - “Continue the operation of the International Space Station (ISS)” *Page 11*
  - “Conduct research and development in support of next-generation launch systems” *Page 11*
  - “Develop launch systems and technologies necessary to assure and sustain future reliable and efficient access to space, in cooperation with U.S. industry, when sufficient U.S. commercial capabilities and services do not exist” *Page 5*
- **2006 National Aeronautics Policy**
  - “Pursue and develop advanced concepts and technologies that enable increased air traffic capacity and new aircraft concepts in the national airspace.” *Page 8*
- **2010 NASA Authorization Act**
  - Develop a “Space Launch System” and “replacement vehicles capable of providing both human and cargo launch capability to low-Earth orbit and destinations beyond” *Sec 2(14), Sec 601(b)(2)*
  - “It is in the U.S. national interest to maintain a government operated space transportation system for crew and cargo delivery to space” *Sec 2(9)*
  - “The multi-purpose crew vehicle shall have “the capability to provide an alternative means of delivery of crew and cargo to the ISS, in the event other vehicles, whether commercial vehicles or partner-supplied vehicles, are unable to perform that function” *Sec 303(b)(3)*
- **Fiscal Year 2012 NASA Presidential Budget Request**
  - Launch/operate “a fleet of [scientific] spacecraft” to “gather information” for researchers *SUM-4*
  - Operate the ISS with “an emphasis on research and technology” to enable “NASA’s plans for long-duration human space flight beyond low Earth orbit” *SUM-2 & 5*
  - Continue developing “an MPCV capable of taking human explorers to distant locations” and a “heavy lift vehicle” to “launch the MPCV, other modules, and cargo for these systems” *SUM-6*
- **2011 NASA Strategic Plan Outcomes 1.3 and 4.2**



# NASA “Policy Map” based on the 1958 Space Act

- **Preservation of Preeminent Status**: “Contribute materially” to “the preservation of the role of the United States as a leader in aeronautical and space science and technology” *Sec 102(d)(5) & (9)*
- **2010 National Space Policy**
  - “Lead in the enhancement of security, stability, and responsible behavior in space” *Page 6*
  - “Demonstrate U.S. leadership in space” *Page 6*
- **2006 National Aeronautics Policy**
  - “Provide a robust foundation for the advancement of U.S. technological leadership in aeronautics,” “maintain and advance world-class U.S. experimental and computational R&D capabilities,” and preserve “the intellectual stewardship and mastery of aeronautics core competencies so that the nation’s world-class aeronautics expertise is retained” *Page 8 & 12*
- **Fiscal Year 2012 NASA Presidential Budget Request**
  - Continue to “lead improvements in aviation, including safety, air traffic capacity, optimized flight procedures and aircraft design” *SUM-4*
  - “Lead the Nation’s current and future human space exploration efforts” *SUM-5*
- **2011 NASA Strategic Plan**
  - Outcome 3.2: “Infuse game-changing and crosscutting technologies throughout the Nation’s space enterprise to transform the Nation’s space mission capabilities.”



# NASA “Policy Map” based on the 1958 Space Act

- **Research & Development**: Arrange for the “widest practicable and appropriate participation” “by the scientific and engineering community.. in planning and carrying out appropriate research, in developing necessary technology and in making necessary observations and measurements,” including “the Nation's industrial organizations and institutions of higher education” **Sec 203 (a)(2), Sec 403 (b)(1) & (2)**
- **2010 National Space Policy**
  - “Implement a new space technology development and test program, working with industry, academia, and international partners to build, fly, and test several key technologies” *Page 11*
- **2006 National Aeronautics Policy**
  - “Engage industry, academia, and other non-Federal stakeholders in support of government planning and performance of aeronautics R&D,” including “strengthen mechanisms to engage partners in industry and academia,” and draw on the expertise of industry *Page 8, 10, 15*
- **2010 NASA Authorization Act**
  - “Aeronautics research should be guided by, and consistent with, the National Aeronautics R&D Policy” *Sec 901(2)*
- **Fiscal Year 2012 NASA Presidential Budget Request**
  - “Support the research interests of other Federal agencies, private, and academic organizations” via the U.S. National Laboratory aboard the ISS *SUM-5*
- **2011 NASA Strategic Plan**
  - Outcome 1.1: Sustain the operation and full use of the International Space Station (ISS) and expand efforts to utilize the ISS as a National Laboratory for scientific, technological, diplomatic, and educational purposes and for supporting future objectives in human space exploration.
  - Outcome 3.1: Sponsor early-stage innovation in space technologies in order to improve the future capabilities of NASA, other government agencies, and the aerospace industry.





# NASA “Policy Map” based on the 1958 Space Act

- **Cooperation with Other Nations**: Cooperate with “other nations and groups of nations in work done pursuant to this Act and in the peaceful application of the results thereof” *Sec 102(d)(7), Sec 205*
- **2010 National Space Policy**
  - “Improve partner-ships through cooperation, collaboration, information sharing, and/or alignment of common pursuits” *Page 6*
  - “Identify potential areas for international cooperation” and “pursue bilateral and multilateral transparency and confidence-building measures” *Page 7*
  - “Leverage existing and planned space capabilities of allies and space partners” *Page 7*
- **2010 NASA Authorization Act**
  - “Expand permanent human presence beyond low-Earth orbit and, where practical, in a manner involving international partners” *Sec 202(a)*
  - Provide “a framework that allows partnering, leveraging and stimulations” of “existing and emerging international efforts” *Sec 2(11)*
- **Fiscal Year 2012 NASA Presidential Budget Request**
  - “Collaborate with other nations” to “strengthen competition and drive innovation” *SUM-2*
  - Continue operation of the ISS with international partners *SUM-5 & 6*
  - “Promote appropriate cost- and risk-sharing” among international partners *Page 7*
- **2011 NASA Strategic Plan**
  - Overarching Strategy: “Expanding partnerships with international, intergovernmental, academic, industrial, and entrepreneurial communities and recognizing their role as important contributors of skill and creativity to our missions and for the propagation of our results”



# NASA “Policy Map” based on the 1958 Space Act

- **Near-Earth Asteroids and Comets:** Direct NASA's “unique competence” “to detecting, tracking, cataloging and characterizing near-Earth asteroids and comets in order to provide warning and mitigation of the potential hazard of such near-Earth objects to the Earth” *Sec 102(g)*
- **2010 National Space Policy**
  - “Pursue R&D of technologies and techniques.. to mitigate and remove on-orbit debris, reduce hazards, and increase understanding of the current and future debris environment” *Page 7*
  - “In cooperation with other departments, agencies, and commercial part-ners,” “pursue capabilities to detect, track, catalog, and characterize near-Earth objects” *Page 12*
- **2010 NASA Authorization Act**
  - “Continue and strengthen discussions with..other space-faring countries..to deal with this orbital debris mitigation” *Sec 1202(b)(1)*
- **Fiscal Year 2012 NASA Presidential Budget Request**
  - The *Near Earth Object Observations (NEOO)* project detects and tracks at least 90 percent of the near Earth objects (NEOs), asteroids, and comets that come within 1.3 astronomical units of the Sun
  - Collect, archive, and analyze the small body data collected by NASA’s WISE mission, and support increased follow-up and analysis of this data;
  - Enable collection of NEO detection and characterization data by ground-based systems, including the U.S. Air Force's (USAF) Panoramic Survey Telescope and Rapid Reporting System (Pan-STARRS) and investigate the use of other USAF space surveillance assets for this mission;
  - Support the continued operation of planetary radar capabilities at the NSF's Arecibo and NASA's Goldstone facilities;
  - and Investigate both ground and space-based concepts for increasing capacity to detect, track and characterize potentially hazardous objects down to sizes 140 meters and below.
- **2011 NASA Strategic Plan**
  - Objective 2.3.5: Identify and characterize small bodies and the properties of planetary environments that pose a threat to terrestrial life or exploration or provide potentially exploitable resources



# NASA “Policy Map” based on the 1958 Space Act

- **Green Energy & Environment**: Direct NASA's “unique competence in scientific and engineering systems” toward “ground propulsion systems research and development,” which shall contribute to “developing energy and petroleum-conserving ground propulsion systems, and of minimizing the environmental degradation caused by such systems” *Sec 102(e)*
- **2010 National Space Policy**
  - “Conduct a program to enhance U.S. global climate change research and sustained monitoring capabilities” and “use international partnerships to help sustain and enhance weather, climate, ocean, and coastal observation from space” *Page 12*
- **2010 NASA Authorization Act**
  - “Consider and pursue concepts which reduce noise, emissions, and fuel consumption” and “pursue research related to alternative fuels” *Sec 902 (2)*
- **Fiscal Year 2012 NASA Presidential Budget Request**
  - Conduct aeronautics research to make “aviation more environmentally responsible” through “strategies and designs that reduce fuel consumption, air pollution, and noise” *SUM-4*
  - “Enter into innovative partnerships with utility companies to provide clean energy to NASA Centers and the communities that surround them” *SUM-7*
- **2011 NASA Strategic Plan**
  - Outcome 2.1: Advance Earth system science to meet the challenges of climate and environmental change.
  - Objective 2.1.1: Improve understanding of and improve the predictive capability for changes in the ozone layer, climate forcing, and air quality associated with changes in atmospheric composition.



# NASA “Policy Map” based on the 1958 Space Act

- **Dissemination of Information**: “Provide for the widest practicable and appropriate dissemination of information concerning [NASA’s] activities and the results thereof” *Sec 102(d)(6), Sec 203 (a)(3), Sec 403(b)(3)*
- **2010 National Space Policy**
  - Improve partnerships “through cooperation, collaboration, information sharing, and/or alignment of common pursuits” *Page 6*
  - Promote the adoption of international policies that “facilitate full, open, and timely access to government environmental data” *Page 6*
- **2006 National Aeronautics Policy**
  - “Provide for the widest practical and appropriate dissemination of research results” *Page 8*
  - Improve the “dissemination of R&D results and lowering barriers that would prevent technology transition from R&D to applications” *Page 15*
- **Fiscal Year 2012 NASA Presidential Budget Request**
  - “Gather information to help researchers” *SUM-4*
  - Share NASA’s “challenges, results, and successes” with the public *SUM-7*
- **2011 NASA Strategic Plan**
  - Strategic Goal 6: “Share NASA with the public, educators, and students to provide opportunities to participate in our Mission, foster innovation, and contribute to a strong national economy.”
  - Outcome 6.1: “Improve retention of students in STEM disciplines by providing opportunities and activities along the full length of the education pipeline.”
  - Outcome 6.4: “Inform, engage, and inspire the public by sharing NASA’s missions, challenges, and results.”



# NASA “Policy Map” based on the 1958 Space Act

- **Efficient Use of Resources**: Utilize the “most effective” “scientific and engineering resources of the U.S...in order to avoid unnecessary duplication of effort, facilities, and equipment,” including “close cooperation among all interested agencies of the U.S.” *Sec 102(d)(8)*
- **2010 National Space Policy**
  - “Enhance operational efficiency, increase capacity, and reduce launch costs” *Page 5*
  - “Conduct basic and applied research that increases capabilities and decreases costs” *Page 5*
  - “Improve management” to “reduce programmatic risk” and “cost-effective opportunities” *Page 6*
- **2006 National Aeronautics Policy**
  - Develop an “infrastructure plan” and “cost and usage polities” in order to “maximize the effectiveness of government R&D resources” *Page 8, 14, 15*
- **2010 NASA Authorization Act**
  - “Rescope [or]down-size to fit current and future missions and expected funding levels” *Sec 1101*
- **Fiscal Year 2012 NASA Presidential Budget Request**
  - Increase Agency “accountability and transparency, “implement energy saving initiatives,” “consolidate activities” and “streamline operations” *SUM-3 & 7*
  - Increase revenue, job growth and consumer confidence while decreasing operating costs via the enhanced capacity of the “NextGen” air transportation system *SUM-5*
  - Provide technological advances that “lower costs and improve capabilities of other government agencies and commercial space activities” *SUM-5*
  - Continue “transitioning key workforce, technology, facilities, and operational expertise to a new generation of human space flight and exploration activities” *SUM-6*
- **2011 NASA Strategic Plan**
  - Outcome 3.3: “Develop and demonstrate the critical technologies that will make NASA’s exploration, science, and discovery missions more affordable and more capable.”
  - Outcome 5.2: “Ensure vital assets are ready, available, and appropriately sized to conduct NASA’s missions.”



**America's Future in Space : Aligning the Civil Space Program with National Needs**

**“As civil space policies and programs have evolved, the geopolitical environment has changed dramatically. Although the U.S. space program was originally driven in large part by competition with the Soviet Union, the nation now finds itself in a post-Cold War world in which many nations have established, or are aspiring to develop, independent space capabilities. Furthermore discoveries from developments in the first 50 years of the space age have led to an explosion of scientific and engineering knowledge and practical applications of space technology. The private sector has also been developing, fielding, and expanding the commercial use of space-based technology and systems.**

**Recognizing the new national and international context for space activities, America's Future in Space is meant to advise the nation on key goals and critical issues in 21st century U.S. civil space policy”**



## Committee on the Rationale and Goals of the U.S. Civil Space Program; National Research Council (2009)

### Goals for the Civil Space Program:

- ***To reestablish leadership for the protection of Earth and its inhabitants through the use of space research and technology.*** The key global perspective enabled by space observations is critical to monitoring climate change and testing climate models, managing Earth resources, and mitigating risks associated with natural phenomena such as severe weather and asteroids.
- ***To sustain U.S. leadership in science by seeking knowledge of the universe and searching for life beyond Earth.*** Space offers a multitude of critical opportunities, unavailable in Earth-based laboratories, to extend our knowledge of the local and distant universe and to search for life beyond Earth.
- ***To expand the frontiers of human activities in space.*** Human spaceflight continues to challenge technology, utilize unique human capabilities, bring global prestige, and excite the public's imagination. Space provides almost limitless opportunities for extending the human experience to new frontiers.
- ***To provide technological, economic, and societal benefits that contribute solutions to the nation's most pressing problems.*** Space activities provide economic opportunities, stimulate innovation, and support services that improve the quality of life. U.S. economic competitiveness is directly affected by our ability to perform in this sector and the many sectors enabled and supported by space activities.
- ***To inspire current and future generations.*** U.S. civil space activities, built on a legacy of spectacular achievements, should continue to inspire the public and also serve to attract future generations of scientists and engineers.
- ***To enhance U.S. global strategic leadership through leadership in civil space activities.*** Because of the growing strategic importance of space, all nations that aspire to global political and economic leadership in the 21st century are increasing their space-faring capabilities. Continued U.S. global leadership is tied to continued U.S. leadership in space.



# 2011 NASA Strategic Plan

## **Vision**

To reach for new heights and reveal the unknown, so that what we do and learn will benefit all humankind

## **Mission**

Drive advances in science, technology, and exploration to enhance knowledge, education, innovation, economic vitality, and stewardship of Earth.

## **NASA Strategic Plan Goals**

1. Extend and sustain human activities across the solar system.
2. Expand scientific understanding of the Earth and the universe in which we live.
3. Create the innovative new space technologies for our exploration, science, and economic future.
4. Advance aeronautics research for societal benefit
5. Enable program and institutional capabilities to conduct NASA's aeronautics and space activities.
6. Share NASA with the public, educators, and students to provide opportunities to participate in our Mission, foster innovation, and contribute to a strong national economy





# Consistent Strategic Direction

	N'l Aero & Space Act of 1958	National Space Policy, 2010	2010 NASA Authorization Act	NASA Strategic Plan
Peaceful purposes/benefit to humankind	X	X	X	X
Welfare and security of the U.S.	X	X	X	X
Encourage the (fullest) commercial use of space, industrial base	X	X	X	X
Expand knowledge of Earth and Space	X	X	X	X
Maintain U.S. preeminence through research and technology	X	X	X	X
Improve U.S. competitiveness/advance economic benefits	X	X	X	X
Expand human presence into space		X	X	X
Warning and Mitigation of Potential Hazards of NEOs	X	X	X	X
Earth Observations/Global climate research	X	X	X	X
Cooperate with other nations	X	X	X	X
Communicate benefits /inspiration to public/STEM education	X	X	X	X