

CRS Report for Congress

U.S. Civilian Space Policy Priorities: Reflections 50 Years After Sputnik

December 3, 2007

Deborah D. Stine
Specialist in Science and Technology Policy
Resources, Science, and Industry Division



Prepared for Members and
Committees of Congress

U.S. Civilian Space Policy Priorities: Reflections 50 Years After Sputnik

Summary

The “space age” began on October 4, 1957, when the Soviet Union (USSR) launched Sputnik, the world’s first artificial satellite. Some U.S. policymakers, concerned about the USSR’s ability to launch a satellite, thought Sputnik might be an indication that the United States was trailing behind the USSR in science and technology. The Cold War also led some U.S. policymakers to perceive the Sputnik launch as a possible precursor to nuclear attack. In response to this “Sputnik moment,” the U.S. government undertook several policy actions, including the establishment of the National Aeronautics and Space Administration (NASA) and the Defense Advanced Research Projects Agency (DARPA), enhancement of research funding, and reformation of science, technology, engineering and mathematics (STEM) education policy.

Following the “Sputnik moment,” a set of fundamental factors gave “importance, urgency, and inevitability to the advancement of space technology,” according to an Eisenhower presidential committee. These four factors include the compelling need to explore and discover; national defense; prestige and confidence in the U.S. scientific, technological, industrial, and military systems; and scientific observation and experimentation to add to our knowledge and understanding of the Earth, solar system, and universe. They are still part of current policy discussions and influence the nation’s civilian space policy priorities — both in terms of what actions NASA is authorized to undertake and the appropriations each activity within NASA receives. NASA has active programs that address all four factors, but many believe that it is being asked to accomplish too much for the available resources.

Further, the United States faces a far different world today. No Sputnik moment, Cold War, or space race exists to help policymakers clarify the goals of the nation’s civilian space program. The Hubble telescope, *Challenger* and *Columbia* space shuttle disasters, and Mars exploration rovers frame the experience of current generations, in contrast to the Sputnik launch and the U.S. Moon landings that form the experience of older generations. As a result, some experts have called for new 21st century space policy objectives and priorities to replace those developed 50 years ago.

The authorization of NASA funding in the National Aeronautics and Space Act of 2005 (P.L. 109-55) extends through FY2008. Congress may decide to maintain or shift NASA’s priorities during the next reauthorization. For example, if Congress believes that national prestige should be the highest priority, they may choose to emphasize NASA’s human exploration activities, such as establishing a Moon base and landing a human on Mars. If they consider scientific knowledge the highest priority, unmanned missions and other science-related activities may be Congress’ major goal for NASA. If international relations are a high priority, Congress might encourage other nations to become equal partners in NASA’s activities. If spinoff effects, such as the creation of new jobs and markets and its effect on STEM education are Congress’ priorities, then technological development, linking to the needs of business and industry, and education may become NASA’s primary goals.

Contents

Sputnik and America’s “Sputnik Moment”	2
Why Was Sputnik So Influential?	5
Why Is Sputnik Important to Today’s Policies?	6
What Are the Activities of Other Nations and the Commercial Sector in Space Exploration?	6
What Is the Nation’s Current Civilian Space Policy?	8
Why Invest in Space Exploration?	11
What Is the Public’s Attitude Toward Space Exploration?	15
What Are the Nation’s Priorities for Civilian Space Exploration and Its Implications for Future Space Policy?	17

List of Figures

Figure 1. Sputnik	2
Figure 2. Timeline of Select Policy Events in the Year Following the Sputnik Launch	4
Figure 3. Global Space Economy Revenues, 2005	13

List of Tables

Table 1. NASA Centers	14
Appendix Table: Possible U.S. Civilian Space Policy Objectives: Comparison of Selected Extracts from Historical and Current Space Policy Documents	20

U.S. Civilian Space Policy Priorities: Reflections 50 Years After Sputnik

Current U.S. space policy is based on a set of fundamental factors which, according to an Eisenhower presidential committee, “give importance, urgency, and inevitability to the advancement of space technology.”¹ These factors were developed fifty years ago as a direct result of the Soviet Union’s (USSR) launch of the first artificial satellite, Sputnik. This launch began the “space age” and a “space race” between the United States and USSR.

The four factors are the compelling need to explore and discover; national defense; prestige and confidence in the U.S. scientific, technological, industrial, and military systems; and scientific observation and experimentation to add to our knowledge and understanding of the Earth, solar system, and universe.² They are still part of current policy discussions and influence the nation’s civilian space policy priorities — both in terms of what actions NASA is authorized to undertake and the appropriations each activity within NASA receives.

NASA has active programs that address all four factors, but many believe that it is being asked to accomplish too much for the available resources. An understanding of how policy decisions made during the Sputnik era influence U.S. space policy today may be useful as Congress considers changing that policy. The response of Congress to the fundamental question, “Why go to space?,” may influence NASA’s programs, such as its earth-observing satellites, human exploration of the Moon and Mars, and robotic investigation of the solar system and wider universe as well as its policies on related activities, including spinoff technological development, science and mathematics education, international relations, and commercial space transportation.

This report describes Sputnik and its influence on today’s U.S. civilian space policy, the actions other nations and commercial organizations are taking in space exploration, and why the nation invests in space exploration and the public’s attitude toward it. The report concludes with a discussion of possible options for future U.S. civilian space policy priorities and the implication of those priorities.

¹ U.S. President (Dwight D. Eisenhower), President’s Science Advisory Committee, *Introduction to Outer Space*, March 26, 1958. p. 1, at [<http://www.hq.nasa.gov/office/pao/History/monograph10/doc6.pdf>].

² *Ibid.*, pp. 1-2.

Sputnik and America’s “Sputnik Moment”

On October 4, 1957, the USSR launched Sputnik, the world’s first artificial satellite. Sputnik (Russian for “traveling companion”) was the size of a basketball and weighed 183 pounds (see **Figure 1**). Sputnik’s launch and orbit³ still influences policy decisions 50 years later.

The USSR’s ability to launch a satellite ahead of the United States led to a national concern that the United States was falling behind the USSR in its science and technology capabilities and thus might be vulnerable to a nuclear missile attack.⁴ The resulting competition for scientific and technological superiority came to represent a competition between capitalism and communism.

Figure 1. Sputnik



Source: NASA, at [<http://history.nasa.gov/sputnik/galleryspu.html>].

Both the 85th Congress and President Eisenhower undertook an immediate set of policy actions in response to the launch of Sputnik. Congress established the Senate Special Committee on Space and Astronautics on February 6, 1958, and the House Select Committee on Science and Astronautics on March 5, 1958 — the first time since 1892 that both the House and Senate took action to create standing committees on an entirely new subject. Each committee was chaired by the Majority

³ Sputnik 1 orbited the Earth every 96 minutes until it fell from orbit on January 4, 1958, three months after its launch. Roger D. Launius, “Sputnik and the Origins of the Space Age,” at [<http://history.nasa.gov/sputnik/sputorig.html>].

⁴ Dwight D. Eisenhower Presidential Center, “Sputnik and the Space Race,” at [<http://www.eisenhower.utexas.edu/dl/Sputnik/Sputnikdocuments.html>].

Leader. The Preparedness Investigating Subcommittee of the Senate Armed Services Committee was also active in analyzing the nation's satellite and missile programs.⁵

Multiple congressional hearings were held in the three months following Sputnik, and President Eisenhower addressed the nation to assure the public that the United States was scientifically strong and able to compete in space. Within 10 months after Sputnik's launch, the Eisenhower Administration and Congress took actions that

- established the National Aeronautics and Space Administration (NASA) through the National Aeronautics and Space Act (P.L. 85-568),⁶
- established the Defense Advanced Research Projects Agency (DARPA) within the Department of Defense through DOD Directive 5105.15 and National Security - Military Installations and Facilities (P.L. 85-325),⁷
- increased its appropriation for the National Science Foundation to \$134 million, nearly \$100 million higher than the previous year,⁸ and
- reformed elementary, secondary, and postsecondary science and mathematics education (including gifted education) and provided incentives for American students to pursue science, technology, engineering, and mathematics postsecondary degrees via fellowships and loans through the National Defense Education Act (P.L. 85-864).⁹

⁵ U.S. Congress, House Committee on Science and Technology, *Toward the Endless Frontier: History of the Committee on Science and Technology, 1959-79*, prepared for the Committee by Ken Hechler, committee print, 96th Cong., 2nd sess., H.Prt. 35-120, (Washington: GPO, 1980), pp. 1-28.

⁶ P.L. 85-568, The National Aeronautics and Space Act ("Space Act"), July 29, 1958, at [http://www.nasa.gov/offices/ogc/about/space_act1.html].

⁷ DARPA was originally called the Advanced Research Projects Agency (ARPA). It was established by DOD Directive 5105.15 on February 7, 1958, and by Congress in P. L. 85-325 on February 12, 1958. The name was changed from ARPA to DARPA by DoD Directive on March 23, 1972. DARPA was redesignated ARPA by President Bill Clinton in an Administration document on February 22, 1993. ARPA's name was changed back to DARPA by P.L. 104-106 on February 10, 1996. For more information about DARPA and its history, see DARPA, "Defense Advanced Research Project Agency: Technology Transition," January 1997 at [<http://www.darpa.mil/body/pdf/transition.pdf>].

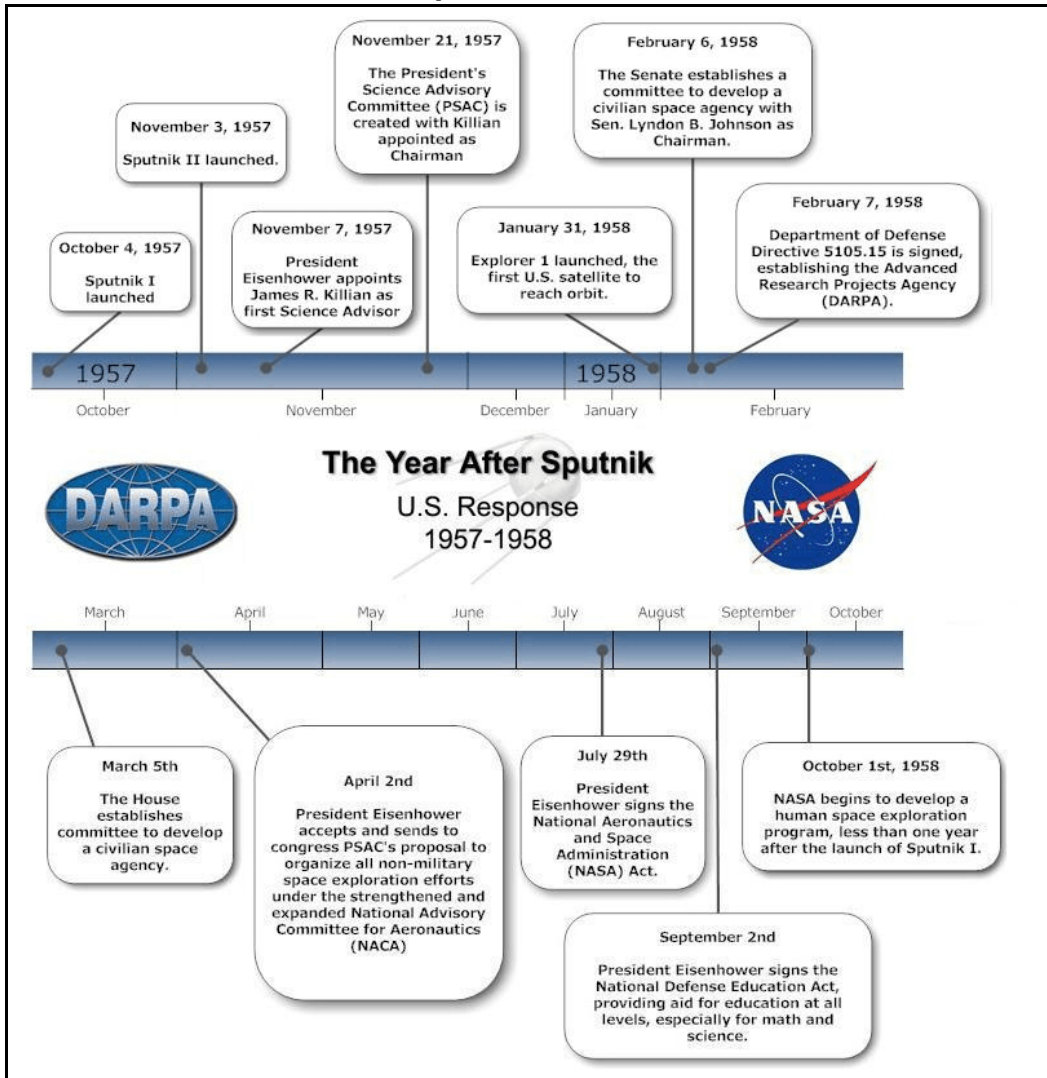
⁸ The appropriation for NSF continued to increase in future years. In 1968, it was almost \$500 million. National Science Foundation, *An Overview of the First 50 years*, at [<http://www.nsf.gov/about/history/overview-50.jsp>].

⁹ P.L. 85-864, National Defense Education Act (NDEA), September 2, 1958.

Figure 2 provides a timeline of the some of the major policy events in the year following the Sputnik launch.

When people today speak of a “Sputnik moment,” they often refer to a rapid national response that quickly mobilizes major policy change as opposed to a response of inaction or incremental policy change. The term is also used to question inaction — as in whether or not the nation is prepared to respond to a challenge without an initiating Sputnik moment.

Figure 2. Timeline of Select Policy Events in the Year Following the Sputnik Launch



Source: Association of American Universities, at [http://www.aau.edu/education/Sputnik_Timeline_2007-09-20.pdf].

Notes: DARPA was also established by Congress in P.L. 85-325.

Why Was Sputnik So Influential?

The Sputnik launch captured the public's attention at a time of heightened U.S. tension regarding the threat posed by the USSR and communism. Societal focus on civil defense, including "duck and cover" drills and the establishment of some personal bomb shelters, predisposed the nation towards identifying the potential threat posed by the Sputnik launch.¹⁰ In this climate, many Americans became concerned that if the USSR could launch a satellite into space, it could also launch a nuclear missile capable of reaching the United States.¹¹

The Sputnik launch was immediately viewed as a challenge to U.S. scientific and technological prowess. The Soviet Union launched both Sputnik and Sputnik 2 before the United States was able to attempt a satellite launch.¹² Additionally, the Soviet launch was of a far heavier satellite than the U.S. had planned.¹³ The net result of the Sputnik launch was called a "Pearl Harbor for American Science" — a sign that the United States was falling behind the USSR in science and technology.¹⁴ The ensuing competition in scientific and technological skills came to represent a competition to determine the political superiority of capitalism versus communism.

The Senate Majority Leader at the time, future President Lyndon B. Johnson, illustrated the concern of many Americans in his own observations of the night sky: "Now, somehow, in some new way, the sky seemed almost alien. I also remember the profound shock of realizing that it might be possible for another nation to achieve technological superiority over this great country of ours."¹⁵

¹⁰ Dwight D. Eisenhower Presidential Center, "Sputnik and the Space Race," at [<http://www.eisenhower.utexas.edu/dl/Sputnik/Sputnikdocuments.html>].

¹¹ Council on Foreign Relations, Chronology of National Missile Defense Programs, June 1, 2002, at [<http://www.cfr.org/publication/10443/>].

¹² The Project Vanguard booster tests on December 6, 1957 (rose 3 feet, caught fire) and February 5, 1958 (rose 4 miles, exploded) were unsuccessful. A new effort, Project Explorer led by Wernher von Braun, was initiated. Explorer 1 was successful, after two aborted launches, on January 31, 1958. Roger D. Launius, "Sputnik and the Origins of the Space Age," at [<http://history.nasa.gov/sputnik/sputorig.html>].

¹³ Sputnik 1 weighed 183 pounds. Sputnik 2 launched on November 3, 1957 weighed 1,120 pounds, carried a dog, and stayed in orbit for almost 200 days. The first satellite to be launched in the American Project Vanguard was planned to be 3.5 pounds. Roger D. Launius, "Sputnik and the Origins of the Space Age," at [<http://history.nasa.gov/sputnik/sputorig.html>].

¹⁴ Davis, James C., *The Human Story: Our History, From the Stone Age to Today* (New York: Harper Collins, 2004). According to Davis, the statement was made by a Japanese newspaper shortly after the event. Others called it a "technological Pearl Harbor."

¹⁵ Roger D. Launius, "Sputnik and the Origins of the Space Age," at [<http://history.nasa.gov/sputnik/sputorig.html>].

Why Is Sputnik Important to Today's Policies?

The Sputnik launch prompted rapid development of new federal policies and programs. In particular, federal investment in NASA is still influenced by the Sputnik-era principles as illustrated in the Space Act, both in terms of what actions NASA is authorized to undertake and the extent to which each activity is funded.

In 2005, NASA was reauthorized for FY2007 and FY2008.¹⁶ As Congress considers future reauthorization of NASA and the agency's 50th anniversary in 2008, the status of the nation's space policy, and the relative importance of the various objectives underlying this policy may become topics of debate.

The United States faces a far different world today than 50 years ago. No Sputnik moment, Cold War, or space race exists to help policymakers clarify the goals of the nation's civilian space program. The Hubble telescope, *Challenger* and *Columbia* space shuttle disasters, and Mars exploration rovers frame the experience of current generations, in contrast to the Sputnik launch and the U.S. Moon landings that form the experience of older generations.

What Are the Activities of Other Nations and the Commercial Sector in Space Exploration?

The United States faces a possible new set of competitors or collaborators in civilian space exploration. China, India, Japan, Russia, and Europe are taking an active role in space exploration as are commercial companies.¹⁷ Japan's Moon orbiter was launched on September 14, 2007, and arrived at the Moon on October 4, 2007, the 50th anniversary of Sputnik. China's Moon orbiter was launched on October 24, 2007 and entered lunar orbit on November 5, 2007. India and the United States also plan to launch vehicles into the Moon's orbit by the end of 2008. The European Space Agency (ESA) is studying a Moon-lander mission, but its major focus is on Mars. The United Kingdom and Germany are independently proposing national Moon-orbiter projects, but their governments have not yet funded or approved these activities.¹⁸

¹⁶ NASA Authorization Act of 2005 (P.L. 109-155).

¹⁷ Peter Spotts, "Many Contestants in Latest 'Space Race' to the Moon," *Christian Science Monitor*, October 1, 2007.

¹⁸ Frank Moring, Jr., Michael A. Taverna and Neelam Mathew, "Nations Looking For a Piece of the Exploration Pie," *Aviation Week and Space Technology*, September 30, 2007, at [http://www.aviationweek.com/aw/generic/story_channel.jsp?channel=space&id=news/aw100107p2.xml&headline=Nations%20Looking%20For%20a%20Piece%20of%20the%20Exploration%20Pie].

China became the third country to send people into space, after the USSR¹⁹ and the United States, completing two human spaceflight missions in 2003 and 2005.²⁰ Press reports indicate that China plans a manned Moon landing leading up to establishment of a Moon base after 2020,²¹ though some have questioned these reports.²² NASA Administrator Michael Griffin contends that China is likely to be the first country to land a human on the Moon since the last U.S. landing in 1972.²³ China has also indicated plans for a joint mission with Russia to send a satellite to orbit Mars in 2009.²⁴

In the commercial sector, the X-Prize Foundation announced on September 13, 2007, the Google Lunar X Prize (\$30 million) that invites private teams from around the world to build a robotic rover capable of landing on the Moon.²⁵ Virgin Galactic, currently based in California with a spaceport under construction in New Mexico, has plans for SpaceShipTwo, a six-passenger spaceliner with test flights scheduled for 2007 and suborbital passenger services to follow in 2008.²⁶ In Europe, EADS-Astrium is developing a four-person spacecraft to make suborbital trips with possibly the first commercial flight in 2012.²⁷ According to press reports, a number

¹⁹ Since the fall of the USSR, Russia is the only former-USSR country to conduct space missions.

²⁰ See CRS Report RS21641, *China's Space Program: An Overview*, by Marcia S. Smith.

²¹ *Agence France-Presse*, "China Aims for Lunar Base after 2020," September 26, 2007, at [http://news.yahoo.com/s/afp/20070926/wl_asia_afp/spacechinamoon_070926154203]. Paul Maidmen, "China Shoots for the Moon," *Forbes*, August 14, 2007, at [http://www.forbes.com/opinions/2007/08/14/notn-china-aerospace-oped-cx_pm_0814notn.html].

²² Dwayne Day, "Exploding Moon Myths: Or Why There's No Race to Our Nearest Neighbor," *The Space Review*, November 12, 2007, at [<http://www.thespacereview.com/article/999/1>].

²³ U.S. Congress, House Committee on Science and Technology, *NASA Fiscal Year 2008 Budget Request*, hearing, 110th Cong., 1st sess., March 15, 2007, H.Rept. 110-12, (Washington: GPO, 2007), p. 48. Michael D. Griffin, "The Role of Space Exploration in the Global Economy," speech, September 17, 2007, p. 41 at [http://www.nasa.gov/audience/formedia/speeches/mg_speech_collection_archive_1.html].

²⁴ "China and Russia Join Hands to Explore Mars," *People's Daily Online*, May 30, 2007, at [http://english.people.com.cn/200705/30/eng20070530_379330.html].

²⁵ X-prize Foundation, "Google Sponsors Lunar X PRIZE to Create a Space Race for a New Generation," press release, September 13, 2007, at [<http://www.xprize.org/lunar/press-release/google-sponsors-lunar-x-prize-to-create-a-space-race-for-a-new-generation>].

²⁶ Virgin Galactic, Overview, at [<http://www.virgingalactic.com/>]. NASA has signed a memorandum of understanding with Virgin Galactic to explore the potential for collaborations on the development of space suits, heat shields for spaceships, hybrid rocket motors, and hypersonic vehicles capable of traveling five or more times the speed of sound. See NASA, "NASA, Virgin Galactic to Explore Future Cooperation," press release, February 21, 2007, at [http://www.nasa.gov/home/hqnews/2007/feb/HQ_07049_Virgin_Galactic.html].

²⁷ EADS-Astrium, "Astrium Rockets into Space Tourism," press release, June 13, 2007, at (continued...)

of venture capitalists are also planning to build spaceships or develop private space programs.²⁸

If China is the first to land humans on the Moon and establish a Moon base in the 21st century or the European Space Agency is the first to land humans on Mars, will policymakers and the public view these activities as a loss in United States status and leadership? If so, what are the policy implications? Would such activities become this century's "Sputnik moment" that would spur further investment in U.S. space exploration activities? If not, how might this affect U.S. space policy priorities?

What Is the Nation's Current Civilian Space Policy?

On August 31, 2006, President Bush announced a new U.S. National Space Policy.²⁹ The space policy defined the key objectives of defense and civilian space policy. The new space policy incorporated key elements of the Vision for Space Exploration ("Vision"), often referred to as the Moon/Mars program, previously announced on January 14, 2004.

In the Vision, President Bush announced new goals for NASA.³⁰ The President directed NASA to focus its efforts on returning humans to the Moon by 2020 and eventually sending them to Mars and "worlds beyond."³¹ The President further directed NASA to fulfill commitments made to the 13 countries that are its partners in the International Space Station (ISS). In the 2005 NASA authorization act (P.L. 109-155), Congress directed NASA to establish a program to accomplish the goals outlined in the Vision, which are that the United States

- 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;

²⁷ (...continued)

[<http://www.astrium.eads.net/press-center/press-releases/astrium-rockets-into-space-tourism>].

²⁸ Jeremy Quittner (ed.), "I Need My Space," *Business Week*, Winter 2007, at [http://www.businessweek.com/magazine/content/07_09/b4023413.htm].

²⁹ U.S. President (G.W. Bush), *U.S. National Space Policy*, August 31, 2006, at [<http://www.ostp.gov/html/US%20National%20Space%20Policy.pdf>]. It replaced the previous space policy that had been in place for 10 years.

³⁰ U.S. President (G.W. Bush), *President Bush Announces New Vision for Space Exploration Program, Fact Sheet: A Renewed Spirit of Discovery*, January 14, 2004, at [<http://www.whitehouse.gov/news/releases/2004/01/20040114-1.html>].

³¹ Twelve U.S. astronauts walked on the Moon between 1969 and 1972. No humans have visited Mars.

- 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.³²

More specifically, the Vision includes plans, via a strategy based on “long-term affordability,” to

- return the Space Shuttle safely to flight (which has been accomplished),
- complete the International Space Station (ISS) by 2010 but discontinue its use by 2017,
- phase out the Space Shuttle when the ISS is complete by 2010,
- send a robotic orbiter and lander to the Moon,
- send a human expedition to the Moon (sometime between 2015-2020),
- send a robotic mission to Mars in preparation for a future human expedition, and
- conduct robotic exploration across the solar system.³³

NASA is developing a new spacecraft called Orion (formerly the Crew Exploration Vehicle) and a new launch vehicle for it called Ares I (formerly the Crew Launch Vehicle). An Earth-orbit capability is planned by 2014 (although NASA now considers early 2015 more likely) with the ability to take astronauts to and from the Moon following no later than 2020.

The Vision has broad implications for NASA, especially since almost all the funds to implement the initiative are expected to come from other NASA activities. Among the issues Congress is debating are the balance between NASA’s exploration activities and its other programs, such as science and aeronautics research; the impact of the Vision on NASA’s workforce needs; whether the space shuttle program might be ended in 2010; and if the United States might discontinue using the International Space Station.³⁴

³² U.S. President (G. W. Bush), “A Renewed Spirit of Discovery,” document, January 14, 2004, at [http://www.whitehouse.gov/space/renewed_spirit.html].

³³ NASA, *Vision for Space Exploration*, February 2004, at [http://www.nasa.gov/mission_pages/exploration/main/index.html].

³⁴ CRS Report RS22625, *National Aeronautics and Space Administration: Overview, FY2008 Budget in Brief, and Key Issues for Congress*, by Daniel Morgan and Carl E. Behrens; CRS Report RL33568, *The International Space Station and the Space Shuttle*, by Carl E. Behrens; and CRS Report RS21720, *Space Exploration: Issues Concerning the “Vision for Space Exploration,”* by Marcia S. Smith.

NASA states that its strategy is to “go as we can afford to pay,” with the pace of the program set, in part, by the available funding.³⁵ Affording such a program is challenging, however, with a 2006 National Research Council report finding “NASA is being asked to accomplish too much with too little.” The report recommended that “both the executive and the legislative branches of the federal government need to seriously examine the mismatch between the tasks assigned to NASA and the resources that the agency has been provided to accomplish them and should identify actions that will make the agency’s portfolio of responsibilities sustainable.”³⁶

At a House Committee on Appropriations hearing, Dr. Michael Griffin, NASA’s Administrator, acknowledged that funding is a challenge, stating

Many people are amazed by the things that NASA accomplishes but don’t realize that our budget is only 0.6 percent of the entire federal budget of the United States. As one of the most internationally recognized agencies in the government, many people assume that NASA’s budget is much higher. In reality, we have to make tough choices in the allocation of scarce resources. We just cannot do everything that our many constituencies would like us to do. We need to set carefully considered priorities of time, energy and resources, and for this we’re guided by the NASA Authorization Act of 2005, our annual appropriations, presidential policy, and the decadal surveys of the National Academy of Sciences.³⁷

The House Committee on Appropriations also expressed concerns about these issues, stating NASA “has too many responsibilities and not enough resources to accomplish them all.”³⁸ Similarly, the Senate Committee on Appropriations stated

NASA’s vision for space exploration maps out an aggressive role for the United States in manned space exploration. However, the potential costs are substantial and will likely be very difficult to maintain at the current estimated funding levels. The Committee is concerned that NASA will neglect areas that only tangentially benefit, or do not fit within, the exploration vision. The Committee

³⁵ Testimony of Michael D. Griffin, Administrator, National Aeronautics and Space Administration before the Senate Committee on Commerce, Science and Transportation Subcommittee on Space, Aeronautics and Related Sciences, Budget Hearing, U.S. Senate, February 28, 2007, at [http://commerce.senate.gov/public/_files/Testimony_MichaelDGriffin_NASA_FY2008PostureStatementFINAL22707.pdf].

³⁶ National Research Council, Space Studies Board, *An Assessment of Balance in NASA’s Science Program*, Washington, DC, 2006, p. 2 [http://www.nap.edu/catalog.php?record_id=11644].

³⁷ Testimony of Michael D. Griffin, Administrator, National Aeronautics and Space Administration before the U.S. House of Representatives, Committee on Appropriations, Subcommittee on Commerce, Justice, Science, and Related Agencies, FY2008 Budget Hearing, March 13, 2007, at [<http://www.cq.com/display.do?dockkey=/cqonline/prod/data/docs/html/transcripts/congressional/110/congressionaltranscripts110-000002468892.html@committees&metapub=CQ-CONGTRANSCRIPTS>].

³⁸ U.S. Congress, House Committee on Appropriations, report to accompany H.R. 3093, 110th Cong., 1st sess., July 25, 2007, H.Rept. 110-24, part 1 (Washington: GPO, 2007), p. 109.

believes that NASA must work diligently to balance existing programs and priorities with its plans for the future.³⁹

Why Invest in Space Exploration?

The **Appendix Table** compares The National Aeronautics and Space Act of 1958 as amended (“Space Act”),⁴⁰ the oldest and most recent Presidential commission reports (Killian⁴¹ and Aldridge⁴²), the U.S. National Space Policy⁴³ (“Space Policy”), and comments by members of Congress in the 110th Congress on the issue of why the United States might explore space. The analyses identify the following reasons why the United States might explore space:

- knowledge and understanding,
- discovery,
- economic growth — job creation and new markets,
- national prestige, and
- defense.

Some also include the following reasons:

³⁹ U.S. Congress, Senate Committee on Appropriations, report to accompany S. 1745, 110th Cong., 1st sess., June 29, 2007, S.Rept. 110-24, part 1 (Washington: GPO, 2007), p. 101.

⁴⁰ P.L. 85-568, The National Aeronautics and Space Act, July 29, 1958, at [http://www.nasa.gov/offices/ogc/about/space_act1.html]. Since 1958, the objectives have only had two modifications. The clause, “of the Earth and” was added to the first objective by the National Aeronautics and Space Administration Authorization Act, 1985, P.L. 98-361, § I 10(b), 98 Stat. 422, 426 (July 16, 1984). Objective (9) was added by the National Aeronautics and Space Administration Authorization Act, Fiscal Year 1989, P.L. 100-685, § 214, 102 Stat. 4083, 4093 (November 17, 1988). Objective (9) states the following: “The preservation of the United States’ preeminent position in aeronautics and space through research and technology development related to associated manufacturing processes.”

⁴¹ During the Sputnik era, President Eisenhower’s Science Advisory Committee, chaired by George Killian, (“Killian Commission”) responded to the fundamental question of why the United States might undertake a national space program in its report *Introduction to Outer Space*. (U.S. President (Dwight D. Eisenhower), President’s Science Advisory Committee, *Introduction to Outer Space*, March 26, 1958. p. 2, at [<http://www.hq.nasa.gov/office/pao/History/monograph10/doc6.pdf>]). The President’s Science Advisory Committee is analogous to today’s President’s Council of Advisors on Science and Technology (PCAST).

⁴² U.S. President (George W. Bush), President’s Commission on Implementation of United States Space Exploration Policy, *A Journey to Inspire, Innovate, and Discover*, June 2004. Available at [http://www.nasa.gov/pdf/60736main_M2M_report_small.pdf]. The commission report is named for its chair, Edward C. “Pete” Aldridge, Jr., and called the “Aldridge Commission” report.

⁴³ U.S. President (G.W. Bush), *U.S. National Space Policy*, August 31, 2006, at [<http://www.ostp.gov/html/US%20National%20Space%20Policy.pdf>].

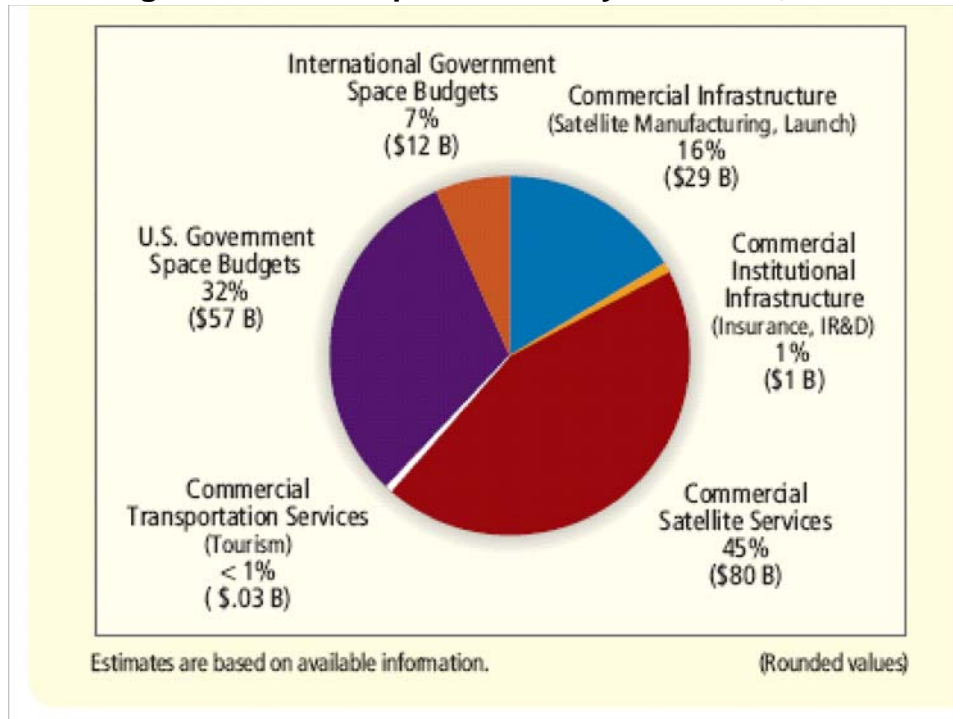
- international relations, and
- education and workforce development.

Although there is broad agreement on the reasons for space exploration, there is a great deal of variation in the details. Among the chief differences in these documents are the degree to which

- discovery is the major reason for space exploration as opposed to meeting needs here on Earth;
- creation of jobs and new markets should be a major focus of NASA activities as opposed to a side effect;
- science and mathematics education and workforce development should be a goal of NASA in addition to other federal agencies; and
- relationships with other countries should be competitive or cooperative regarding space exploration.

According to an analysis conducted by the Space Foundation, the global space industry in 2005 generated \$180 billion in revenues.⁴⁴ (See **Figure 3**.) Comparing the Aldridge Commission themes, the Space Policy goals, and the Space Act objectives on the issue of the relationship of the space program to economic growth provides some insights. While the Aldridge committee has a much broader view of the industries related to space exploration, focusing on the potential role of space exploration in job generation and new market development, the Space Act and Space Policy focus on only one sector, the aeronautical and space vehicle industry.

⁴⁴ Space Foundation, *The Space Report: Guide to Global Space Activities*, 2006, at [<http://www.thespacereport.org/>]. For more on the space economy, see Michael D. Griffin, Administrator, National Aeronautics and Space Administration, *The Space Economy*, NASA 50th Anniversary Lecture Series, September 17, 2007, at [http://www.nasa.gov/audience/formedia/speeches/mg_speech_collection_archive_1.html].

Figure 3. Global Space Economy Revenues, 2005

Source: Space Foundation, *The Space Report: Guide to Global Space Activities*, 2006, at [<http://www.thespacereport.org/>].

The two Presidential commissions have two key differences. One is the first theme outlined in the Sputnik-era Killian Committee report: “the compelling urge of man to explore and discover.” This is quite different from the recent Aldridge Commission report, which, although indicating exploration and discovery should be among NASA goals, states that “exploration and discovery will perhaps *not* be sufficient drivers to sustain what will be a long, and at times risky, journey.” The implication is that, today, solely responding to the challenge of going to the Moon or Mars is not sufficient to energize public support for space exploration.

The second key difference is the focus of the Aldridge Commission on economic growth as a proposed space exploration theme. The Aldridge Commission identifies the ability of investments in civilian space programs to generate new jobs within current industries and spawn new markets. The contribution that federal space investments make to the nation’s economy was not a key factor identified by the Killian Committee.

As a result of its focus on economic growth as a key theme of space exploration, the Aldridge Commission recommended that “NASA’s relationship to the private sector, its organizational structure, business culture, and management processes — all largely inherited from the Apollo era — must be decisively transformed to implement the new, multi-decadal space exploration vision.” Two of its specific recommendations were that NASA recognize and implement a far larger private industry presence in space operations, with the specific goal of allowing private

industry to assume the primary role of providing services to NASA, and that NASA's centers be reconfigured as Federally Funded Research and Development Centers (FFRDCs) to enable innovation, work effectively with the private sector, and stimulate economic development.⁴⁵

FFRDCs are not-for-profit organizations which are financed on a sole-source basis, exclusively or substantially by an agency of the federal government, and not subject to Office of Personnel Management regulations. They operate as private non-profit corporations, although they are subject to certain personnel and budgetary controls imposed by Congress and/or their sponsoring agency. Each FFRDC is administered by either an industrial firm, a university, or a nonprofit institution through a contract with the sponsoring federal agency. FFRDC personnel are not considered federal employees, but rather employees of the organization that manages and operates the center.⁴⁶

Table 1. NASA Centers

Center	Mission Area	Location
Ames Research Center	New Technology Research	Moffett Field, CA
Dryden Flight Research Center	Flight Research	Edwards, CA
Glenn Research Center	Aeropropulsion and Communications Technologies	Cleveland, OH
Goddard Space Flight Center	Earth, the Solar System, and Universe Observations	Greenbelt, MD
Jet Propulsion Laboratory (FFRDC)	Robotic Exploration of the Solar System	Pasadena, CA
Johnson Space Center	Human Space Exploration	Clear Lake, TX, near Houston, TX
Kennedy Space Center	Prepare and Launch Missions Around the Earth and Beyond	Cape Canaveral, FL
Langley Research Center	Aviation and Space Research	Hampton, VA
Marshall Space Flight Center	Space Transportation and Propulsion Technologies	Huntsville, AL
Stennis Space Center	Rocket Propulsion Testing and Remote Sensing Technology	Hancock County, MS, near Slidell, LA

Source: NASA, [<http://education.nasa.gov/about/nasacenters/index.html>]

Note: FFRDC is a federally funded research and development center.

⁴⁵ U.S. President (George W. Bush), President's Commission on Implementation of United States Space Exploration Policy, *A Journey to Inspire, Innovate, and Discovery*, June 2004, p. 7, at [http://www.nasa.gov/pdf/60736main_M2M_report_small.pdf].

⁴⁶ See CRS Report RS21542, *Department of Homeland Security: Issues Concerning the Establishment of Federally Funded Research and Development Centers (FFRDCs)*, by Michael E. Davey.

NASA has not fully adopted the Aldridge Commission recommendations. NASA has 10 centers (see **Table 1**).⁴⁷ One, the Jet Propulsion Laboratory (JPL), is already an FFRDC and is managed by the California Institute of Technology. In 2005 testimony before Congress discussing the involvement of private industry in NASA activities, NASA Administrator Griffin identified a need for continued federal capabilities. In particular, on the issue of private entrepreneurs who believe that they can launch vehicles and put payloads, including human beings, into space at a fraction of what it costs NASA, Griffin stated, “while I am enlisting the entrepreneurial community to step forward and help meet those requirements, we cannot stop work on the, admittedly less efficient, government systems.... [T]hat just doesn’t work.”⁴⁸ Similarly, when asked about whether or not NASA Centers would be converted to FFRDCs, Administrator Griffin stated, “I do not fundamentally see any gain to be achieved by having NASA convert federal centers to FFRDCs.”⁴⁹

What Is the Public’s Attitude Toward Space Exploration?

Some editorialists question whether investing in space exploration is relevant today.⁵⁰ Others question if NASA has the right priorities.⁵¹ Would the public care if the country’s investment in space exploration ended? Does the public believe it would be better to invest in social needs here on Earth rather than space exploration? Does the public support the current prioritization of the nation’s space exploration activities?

According to poll data, Americans do not rank space exploration as a high priority for federal government spending. For example, in an April 10, 2007 Harris poll, respondents were given a list of twelve federal government programs and asked to pick two which should be cut “if spending had to be cut.” Space programs led the list (51%), followed by welfare programs (28%), defense spending (28%), and farm subsidies (24%).⁵² Space exploration was also near the bottom of a University of

⁴⁷ For more information, see [<http://education.nasa.gov/about/nasacenters/index.html>].

⁴⁸ U.S. Congress, House Committee on Science, *Status of NASA’s Programs*, H.Rept. 109-31, 109th Cong., 1st session, November 2, 2005, p. 53 (Washington, GPO, 2005).

⁴⁹ U.S. Congress, House Committee on Science, *The Future of NASA*, H.Rept. 109-19, 109th Cong., 1st session, June 28, 2005, p. 48 (Washington, GPO, 2005).

⁵⁰ See, for example, Anne Applebaum, “Mission to Nowhere,” *Washington Post*, January 7, 2004, p. A21.

⁵¹ See, for example, Gregg Easterbrook, “How NASA Screwed Up (And Four Ways to Fix It),” *Wired*, May 22, 2007, at [http://www.wired.com/science/space/magazine/15-06/ff_space_nasa]; *The Economist*, “Spacemen Are from Mars,” September 27, 2007, at [http://www.economist.com/opinion/displaystory.cfm?story_id=9867224].

⁵² Harris Interactive, “Closing the Budget Deficit: U.S. Adults Strongly Resist Raising Any Taxes Except “Sin Taxes” Or Cutting Major Programs,” press release, April 10, 2007, at [http://www.harrisinteractive.com/harris_poll/index.asp?PID=746]. The poll was of 2,223

(continued...)

Chicago National Opinion Research Center survey reported in January 2007 that asked Americans about how they would prioritize federal spending.⁵³

On the other hand, Americans are interested in space exploration. According to a Zogby poll reported in May 2007, most Americans (66%) are interested in space exploration with about half of those personally interested in commercial space travel and tourism. About half (49%) gave NASA a positive job approval rating. Many of those surveyed (45%) expressed concerns that the shuttle fleet is too old, too expensive, and too frail to fly humans into space safely. NASA's great achievements, according to poll respondents, are the Apollo Moon missions (34%) and the Hubble Space Telescope (18%).⁵⁴

NASA's Office of Strategic Communication funded several analyses of the public's attitude toward space exploration based on focus groups⁵⁵ and a survey,⁵⁶ the results of which were presented in June 2007.⁵⁷ According to an analysis conducted for NASA, the focus group participants were ambivalent about going to the Moon and Mars and wanted to know why these missions were important. Reasons such as leadership, legacy, and public inspiration were found to be less persuasive, especially for future Moon exploration, than NASA-influenced technologies. Most participants agreed that partnership with other countries would be beneficial, but doubted whether it can be achieved realistically.

⁵² (...continued)

adults surveyed online between March 6 and 14, 2007. This online survey is not based on a probability sample and therefore no theoretical sampling error can be calculated.

⁵³ University of Chicago, "Americans Want to Spend More on Education, Health," press release, January 10, 2007, at [<http://www-news.uchicago.edu/releases/07/070110.gss.shtml>]. The General Social Survey, supported by the National Science Foundation, has been conducted since 1973, and is based on face-to-face interviews of randomly selected people who represent a scientifically accurate cross section of Americans. For the 2006 survey, 2,992 people were interviewed and asked a wide variety of questions in addition to those related to spending priorities.

⁵⁴ Zogby, "Zogby Poll: Most Believe Humans Will Someday Colonize the Moon," press release, May 3, 2007, at [<http://www.zogby.com/news/ReadNews2.dbm?ID=1296>]. The Zogby Interactive poll of 4,824 adults nationwide was conducted online from March 14-16, 2007, and carries a margin of error of ± 1.4 percentage points.

⁵⁵ The focus groups were professionally moderated by Dr. Stephen Everett of the Everett Group, Inc., in consultation with ViaNovo. The six focus groups were located in San Diego, Kansas City, and Philadelphia.

⁵⁶ The professionally conducted telephone survey was of 1,001 U.S. adults in February 2007. The margin of error was $\pm 3.2\%$. The survey was conducted by Dr. Mary Lynne Dittmar of Dittmar Associates, in consultation with ViaNovo.

⁵⁷ Robert Hopkins, "Strategic Communications Framework Implementation Plan," powerpoint presentation, NASA, Office of Strategic Communications, June 26, 2007, at [<http://www.spaceref.com/news/viewsr.html?pid=24646>].

In addition, one of the analysis conducted for NASA found that most survey respondents rated NASA-influenced technologies⁵⁸ as somewhat or extremely relevant to them. Over 52% of participants said such technologies were a “very strong” reason to go to space. In contrast, the public’s response to a mission to send humans to the Moon by the year 2020 was less strong with 15% of respondents very excited and 31% somewhat excited. Results for a mission to send humans to the Mars were similar to those for the Moon.

The public opinion analysis conducted for NASA found that there are generational differences in regard to NASA’s proposed activities. For example, NASA’s base support came from those who encompass “The Apollo Generation” (45-64 year olds), the majority (79%) of whom support NASA’s new space exploration mission, particularly the return to the Moon. By contrast, the majority (64%) of those between 18-24 years of age are uninterested or neutral about a human Moon mission. Those between 25 and 44 years of age are approximately evenly split between those who are interested/excited and those who are either uninterested or neutral. Those over 65 were more likely to be neutral or disinterested in a Moon mission, with those over 75 years of age the least interested of all age groups.⁵⁹

What Are the Nation’s Priorities for Civilian Space Exploration and Its Implications for Future Space Policy?

Current U.S. civilian space policy is based on a set of fundamental objectives in the Space Act, based on policy discussions that occurred following the launch of Sputnik over 50 years ago. Those objectives are still part of current policy discussions and influence the nation’s civilian space policy priorities — both in terms of what actions NASA is authorized to undertake and the degree of appropriations

⁵⁸ An example of a NASA-influenced technology (commonly called “spinoff”) mentioned in the survey that had significant results is a smoke alarm. According to NASA, in the 1970s NASA needed a smoke and fire detector with adjustable sensitivity for Skylab, America’s first space station. Honeywell developed the device for NASA and then made it available commercially so that consumers could avoid “nuisance” alarms while cooking. Other devices in the survey were advanced breast cancer imaging, heart defibrillators, weather satellites, remote-controlled robots, global positioning system, cordless tools, satellite radio, and DirecTV. See [<http://www.sti.nasa.gov/tto/>] for more details on NASA’s spinoffs. See a list of NASA’s top 20 spinoffs in the last five years at [http://www.ipp.nasa.gov/spinoff_top_20a.pdf].

⁵⁹ Ibid., p. 9. Robert Hopkins, “Strategic Communications Framework,” powerpoint presentation, NASA, Office of Communications Planning, February 2007, at [<http://images.spaceref.com/news/2007/feb07.stratcomm.pdf>]. M. L. Dittmar, *The Market Study for Space Exploration*, (Houston, TX: Dittmar Associates, Inc., 2004), pp. 26-29 (age data) and pp. 8-11 (Executive Summary). M. L. Dittmar, “Engaging the 18-25 Generation: Educational Outreach, Interactive Technologies, and Space”. Paper #2006-7303 in Proceedings of AIAA Space 2006, September 19-21, (San Jose, California. Washington, D.C.: AIAA, 2006). Paper and presentation available at [http://www.dittmar-associates.com/Paper_Downloads.htm].

each activity within NASA receives. NASA has active programs that address all its objectives, but many believe that it is being asked to accomplish too much for the available resources.

NASA was last reauthorized in 2005 for FY2007 and FY2008.⁶⁰ Thus, the reauthorization of NASA for FY2009 and beyond, along with NASA's upcoming 50th anniversary in Fall 2008, may provide an opportunity for Congress to rethink the nation's space policy. Some analysts have called for new 21st century space policy objectives and priorities to replace those developed 50 years ago.⁶¹

The goals of the nation's investment in space exploration may be a key factor in determining the focus of NASA's activities and the degree of funding appropriated for its programs. Congress and outside experts have concerns as to whether the United States can afford to implement President Bush's Vision for Space Exploration without adversely influencing NASA's other programs.⁶² Congress may need to make challenging decisions to determine how to reap the most benefit from the nation's civilian space program investment. These decisions might answer questions such as

- What are the priorities among the many reasons for U.S. space exploration? For example, what might be the priority ranking among the previously identified reasons as to why the United States might explore space — knowledge and understanding, discovery, economic growth, national prestige, defense, international relations, and education and workforce development?
- What implications would this prioritization have for NASA's current and future budgets and the balance among its programs? For example, what is the proper balance between human and robotic space activities?
- What influence might the timing of other countries' space exploration activities have on U.S. policy? For example, what

⁶⁰ P.L. 109-155, NASA Authorization Act of 2005, December 30, 2005.

⁶¹ See, for example, International Academy of Astronautics, "The Next Steps in Exploring Deep Space," June 9, 2004, at [<http://iaaweb.org/iaa/Studies/nextsteps.pdf>]; Roger A. Pielke, "NASA Needs a New Vision," *San Francisco Chronicle*, October 7, 2007, p. E-5, at [<http://www.sfgate.com/cgi-bin/article.cgi?file=/c/a/2007/10/07/edbjshsmh.dtl>]; Donald A. Beattie, "NASA's troubled future," *The Space Report*, September 4, 2007, at [<http://www.thespacereview.com/article/945/1>]; USA Today, "3 Alternate Visions for NASA's Future," April 11, 2005, at [http://www.usatoday.com/tech/science/space/2005-04-11-space-alternate-visions_x.htm].

⁶² See earlier discussion for Senate and House Committee on Appropriations report language; also Lennard Fisk, Chair, Space Studies Board, National Research Council and Thomas M. Donahue Collegiate Professor of Space Science, University of Michigan, *The President's Vision for Space Exploration: Perspectives from a Recent NRC Workshop on National Space Policy*, Testimony before the House Committee on Science, March 10, 2004, at [<http://science.house.gov/Commdocs/hearings/full04/mar10/fisk.pdf>].

would be the impact of the United States, China, or another country, or a commercial organization, establishing the first Moon base or landing on Mars?

New objectives and priorities might help determine NASA's goals. This, in turn, might potentially help Congress determine the most appropriate balance of funding available among NASA's programs during its authorization and appropriation process.

For example, if Congress believes that national prestige should be the highest priority, they may choose to emphasize NASA's human exploration activities, such as establishing a Moon base and landing a human on Mars. If they consider scientific knowledge the highest priority, Congress may emphasize unmanned missions and other science-related activities as NASA's major goal. If international relations are a high priority, Congress might encourage other nations to become equal partners in actions related to the International Space Station. If spinoff effects, including the creation of new jobs and markets and its catalytic effect on math and science education, are Congress' priorities, then they may focus NASA's activities on technological development and linking to the needs of business and industry, and expanding its role in science and mathematics education.

Appendix Table: Possible U.S. Civilian Space Policy Objectives: Comparison of Selected Extracts from Historical and Current Space Policy Documents

Possible U.S. Civilian Space Policy Objectives	Space Act Objectives (July 1958, as amended)	Eisenhower Administration “Killian Committee” Factors (March 1958)	G.W. Bush Administration “Aldridge Commission” Themes (2004)	G.W. Bush Administration “Space Policy” Goals (2006)	Congressional Comments on Civilian Space Policy Objective-Related Issues in the 110 th Congress
Knowledge and Understanding	“(1) The expansion of human knowledge <i>of the Earth and</i> of phenomena in the atmosphere and space.”	“Fourth, space technology affords new opportunities for scientific observation and experiment which will add to our knowledge and understanding of the earth, the solar system, and the universe.”	“Exploring the Moon, Mars, and beyond is a great journey worthy of a great nation. The impulse to explore the unknown is a human imperative, and a notable part of what animates us as a people. This endeavor presents an opportunity to inspire a new generation of American explorers, scientist, entrepreneurs, and innovators.”	“Increase the benefits of civil exploration, scientific discovery, and environmental activities.”	“From 2010, for another 3 to 5 years, we will have no access in space. We are going to rely on the kindness of allies to go back. We cannot lose time or ground. Our national security and our national honor depend upon it. Also, this would have a tremendous impact on the state of science, which goes to major efforts in terms of better understanding our planet Earth, where we do suspect intelligent life, and also the impact of climate changes.” ^a (Senator Barbara Mikulski)

Possible U.S. Civilian Space Policy Objectives	Space Act Objectives (July 1958, as amended)	Eisenhower Administration “Killian Committee” Factors (March 1958)	G.W. Bush Administration “Aldridge Commission” Themes (2004)	G.W. Bush Administration “Space Policy” Goals (2006)	Congressional Comments on Civilian Space Policy Objective-Related Issues in the 110 th Congress
Discovery	<p>“(2) The improvement of the usefulness, performance, speed, safety, and efficiency of aeronautical and space vehicles.”</p> <p>“(3) The development and operation of vehicles capable of carrying instruments, equipment, supplies, and living organisms through space.”</p>	<p>“The first of these factors is the compelling urge of man to explore and to discover, the thrust of curiosity that leads men to try to go where no one has gone before. Most of the surface of the Earth has now been explored and men now turn to the exploration of outer space as their next objective.”</p>	<p>“Despite the spiritual, emotional, and intellectual appeal of a journey to space — exploration and discovery will perhaps <i>not</i> be sufficient drivers to sustain what will be a long, and at times risky, journey. We must also undertake this mission for pragmatic, but no less compelling reasons, which have everything to do with life here on Earth.”</p>	<p>“Implement and sustain an innovative human and robotic exploration program with the objective of extending human presence across the solar system.”</p>	<p>“...[H]ere we are on the 50th anniversary of Sputnik and it is another sputnik moment. When all of us in America were shocked that Russia had put up the first spaceflight, we were left to say: Why weren’t we first? Today, 50 years later, we are looking at a 5-year gap from the end of the space shuttle before the crew-return vehicle will be on line to put American astronauts back in space. That is another Sputnik moment. Are we going to rely on Russia after 2010 to put American astronauts in space? I hope not. I hope America never loses its commitment to be the first in technology, in knowing what can be done, in exploring issues we haven’t even thought about because we know how much that exploration has already done for our country.”^b (Senator Kay Bailey Hutchinson)</p>

Possible U.S. Civilian Space Policy Objectives	Space Act Objectives (July 1958, <i>as amended</i>)	Eisenhower Administration “Killian Committee” Factors (March 1958)	G.W. Bush Administration “Aldridge Commission” Themes (2004)	G.W. Bush Administration “Space Policy” Goals (2006)	Congressional Comments on Civilian Space Policy Objective-Related Issues in the 110 th Congress
Economic Growth — Job Creation and New Markets	“(4) The establishment of long-range studies of the potential benefits to be gained from, the opportunities for, and the problems involved in the utilization of aeronautical and space activities for peaceful and scientific purposes.”	Not discussed.	“Further space exploration will generate new jobs within current industries and will likely spawn entire new markets involving leading-edge manufacturing and flight support services....As one impressive labor leader testified to the Commission, ‘every dollar spent on space is a dollar spent here on Earth.’ This focus is good for jobs, good for the economy, and good for American families.”	“Enable a dynamic, globally competitive domestic commercial space sector in order to promote innovation, strengthen U.S. leadership, and protect national, homeland, and economic security.”	“NASA’s space and Earth science basic research activities, along with microgravity research, are prime examples of research investments that cannot only advance our knowledge but benefit society.... [T]he investments also play a critical role in educating the next generation of scientists and engineers. Aeronautics R&D, we have discussed that at some great length, is another area where investments we make benefit our economy, our quality of life, and our national security.... Human space flight and exploration is another area that offers benefits ranging from the very important intangible inspiration it provides to the public, to the advanced technologies, and research results that can come from those initiatives” ^c (Congressman Mark Udall)

Possible U.S. Civilian Space Policy Objectives	Space Act Objectives (July 1958, as amended)	Eisenhower Administration “Killian Committee” Factors (March 1958)	G.W. Bush Administration “Aldridge Commission” Themes (2004)	G.W. Bush Administration “Space Policy” Goals (2006)	Congressional Comments on Civilian Space Policy Objective-Related Issues in the 110 th Congress
National Prestige	<p>“(5) The preservation of the role of the United States as a leader in aeronautical and space science and technology and in the application thereof to the conduct of peaceful activities within and outside the atmosphere.”</p> <p><i>“(9) The preservation of the United States’ preeminent position in aeronautics and space through research and technology development related to associated manufacturing processes.”</i></p>	<p>“Third, there is the factor of national prestige. To be strong and bold in space technology will enhance the prestige of the United States among the peoples of the world and create added confidence in our scientific, technological, industrial, and military strength.”</p>	<p>“Exploring the Moon, Mars, and beyond is a great journey worthy of a great nation. The impulse to explore the unknown is a human imperative, and a notable part of what animates us as a people.”</p>	<p>“Strengthen the nation’s space leadership and ensure that space capabilities are available in time to further U.S. national security, homeland security, and foreign policy objectives.”</p>	<p>“We are in a space race. While we are the current leader in space, there are many countries that want to take our place and are aggressively moving forward to do so...[O]ur Nation’s space program benefits the lives of every American. The work that NASA does, from encouraging students into science and engineering careers, to innovative technology advances, improve our quality of life. The forward and innovative thinking at NASA helps to ensure our Nation has the ability to compete, and lead, in the global economy. We are committed to keeping our leadership role in space. In order to do so, we must make the right investments in space at the right times. That time is now.”^d (Senator Richard Shelby)</p>

Possible U.S. Civilian Space Policy Objectives	Space Act Objectives (July 1958, <i>as amended</i>)	Eisenhower Administration “Killian Committee” Factors (March 1958)	G.W. Bush Administration “Aldridge Commission” Themes (2004)	G.W. Bush Administration “Space Policy” Goals (2006)	Congressional Comments on Civilian Space Policy Objective-Related Issues in the 110 th Congress
Defense	“(6) The making available to agencies directly concerned with national defense of discoveries that have military value or significance, and the furnishing by such agencies, to the civilian agency established to direct and control nonmilitary aeronautical and space activities, of information as to discoveries which have value or significance to that agency.”	“Second, there is the defense objective for the development of space technology. We wish to be sure that space is not used to endanger our security. If space is to be used for military purposes, we must be prepared to use space to defend ourselves.”	“Much of the United States’ current military strength and economic security rests on our technological leadership. Our technological and industrial base must constantly be renewed. Therefore, the United States must continue to lead, especially in those industries that require, and therefore build, technology skills.”	“Enable unhindered U.S. operations in and through space to defend our interests there.” “Enable a robust science and technology base supporting national security, homeland security, and civil space activities.”	“There is a strong, symbiotic relationship between space research and national security. For example, by using space-based navigation systems, we can guide a missile to within meters of its intended target. This not only allows our military to more effectively hit a target, it also saves civilian lives and limits collateral damage. The Chinese are gaining ground in technological areas. For example, China recently surpassed the U.S. as the world’s largest exporter of information-technology products (and the U.S. has become a net importer of those products). The Chinese are now turning their attention to space technology — and they are determined to use it as a means of strengthening their military. We cannot allow other countries to acquire new weapons technologies while America does not keep up.” ^e (Senator Bill Nelson)

Possible U.S. Civilian Space Policy Objectives	Space Act Objectives (July 1958, <i>as amended</i>)	Eisenhower Administration “Killian Committee” Factors (March 1958)	G.W. Bush Administration “Aldridge Commission” Themes (2004)	G.W. Bush Administration “Space Policy” Goals (2006)	Congressional Comments on Civilian Space Policy Objective-Related Issues in the 110 th Congress
International Relations	“(7) Cooperation by the United States with other nations and groups of nations in work done pursuant to this act and in the peaceful application of the results thereof.”	Not discussed.	“Although the era of Sputnik has given way to an age of international cooperation in space, it remains a competitive frontier...Other nations, against whom we compete for jobs in the global economy, are also intent on exploring space. If not us, someone else will lead in the exploration, utilization, and ultimately, the commercialization of space, as we sit idly by.”	“Encourage international cooperation with foreign nations and/or consortia on space activities that are of mutual benefit and that further the peaceful exploration and use of space, as well as to advance national security, homeland security, and foreign policy objectives.”	“NASA has a successful history of international cooperation in science and involves non-U.S. partners on some two-thirds of its science missions, and also provides instruments, science support, and other in-kind contributions to non-U.S.-led space and Earth science missions. Successful cooperative missions can increase the scientific content of a mission and build mutually beneficial relationships. At the same time, cooperation can lead to delays and added mission costs. Among the factors that have made international cooperative missions harder in recent years is ITAR” (International Traffic in Arms Regulations). ^f (House Committee on Science and Technology)

Possible U.S. Civilian Space Policy Objectives	Space Act Objectives (July 1958, <i>as amended</i>)	Eisenhower Administration “Killian Committee” Factors (March 1958)	G.W. Bush Administration “Aldridge Commission” Themes (2004)	G.W. Bush Administration “Space Policy” Goals (2006)	Congressional Comments on Civilian Space Policy Objective-Related Issues in the 110 th Congress
Education and Workforce Development	“(8) The most effective utilization of the scientific and engineering resources of the United States, with close cooperation among all interested agencies of the United States in order to avoid unnecessary duplication of effort, facilities, and equipment.”	Not discussed.	“Long-term competitiveness requires a skilled workforce. The space exploration vision can be a catalyst for a much-needed renaissance in math and science education in the United States.”	Not discussed.	“Madam President, we are observing the 50th anniversary of the launch of Sputnik, the first artificial satellite that was launched by humans...we suddenly became shocked at the fact that we were falling behind in math, in science and technology, and that, lo and behold, with the symbolic value of the Soviet Union — at that point our mortal enemy in the Cold War — having achieved that first. Now, there is a lesson in what I have just discussed about our history in space that would teach us not to repeat that now. What is that lesson? First of all, one of the great lessons of that era is the fact that we got excited about science and technology and mathematics and engineering and space flight. We produced a generation of exceptionally talented and educated young people who were told to go to their limit.” ^g (Senator Bill Nelson)

Sources: “Space Act”: P.L. 85-568, The National Aeronautics and Space Act, July 29, 1958. This analysis focuses on the objectives section. “Killian Committee”: U.S. President (Dwight D. Eisenhower), President’s Science Advisory Committee, *Introduction to Outer Space*, March 26, 1958. p. 2. Available at [<http://www.hq.nasa.gov/office/pao/History/monograph10/doc6.pdf>]. “Aldridge Commission”: U.S. President (George W. Bush), President’s Commission on Implementation of United States Space Exploration Policy, *A Journey to Inspire, Innovate, and Discover*, June 2004, p. 11. Excerpts are from the section entitled “Why Go?”. Available at [http://www.nasa.gov/pdf/60736main_M2M_report_small.pdf]. “Space Policy”: U.S. President (G.W. Bush), U.S. National Space Policy, August 31, 2006, at [<http://www.ostp.gov/html/US%20National%20Space%20Policy.pdf>]. Excerpts are from section 3, “United States Space Policy Goals.”

Notes: Excerpts are selected to reflect the general tone of text and are not necessarily the only language discussing these issues. The words in italics in the “Space Act” column show the changes made to the objectives since 1958.

- a. Senator Barbara Mikulski, “Departments of Commerce and Justice, and Science, and Related Agencies Appropriations Act, 2008,” remarks in the Senate, Congressional Record, October 16, 2007, p. S12904.
- b. Senator Kay Bailey Hutchinson, “Departments of Commerce and Justice, and Science, and Related Agencies Appropriations Act, 2008,” remarks in the Senate, Congressional Record, October 4, 2007, p. S12724.
- c. Congressman Mark Udall, U.S. Congress, House Committee on Science and Technology, Subcommittee on Space and Aeronautics, *NASA’s Fiscal Year 2008 Budget Request*, opening statement, 110th Cong., 1st sess., March 15, 2007, H.Rept. 110-12 (Washington: GPO, 2007), p. 17.
- d. Senator Richard Shelby, “Departments of Commerce and Justice, and Science, and Related Agencies Appropriations Act, 2008,” remarks in the Senate, Congressional Record, October 16, 2007, p. S12905.
- e. Senator Bill Nelson, “Departments of Commerce and Justice, and Science, and Related Agencies Appropriations Act, 2008,” remarks in the Senate, Congressional Record, October 4, 2007, p. S12726.
- f. U.S. Congress, House Committee on Science and Technology, Subcommittee on Space and Aeronautics, *NASA’s Space Science Programs: Review of Fiscal Year 2008 Budget Request and Issues*, 110th Cong., 1st sess., May 2, 2007, H.Rept. 110-24 (Washington: GPO, 2007), p. 6.
- g. Senator Bill Nelson, “Departments of Commerce and Justice, and Science, and Related Agencies Appropriations Act, 2008,” remarks in the Senate, Congressional Record, October 4, 2007, p. S12726.