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U.S. Space Programs: Civilian, Military, and Commercial

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U.S. Space Programs: Civilian, Military, and Commercial

SUMMARY

The 109th Congress is addressing a broad range of civilian, military, and commercial space issues.

The National Aeronautics and Space Administration (NASA) conducts the most visible space activities. For FY2005, NASA received a total of $16.2 billion (including $126 million in a supplemental for hurricane relief). The FY2006 request is $16.46 billion. The future of the U.S. human space flight program is dominating debate about NASA. NASA hopes to return the space shuttle to flight status in July 2005; the shuttle has been grounded since the February 2003 *Columbia* tragedy. Pursuant to the "Vision for Space Exploration" announced by President Bush in January 2004, the shuttle program then would be terminated in 2010 after construction of the International Space Station (ISS) is completed. The Vision directs NASA to focus its activities on returning humans to the Moon by 2020 and eventually sending them to Mars. The Vision has broad implications for the agency, especially since most of the money to implement it is expected to come from other NASA activities. Consequently, NASA would need to shift funds away from aeronautics, space science, and earth science programs. It plans to reduce its workforce by over 2,500 people by FY2007. Many of the personnel cuts would come from its aeronautics program. Congress is debating the many issues raised by the Vision, including what the balance should be among NASA's various space and aeronautics activities, and whether the United States should end the shuttle program before a replacement is available.

The Department of Defense (DOD) has a less visible but equally substantial space program. Tracking the DOD space budget is extremely difficult since space is not identified as a separate line item in the budget. DOD sometimes releases only partial information (omitting funding for classified programs) or will suddenly release without explanation new figures for prior years that are quite different from what was previously reported. Figures provided to CRS show a total (classified and unclassified) space budget of $19.4 billion for FY2003, $20 billion for FY2004, $19.8 billion for FY2005, and a request of $22.5 billion for FY2006. How to manage DOD space programs to avoid the cost growth and schedule delays that have characterized several recent projects is a key issue facing DOD.

The appropriate role of the government in facilitating commercial space businesses is an ongoing debate. For many years, the focus has been on space launch services, but commercial remote sensing satellites also pose complex questions. President Bush signed a new commercial remote sensing policy in 2003, and a new space launch policy in 2004, that try to strike a balance between facilitating commercial activities while ensuring the U.S. government has needed data and services.

International cooperation and competition in space are affected by the world economic situation and the post-Cold War political climate. President Clinton's 1993 decision to merge NASA's space station program with Russia's is symbolic of the dramatic changes, and the risks.

MOST RECENT DEVELOPMENTS

For FY2006, NASA is requesting $16.456 billion, a 2.4% increase over the $16.070 billion it received in the FY2005 Consolidated Appropriations Act (P.L. 108-447). Separately, NASA received $126 million for hurricane relief in a FY2005 supplemental, giving the agency a total FY2005 budget of $16.196 billion. The FY2006 request is a 1.6% increase over that amount. Last year, a 4.7% increase was projected to allow NASA to implement the Vision for Space Exploration announced by President Bush in January 2004. For more on the NASA FY2006 request, see CRS Report RS22063. For more on the Vision, see CRS Report RS21720. The House passed the FY2006 Science, State, Commerce and Justice appropriations bill, which includes NASA, on June 16 (H.R. 2862) approving a net increase of $15 million over the request. The Senate Appropriations Committee reported the bill (S.Rept. 109-88) on June 23, recommending a net decrease of $60 million from the request. The Senate Commerce Committee ordered reported a FY2006-2010 NASA authorization bill on June 23 (S. 1281), recommending a $100 million increase for FY2006 above the request. The House Science Committee reported its version, H.R. 3070, on July 18 (H.Rept. 109-183), authorizing an increase for FY2006 of $15 million above the request. NASA submitted a budget amendment on July 15; the total for the agency did not change.

NASA's space shuttle remains grounded following the February 2003 space shuttle *Columbia* tragedy. NASA's attempt to launch the shuttle on its first Return to Flight (RTF) mission on July 13, 2005 was scrubbed. It plans to try again on July 26. For more on the shuttle, see CRS Issue Brief IB93062.

DOD is requesting $22.5 billion for space activities in FY2006, compared with the $19.8 billion appropriated in FY2005. The House has passed, and the Senate Armed Services Committees has reported, their respective versions of the FY2006 DOD authorization bill (H.R. 1815/ S. 1042). The House has passed the FY2006 DOD appropriation bill (H.R. 2863). All three bills make significant cuts to two DOD space programs: Space-Based Radar (SBR), and TSAT (the transformational communications satellite program). These programs are the subject of debate because their cost estimates are high, and congressional overseers are skeptical of those estimates and of DOD's ability to manage the programs successfully.

BACKGROUND AND ANALYSIS

U.S. Government Civilian Space Programs

National Aeronautics and Space Administration (NASA)

The establishment of NASA in the National Aeronautics and Space Act of 1958 (P.L. 85-568, the "NASA Act") symbolized the entrance of the United States into the space age. The Soviet Union had successfully orbited the first artificial satellite, Sputnik 1, on October 4, 1957, lending the U.S. space program a new urgency. The first U.S. satellite, Explorer 1 (developed and launched by the Army), was orbited on January 31, 1958 after several failures of the Naval Research Laboratory's Vanguard rocket. President Eisenhower's desire to separate military and civilian space activities led to the "NASA Act" and the creation of the

civilian NASA on October 1, 1958, with the Department of Defense (DOD) retaining control over military space programs.

Human Spaceflight. The Soviets achieved another space "first" on April 12, 1961, when Yuri Gagarin became the first human to orbit Earth. The United States responded by launching Alan Shepard into space on May 5, 1961, though he made only a suborbital flight (the first American to orbit the earth was John Glenn in February 1962), as part of the Mercury program. Following Shepard's flight, on May 25, 1961, President Kennedy announced that the United States intended to put a man on the Moon within a decade, initiating the Apollo program. Following successful completion of the Mercury and Gemini programs, NASA was ready to begin Apollo flights, but in January 1967, the first Apollo crew was killed when fire erupted in their Apollo command module during a pre-launch test. The first successful Apollo flight took place in 1968. On July 20, 1969, Neil Armstrong and Buzz Aldrin became the first humans to walk on the Moon as the Apollo 11 spacecraft and pilot Michael Collins orbited overhead. A total of six 2-man crews (Apollo 11, 12, 14, 15, 16 and 17) walked on the Moon through December 1972. Another crew (Apollo 13) intended to do so, but instead made an emergency return to Earth when the craft's Service Module exploded enroute to the Moon. Apollo was followed by the Skylab space station (to which 3 crews were sent in 1973-1974) and the 1975 Apollo-Soyuz Test Project in which a U.S. Apollo spacecraft with three astronauts and a Soviet Soyuz spacecraft with two cosmonauts docked for two days of joint experiments.

In 1972, President Nixon approved NASA's proposal to develop a reusable vehicle for taking crews and cargo into Earth orbit — the space shuttle. The first shuttle flight occurred in 1981 and NASA declared the system operational in 1982. The *Challenger* tragedy in January 1986 suspended shuttle operations for 32 months. Flights resumed in 1988. After 87 successful flights, on February 1, 2003, the space shuttle *Columbia* disintegrated during its return to Earth (see CRS Report RS21408). The space shuttle fleet is currently grounded. NASA's attempt to launch the shuttle on its first Return to Flight mission on July 13, 2005 was scrubbed due to a fuel sensor malfunction. NASA plans to try again on July 26. See CRS Report RS21408 for current status.

The shuttle is NASA's sole means of launching humans into space. Beginning in the early 1980s, NASA, sometimes with DOD, attempted to develop a replacement for it (see **Developing New Space Launch Vehicles**, below). For many years, NASA's plan was to phase out the shuttle in 2012. The replacement programs were not successful, however, and in November 2002, NASA announced that it would keep the shuttle operational at least until 2015, and perhaps until 2020 or longer. However, in January 2004, President Bush announced a "Vision For Space Exploration" that calls for the space shuttle to be retired after construction of the International Space Station (see next paragraph) is completed, currently expected in 2010. He directed NASA to build a new "Crew Exploration Vehicle" (CEV) to take astronauts to and from the Moon. The CEV is a spacecraft, not a launch vehicle. What launch vehicle will be used for the CEV is yet to be determined. The CEV is scheduled to be available for taking people to space in 2014. Between 2010 and 2014, the United States would not have an ability to place astronauts in space. Dr Griffin, the new Administrator of NASA, has stressed his intent to shorten that gap.

NASA continues to build and operate the International Space Station (ISS) in cooperation with Russia, Canada, Japan, and 10 European countries (see CRS Issue Brief

IB93017). The space station program began in 1984 (FY1985) and has been very controversial because of cost growth and schedule delays. Twenty-two attempts in Congress since 1991 to terminate the program in NASA funding bills failed. The ISS is being assembled in orbit, with segments taken into space by the U.S. space shuttle or Russian launch vehicles. The first assembly flight was in 1998, and construction is now approximately 50% complete. Construction is suspended until the space shuttle returns to flight because most of the remaining segments are designed to be launched on the shuttle. Crews rotating on six-month schedules continue to live and work aboard the station using Russian Soyuz spacecraft for crew transport and "crew return" (essentially serving as a lifeboat to return the crew to Earth in an emergency), and Russian Progress spacecraft for cargo delivery. Under a 1996 agreement, Russia agreed to provide crew transport and crew return for U.S. astronauts on 11 Soyuz missions at no cost to NASA. The 11th Soyuz is due to be launched in October 2005, returning to Earth in April 2006. After that time, NASA would be limited to having its crews aboard ISS only when the space shuttle is docked unless it can negotiate an agreement with Russia to continue providing crew return services. The shuttle typically docks for 1-2 weeks at a time a few times a year. No agreement exists for Russia to provide these services to NASA, however, and NASA may not pay Russia for such services under the Iran Nonproliferation Act (P.L. 106-178) unless President Bush makes a determination that Russia is not proliferating certain technologies to Iran. Issues concerning U.S. access to the ISS after April 2006 are discussed in CRS Issue Brief IB93017.

Science Programs. NASA has launched many spacecraft for space science and earth science research. Robotic probes served as pathfinders to the Moon for astronauts, and have visited all the planets in the solar system except Pluto, and a probe is scheduled to be launched to that planet in 2006. Many of the probes have been quite successful, but there were failures, too. In 1999, for example, two NASA Mars missions failed, at a combined cost of $328.5 million. They reflected NASA's "faster, better, cheaper" (FBC) approach to scientific spacecraft, replacing large, complex spacecraft that can acquire more information, but take longer and cost more to build. The FBC approach was subsequently scrutinized and NASA restructured its Mars exploration program significantly. Two NASA probes, Mars Odyssey and Mars Global Surveyor, are now orbiting Mars, and twin rovers, Spirit and Opportunity, are investigating the planet's surface (a European probe, Mars Express, also is orbiting Mars). NASA also has sent, or plans to send, spacecraft to other planets, comets, and asteroids. These include Cassini, which arrived at Saturn on July 1, 2004 (GMT) after a seven-year journey; and the Stardust probe that is on its way back to Earth after collecting samples of a comet (it will return in January 2006).

Space-based observatories in Earth orbit have studied the universe since the 1960s, creating new fields of astronomy since space-borne telescopes can intercept wavelengths (such as x-rays and gamma rays) that cannot penetrate Earth's atmosphere. In the 1980s, NASA embarked upon building four "Great Observatories" for studies in different parts of the electromagnetic spectrum: Hubble Space Telescope, launched April 1990 (primarily for the visible wavelengths); Compton Gamma Ray Observatory, launched April 1991, deorbited June 2000; Chandra X-Ray Observatory, launched July 1999; and the Spitzer Space Telescope (formerly the Space Infrared Telescope Facility or SIRTF), launched August 2003. NASA is planning the James Webb Space Telescope for further infrared observations. Hubble was designed to be serviced and eventually returned to Earth by the space shuttle, but NASA announced in January 2004 it would not send any more shuttles to Hubble because

of safety concerns. The new NASA Administrator, Dr. Griffin, said that he would reassess that decision once the shuttle returns to flight (see CRS Report RS21767).

NASA has solar-terrestrial physics programs that study the interaction between the Sun and the Earth. In FY2001, NASA began the Living with a Star program that envisions the launch of many spacecraft over the next decade to obtain more accurate information on how the Earth and society are affected by what has come to be known as "space weather" — including, for example, negative effects of solar activity on telecommunications.

During the 1960s and 1970s, NASA developed communications, meteorological, and land and ocean remote sensing satellites. NASA's role in this aspect of space utilization traditionally is R&D. Once the technology is proven, operational responsibility is transferred to other agencies or the private sector. NASA continues to perform research in many of these areas, however, particularly earth sciences (including global climate change). NASA, sometimes in partnership with other countries, has a variety of earth science probes in orbit today, including three large satellites in the Earth Observing System (EOS). The United States also is leading the international Global Environmental Observing System and Systems (GEOSS) program [http://iwgeo.ssc.nasa.gov/]. NASA's FY2005 and FY2006 budgets assume significantly reduced funding for earth sciences research, an issue that was explored at an April 28, 2005 House Science Committee hearing.

Other Civilian Government Agencies

Beginning in the 1960s, other civilian agencies became involved in space. Operation of weather satellites was transferred to what is now the National Oceanic and Atmospheric Administration (NOAA) in the Department of Commerce. NOAA is currently working with DOD to build a joint weather satellite system that merges the capabilities of its Polar Orbiting Environmental Satellite (POES) system with those of DOD's Defense Meteorological Satellite Program (DMSP). Called the National Polar Orbiting Environmental Satellite System (NPOESS), it is managed by an integrated program office (see [http://www.ipo.noaa.gov/]). NASA develops new technology for NPOESS. The first NPOESS launch is expected by 2010. Other parts of the Department of Commerce are involved in space issues as well due to the Department's role in trade policy and export of items on the Commerce Control List. It also has an Office of Space Commercialization (part of the Technology Administration) to facilitate commercial space businesses.

In 1983, the Department of Transportation (DOT) was given responsibility for facilitating and regulating commercial launch services companies. This function is performed through the Federal Aviation Administration. DOT and DOD co-chair a group that oversees use of DOD's Global Positioning System of navigation satellites [http://www.igeb.gov/]. DOT represents civilian users and has programs to augment the system's utility to the civilian community. Other government agencies involved in space include the Department of Energy, which develops nuclear power sources for spacecraft; the U.S. Geological Survey in the Department of Interior, which operates the government's Landsat land remote sensing satellites; the Departments of Agriculture and other departments that use satellite data for crop forecasting and map making, for example; and the Department of State, which develops international space policy and determines whether to grant export licenses for items on the Munitions List. The White House's National Security Council and Office of Science and Technology Policy are involved in developing policy.

Interagency Coordination

Several mechanisms have been tried since 1958 to coordinate interagency space policy. Congress created a National Aeronautics and Space Council in the NASA Act. That Space Council was abolished in 1973 by President Nixon. President Carter established a Policy Review Committee on Space under the aegis of the National Security Council (NSC), but it was chaired by the Director of the Office of Science and Technology Policy. President Reagan established a Senior Interagency Group on Space (SIG/Space) under the NSC, chaired by the National Security Adviser. Congress was dissatisfied with SIG/Space, however, particularly in terms of slow decision making after the 1986 space shuttle *Challenger* tragedy. Congress created a National Space Council in the FY1989 NASA authorization act (P.L. 100-685), chaired by the Vice President. Under President George H. W. Bush, the Space Council was headed by Vice President Quayle.

President Clinton decided not to use the Space Council mechanism. It still exists in law, but is not staffed or funded. Instead, Space Council functions were merged into a National Science and Technology Council, administered through the Office of Science and Technology Policy. NSTC oversaw civil and commercial space policy; while military space activities were overseen by the National Security Council. Some space advocates hoped President George W. Bush would reactivate the Space Council, but instead his administration uses a Policy Coordinating Committee under the NSC (similar to SIG/Space). NASA and DOD also have a "Partnership Council" to facilitate communication between their organizations and identify areas for collaboration and cooperation.

On July 28, 2002, in NSPD-15, President Bush directed the NSC to chair a review of national space policies. The first new policy, on commercial remote sensing, was signed April 25, 2003. On January 6, 2005, the White House released a new U.S. Space Transportation Policy, which had been authorized by President Bush on December 21, 2004. Also, President Bush announced a new Vision for Space Exploration for NASA on January 14, 2004. An overall national space policy is still being developed.

Commercial Space Programs

Commercial communications satellites have been chiefly a private sector activity since passage of the 1962 Communications Satellite Act (P.L. 87-624). Attempts to commercialize other aspects of space activities have yielded mixed success.

Space Launch Services

Congress has passed several laws to facilitate the commercialization of space launch services for putting satellites into orbit (the 1984 Commercial Space Launch Act, the 1988 Commercial Space Launch Act Amendments, the 1998 Commercial Space Act, and the 2004 Commercial Space Launch Act Amendments). The development of a U.S. commercial launch services industry has been largely successful. DOD and NASA continue to play a role in developing new launch vehicles, though some private companies are developing their own. The most controversial issues are the relative roles of the government versus the private sector in developing new systems, ensuring that U.S. companies can compete with foreign launch services companies (primarily in Europe and Russia), and trade and missile

proliferation issues involved in exporting satellites to other countries for launch. In terms of competition, it must be mentioned that the two major U.S. space launch service companies operate in partnership with companies in other countries. Lockheed Martin and two Russian companies comprise International Launch Services, which offers launches on the U.S. Atlas and Russian Proton vehicles. Boeing offers launches on its Delta 2 launch vehicle, and also is a partner in the Sea Launch venture, where a Ukrainian Zenit launch vehicle with a Russian third stage is launched from a mobile oil rig built by Norway. See CRS Issue Brief IB93062 for more information.

Commercial Remote Sensing, and Landsat

Congress also sought to facilitate commercialization of land remote sensing satellites by privatizing the government's Landsat program through the 1984 Land Remote Sensing Commercialization Act (P.L. 98-365). Such satellites provide imagery of the Earth that can be used for land-use planning, environmental studies, mineral exploration, and many other purposes. The first Landsat satellite was launched in 1972. After a tumultuous eight years that saw the effort to privatize Landsat fail, Congress repealed that act and replaced it with the Land Remote Sensing Policy Act of 1992 (P.L. 102-555), bringing Landsat back under government sponsorship. Landsat 5 and 7, built and operated by the government, are now in orbit. Landsat 5, launched in 1984, is well past its design lifetime and only partially functioning. One of the sensors on Landsat 7, launched in 1999, also is not functioning properly. Whether and how the U.S. government should ensure the continuity of Landsat-type data is currently being debated. NASA hoped the private sector, rather than the government, would build the next satellite. NASA solicited bids, but only one was received and NASA rejected it. NASA's current plan is to place Landsat-type sensors (called OLIs — Operational Land Imagers) on the NPOESS satellites discussed earlier. Some scientists are concerned that Landsat 5 and 7 will fail before the first NPOESS satellite is launched, creating a gap in data acquisition, and want a "gapfiller" satellite launched. This does not appear to be in NASA's plans.

The Land Remote Sensing Policy Act also promoted development of new systems by the private sector. Coupled with a 1994 Clinton Administration policy, these actions led several U.S. companies to initiate programs to build remote sensing satellites and offer imagery on a commercial basis. Those companies must obtain an operating license from NOAA for such systems. Three U.S. companies — Space Imaging, DigitalGlobe, and Orbimage — have commercial remote sensing satellites in orbit. The market for their products is limited, however, and they reportedly are struggling financially. Partially in response to that concern, President Bush signed a new commercial remote sensing policy on April 25, 2003 that is intended to sustain and enhance the U.S. remote sensing industry.

Controversy over the fact that the imagery has military as well as civilian uses complicates this commercial space effort, however. Though not as precise as military reconnaissance satellites, the three operating U.S. private sector satellites, Ikonos 2 (Space Imaging), QuickBird (DigitalGlobe), and Orbview 3 (Orbimage) produce imagery with resolution (the ability to "see" an object or feature of a certain size) of 1 meter or less. Competitors include French, Russian, Indian, and Israeli companies that offer imagery with 2.5-meter, 1-meter, 1-meter, and 1.8-meter resolution respectively. One major issue is when the U.S. government can exercise "shutter control," forcing U.S. companies to discontinue obtaining or distributing imagery of certain parts of the world in times of crisis. DOD took

a different approach to controlling access to imagery when the United States initiated attacks in Afghanistan. For two months, the National Imagery and Mapping Agency (NIMA, now the National Geospatial-Intelligence Agency or NGA) bought exclusive rights to Ikonos imagery of that area so that no one else could use the data without NIMA's approval, a practice dubbed "checkbook shutter control" in the media. The government apparently did not limit access to commercial satellite imagery during the 2003 Iraqi war. Another issue is the government's role in controlling to whom the imagery is sold and which countries may invest in the U.S.-owned systems. U.S. companies want time limits on how long the government can take to decide whether particular sales or investments will be permitted so they can make wise business decisions. The 2003 Bush policy states that the government will provide a timely and responsive regulatory environment.

Special issues have arisen regarding Israel. On October 7, 1994, Senator Bingaman and 63 other Senators sent a letter to the Secretary of Commerce expressing concern that data from Eyeglass (subsequently renamed Orbview) that could be used against Israel would be made available to Saudi Arabia, which was providing partial financing for the system and would be the location of a ground station. The FY1997 DOD authorization bill (P.L. 104-201) prohibits collection and release, or U.S. government declassification, of satellite imagery of Israel unless such imagery is no more detailed or precise than what is available from commercial sources.

Potential availability of commercial imagery also has a positive side for the military, since the U.S. military and intelligence communities could reduce costs by acquiring imagery commercially instead of building their own systems for some purposes. Congress has strongly encouraged NIMA (now NGA) to purchase commercial imagery to augment classified imagery. The 2003 Bush policy directs the U.S. government to utilize U.S. commercial remote sensing space capabilities, for both civil and national security purposes, to the maximum extent practicable. Foreign commercial remote sensing space capabilities may be used consistent with national security and foreign policy objectives. (See below for more on the use of commercial imagery by NGA/NIMA.)

Space Tourism

A nascent commercial space area is "space tourism." On June 21, 2004, Mike Melvill became the first person to reach space (on a suborbital flight) aboard a privately funded launch vehicle, SpaceShipOne, designed by Scaled Composites. Mr. Melvill is sometimes referred as the first "commercial astronaut," but several representatives of commercial companies, and other private individuals, have flown in space. Mr. Melvill's flight is notable because SpaceShipOne was developed without government funding, and some hope it will usher in an era of "affordable" space tourism. In 2004, Congress passed the Commercial Space Launch Act Amendments (P.L. 108-492) that, inter alia, create a regulatory structure for space tourism. See CRS Issue Brief IB93062.

Military Space Programs

The 1958 National Aeronautics and Space Act specified that military space activities be conducted by the Department of Defense (DOD). The Undersecretary of the Air Force is DOD's executive agent for space, and the Air Force acquisition executive for space. The

intelligence community makes significant use of space-based intelligence collection capabilities. The National Reconnaissance Office (NRO), an agency within DOD, builds and operates intelligence collection satellites, and collects and processes the resulting data, which are provided to users such as the National Geospatial-Intelligence Agency (NGA) and the National Security Agency (NSA). The Undersecretary of the Air Force is the Director of NRO. NRO, NGA, and NSA also are under the oversight of the new Director of National Intelligence (DNI). See CRS Report RL32515 for more on the DNI and potential effects for DOD intelligence agencies, including NRO, NGA, and NSA.

DOD and the intelligence community manage a broad array of space activities, including launch vehicle development, communications satellites, navigation satellites (the Global Positioning System — GPS), early warning satellites to alert the United States to foreign missile launches, weather satellites, reconnaissance satellites, and developing capabilities to protect U.S. satellite systems and to deny the use of space to adversaries (called "space control" or "counterspace systems"). The 1990-1991 Persian Gulf War is dubbed by some as the first "space war" because support from space displayed great improvement over what was available during the previous major conflict, Vietnam. These systems continue to play significant roles in U.S. military operations.

How to organize DOD and the intelligence community to work effectively on space programs has been an issue for many years. Congress established commissions to review the NRO in the FY2000 intelligence authorization act, P.L. 106-120; NGA (then called NIMA, the National Imagery and Mapping Agency) in the classified annex to the FY2000 DOD appropriations act, P.L. 106-79; and overall U.S. national security space management and organization in the FY2000 DOD authorization act, P.L. 106-65. The NRO, NGA/NIMA, and "Rumsfeld Space Commission" reports are discussed below.

Although U.S. military and civilian space programs are separated organizationally, the functions performed by satellites and the vehicles that launch them are not easily divided. Both sectors use communications, navigation, weather, and remote sensing/reconnaissance satellites, which may operate at different frequencies or have different capabilities, but have similar technology. The same launch vehicles can be used to launch any type of military, civilian, or commercial satellite. DOD uses some civilian satellites and vice versa.

After the Cold War, interest in space weapons to attack satellites (antisatellite, or ASAT, weapons) or ballistic missiles declined initially, but was rekindled beginning with the 104th Congress. Using satellites to attack ballistic missiles has been controversial since President Reagan's 1983 announcement of a Strategic Defense Initiative to study the viability of building a ballistic missile defense system to protect the United States and its allies. The Clinton Administration changed the name of the Strategic Defense Initiative Organization to the Ballistic Missile Defense Organization to reflect a new focus on theater missile defense in the wake of the Persian Gulf War, rather than national missile defense. The George W. Bush Administration changed the name to the Missile Defense Agency (MDA) to reflect its interest in broad missile defense goals (see CRS Report RL31111).

The concept of placing weapons in space, as part of a missile defense system or otherwise, remains controversial. A May 18, 2005 New York Times article reported that the new national space policy being developed by the Bush Administration (discussed earlier) would "move the United States closer to fielding offensive and defensive space weapons."

White House Press Secretary Scott McClellan, responding to questions at that day's White House press briefing, stressed that the new policy, which is still being developed, does not represent a substantial shift in U.S. policy, as claimed by the newspaper. The same day, Representative Kucinich introduced a bill (H.R. 2420) to ban weapons in space, and the use of weapons to damage or destroy objects in orbit.

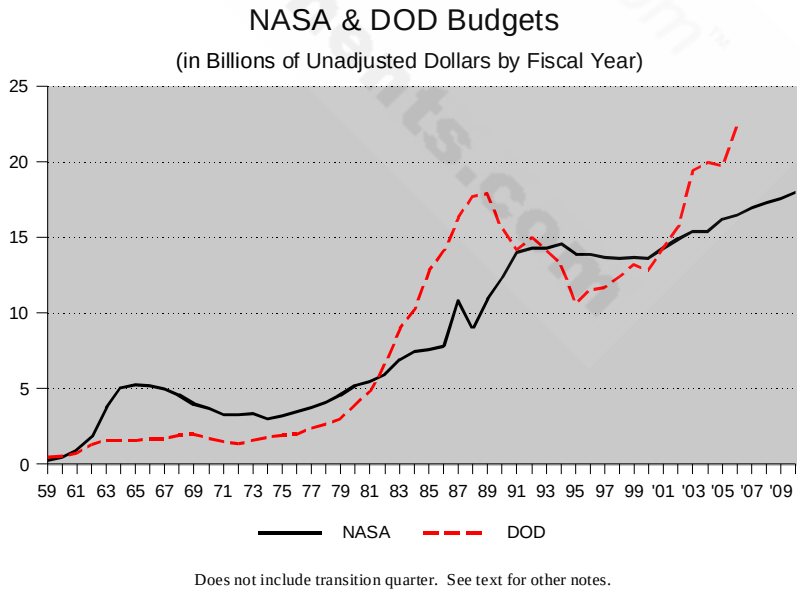
International Cooperation and Competition

Virtually every country in the world uses satellites for communications and obtaining weather data, but the usual measure of whether a country is a member of the "space-faring" club is its ability to launch satellites. By that criterion, Russia, the United States, China, Japan, India, Israel, Ukraine, and the European Space Agency (ESA) are members. ESA developed the Ariane launch vehicle; Ariane launches are conducted by the French company Arianespace. These countries, including many of the individual members of ESA, present opportunities for cooperation, as well as competition. The 16 members of ESA are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.

The NASA Act specifically states that NASA may conduct international space activities. Many NASA programs today have an international component. One of the major cooperative projects today is the space station (see CRS Issue Brief IB93017). European countries, both individually and through ESA, Canada, and Japan, in particular, have participated in many cooperative space programs with NASA. They also compete with U.S. companies in some space areas. Europe, India, Ukraine, and Russia compete in launch services for placing satellites into orbit. France, Russia, India and Israel compete in satellite remote sensing, and Europe competes in communications satellite manufacturing. n Cooperation and competition between the United States and the former Soviet Union attracted much attention. Competition with the Soviet Union was measured less in economic terms than in prestige and national defense. The main area of competition today seems to be on the economic front, although Russian and Ukrainian companies have joint ventures with U.S. firms to provide launch services, so economic cooperation also exists.

NASA and DOD Space Budgets

The majority of U.S. government space funding goes to NASA and DOD. This table shows NASA and DOD space funding from FY1959 to FY2005, with projections (for NASA) through FY2010. The DOD funding figures must be used cautiously, however. Space is not a line item in the DOD budget, and DOD's annual



budget justifications do not include a figure for "space activities." DOD sometimes releases only partial information or will release without explanation new figures for prior years that are quite different from what was previously reported. Space spending by all federal government agencies, by year since FY1959, is provided in Appendix E of the annual Aeronautics and Space Report of the President, submitted to Congress by NASA. The most recent edition [http://history.nasa.gov/presrep2003.pdf]covers through FY2003. This table uses data from that report for NASA and DOD through FY2003. NASA figures for FY2004 and beyond, including projections through FY2010, are from NASA's annual budget justifications. The DOD figures for FY2004-FY2006 were supplied to CRS by DOD's Office of the Comptroller; out-year projections were not provided. According to the DOD data provided in March 2004 and March 2005, DOD requested $21.7 billion for space programs in FY2005, while Congress provided $19.8 billion; the FY2006 request is $22.5 billion. According to NASA budget documents, NASA requested $16.2 billion for FY2005 and received $16.07 billion in the FY2005 Consolidated Appropriations Act (adjusted for the across-the-board rescission), plus $126 million in a FY2005 supplemental for hurricane relief, for a total FY2005 budget of $16.2 billion. Its FY2006 request is $16.5 billion. All NASA figures include aeronautics funding ($400 million-$1 billion annually in recent years).

Space Program Issues

NASA Issues: The "Vision for Space Exploration"

President Bush's January 14, 2004 announcement of a new "Vision for Space Exploration" (see CRS Report RS21720) is capturing the spotlight of NASA issues. The President's directive called for redirecting NASA's human exploration program from low Earth orbit to the Moon, Mars, and "worlds beyond." Achieving that goal involves both robotic and human missions. According to the President's speech, humans would return to the Moon in 2015-2020, and eventually go to Mars (no date given). The space shuttle program would be terminated when construction of the International Space Station (ISS) is completed, currently expected in 2010. The President also asserted that the United States would meet its obligations to the other partners in the program (see CRS Issue Brief IB93017). How it will do so without the shuttle is uncertain; NASA is assessing what other government or commercial launch vehicles and spacecraft might be able to accomplish the tasks. The President invited other countries to join the United States in the Vision.

U.S. research aboard the ISS would focus only on that which is needed to support the Vision instead of the broadly-based program that was planned. According to a budget chart released the same day as the President's speech, NASA would end its involvement in the ISS program by FY2017. The plan called for NASA to build a Crew Exploration Vehicle (CEV) to ferry crews to and from the Moon, with an Earth-orbital capability by 2014. U.S. astronauts would have to rely on Russia to take them to and from ISS during the gap between the end of the shuttle program in 2010 and the availability of the CEV. NASA Administrator Griffin is committed to reducing that gap. If the CEV remains on its original schedule, obtaining services from Russia could be problematical. Russia currently provides NASA with crew transport and crew return services at no cost under a 1996 agreement. Russia's obligations under that agreement will be fulfilled with a Soyuz spacecraft scheduled for launch in October 2005 and return to Earth in April 2006. Assuming that the space shuttle has returned to flight status by then, NASA could continue to place U.S. astronauts aboard

the ISS as long as the shuttle is flying, but they could not remain there for long duration missions without access to the Russian crew return ("lifeboat") services. They would have to depart with the shuttle, which typically remains at the ISS for 1-2 weeks, unless NASA changes its policy requiring an emergency escape route for its astronauts. Once the shuttle is retired, U.S. astronauts would not be able to visit the ISS without access to Russia crew transport services. Russian space officials have repeatedly indicated that they will not provide these services for free, yet, under the terms of the Iran Nonproliferation Act (INA, P.L. 106-178), NASA is prohibited from making payments to Russia for ISS-related services unless the President makes a determination that Russia is not proliferating certain technologies to Iran. The Bush Administration has proposed an amendment to the INA. For more on the INA and ISS, see CRS Report RS22072 and CRS Issue Brief IB93017.

In February 2004, NASA estimated that returning humans to the Moon by 2020 would cost $64 billion in 2003 dollars, not including the cost of associated robotic missions. A September 2004 Congressional Budget Office report [http://www.cbo.gov] concluded that, based on historical NASA experience, that cost could be much higher. NASA has not provided an estimate for sending astronauts to Mars. Most of the required funding would come from redirecting funds from other NASA programs. In the FY2005 budget, the White House projected approximately 5% increases for NASA each year for FY2005-2007, but the FY2006 request for FY2006 does not meet that expectation (see below).

The House and Senate Appropriations Committees expressed support for the Vision in their reports on the FY2005 VA-HUD-IA appropriations bill (H.Rept. 108- 674; S.Rept. 108-353), but each committee cut funding for it. The final version of the bill (incorporated in the Consolidated Appropriations Act, H.R. 4818, P.L. 108-447) funds NASA almost at its requested level, which many supporters of the Vision viewed as an endorsement of the plan. However, conferees noted that they were giving NASA funding for the Vision even though "there has been no substantive Congressional action endorsing" it. At a February 17, 2005 hearing on the FY2006 NASA budget request, House Science Committee Chairman Boehlert echoed that comment, saying in his opening statement that "Congress has never endorsed — in fact, has never discussed — the Vision." (The statement is available at [http://www.house.gov/science/hearings/full05/feb17/SBopening.pdf].)

For FY2006, NASA is requesting a total of $16.456 billion, a 2.4% increase over the amount included in the FY2005 Consolidated Appropriations Act ($16.070 billion). NASA also received a $126 million FY2005 supplemental for hurricane relief, making its total FY2005 budget $16.196 billion. The FY2006 request is a 1.6% increase over that amount. As noted above, in FY2005 budget documents, the NASA budget was projected to increase approximately 5% for each year FY2005-2007. Some view the lower than expected increase as a sign of soft White House support for the Vision. See CRS Report RS22063 or CRS Report RL32988 for the status of NASA's FY2006 funding bills.

NASA Administrator Griffin has outlined how he plans to implement the Vision in congressional testimony and other public venues. His first priority is returning the shuttle to flight status and completing construction of the ISS. He considers 2010 to be a firm date for terminating the space shuttle, even if ISS construction is not completed then, however. He is assessing alternatives to the shuttle for fulfilling that task. He wants to accelerate development of the CEV to avoid the multi-year gap between when the shuttle is terminated and the CEV becomes available. He agreed to reconsider whether to send the shuttle to

service the Hubble Space Telescope once the shuttle returns to flight and more is known about its risk factors now that various redesigns have been made. He told a Senate Appropriations subcommittee that increased costs for Return to Flight activities, costs associated with preserving the option to do a Hubble shuttle servicing mission, costs for other congressionally directed items, and cost increases in several other programs, means that NASA does not have enough funding to pursue all the programs now on its plate. Cutbacks therefore will have to be made in a number of areas — including future robotic Mars exploration, future astronomy programs, development of nuclear power and propulsion (Project Prometheus), and research aboard the space station. NASA submitted a FY2006 budget amendment on July 15 showing those changes (see CRS Report RL32988 for details).

Military Space Issues

For many years, questions have arisen about whether DOD effectively manages its space activities, and several commissions and task forces have studied the issue. Congress created a commission in the FY2000 DOD authorization bill to make recommendations on the overall management of national security space programs. Chaired by Donald Rumsfeld, the Commission released its report on January 11, 2001, shortly after Mr. Rumsfeld became Secretary of Defense. The "Rumsfeld Space Commission" made sweeping recommendations for management of DOD and intelligence community space programs (see CRS Report RS20824 for a synopsis). According to two GAO reports (GAO-02-772, June 2002; GAO-03-379, April 2003), DOD plans to implement 10 of the 13 organizational recommendations.

Several DOD space programs have experienced significant cost overruns and schedule delays, raising concerns about DOD's acquisition process for space systems. The Defense Science Board (DSB) and Air Force Scientific Advisory Board (AFSAB) commissioned a task force to review DOD space program acquisition because of significant cost increases in several programs. Chaired by retired Lockheed Martin executive Tom Young, its May 2003 report was publicly released in September 2003 [http://www.acq.osd.mil/dsb/reports/space.pdf]. Four key points are that cost has replaced mission success as the primary driver in managing acquisition processes, creating excessive technical and schedule risk; the space acquisition system is strongly biased to produce unrealistically low cost estimates; government capabilities to lead and manage the acquisition process have seriously eroded; and there are long term concerns about the space industrial base. According to press reports (e.g., *Wall Street Journal*, August 25, 2004, B7), the task force produced an update in August 2004 that concluded that some of the space programs it criticized were making progress but still required close review, and that better coordination in needed between the military and intelligence agencies in setting requirements.

Meanwhile, figures from the DOD Comptroller's Office over several years showed that the Bush Administration planned to increase DOD's space budget significantly — from $15.7 billion in FY2002, to $20 billion in FY2004, to a request of $21.7 billion for FY2005, and continued increases to a projected $28.7 billion in FY2008. However, in its report on the FY2005 DOD appropriations bill (S. 2559, S.Rept. 108-284), the Senate Appropriations Committee cautioned that funding for DOD's space activities may not be sustainable. Figures provided to CRS by the DOD Comptroller's Office in March 2005 showed that DOD received $19.8 billion for FY2005 (compared to the $21.7 billion requested). The FY2006 request is $22.5 billion. Projected future year funding was not provided.

Space-Based Radar (SBR) and TSAT. A number of DOD space programs are encountering cost growth and schedule delays, including the Air Force's Space Based Infrared System-High (SBIRS-High) for early warning of missile launches (see CRS Report RS21148), the Air Force's Advanced Extremely High Frequency (AEHF) communications satellite system, and the National Reconnaissance Office's (NRO's) Future Imagery Architecture reconnaissance satellite system. DOD's requests to initiate new programs, including a Space-Based Radar (SBR) program, and the Transformational Satellite (TSAT) communications satellite program, are controversial because of the potentially large costs involved, whether the technologies they require are ready, and how to avoid the cost growth and schedule delays experienced in other DOD space programs.

SBR would be a system of many satellites (the exact number has not been determined) that would track mobile targets (as opposed to fixed targets) on the ground. The House Appropriations Committee has sharply criticized the SBR program for the past several years. Most recently, in its report on the FY2005 DOD appropriations bill (H.Rept. 108-557), the committee noted that the estimated cost for a 9-satellite constellation is $34 billion, and the Air Force considers nine satellite to be less than half the number required. The committee expressed skepticism about the $34 billion estimate, as well.

The TSAT program would be a follow-on to the AEHF program, which, in turn, is a follow-on to the current series of Milstar satellites. AEHF itself is controversial because of cost overruns, and, in 2002, DOD decided to procure only three instead of five AEHF satellites. The first AEHF launch is scheduled for 2008. TSAT is expected to "transform" DOD communications by providing vastly greater capacity than is available today by operating at much higher (optical) frequencies. If TSAT is delayed, additional AEHF satellites may be needed.

Congressional Action. The Senate Armed Services Committee (SASC) reported its version of the FY2005 DOD authorization bill on May 17, 2005 (S. 1042, S.Rept. 109-69). The House Armed Services Committee (HASC) reported its version (H.R. 1815, H.Rept. 109-89), which passed the House on May 25. The House Appropriations Committee reported the FY2006 DOD appropriations bill on June 10 (H.R. 2863, H. Rept. 109-119).

The request for SBR was $226 million. SASC recommended a cut of $75 million; HASC and the House Appropriations Committee cut it by $126 million. SASC and HASC commented extensively on the program (pp. 200-201 in the Senate report, pp. 214-216 in the House report), each referring to it as the "space radar" (instead of "space-based radar") program. Both discussed the need to integrate the space radar into a broader architecture of radar capabilities, including airborne radars. SASC also emphasized the need for a single space radar system to meet military and intelligence needs, and expressed concern about the lack of certainty about cost and other issues. HASC noted a number of concerns, including that the Air Force has not sufficiently emphasized affordability as a key objective, or fully considered the requirements for a demonstration program. HASC provided specific direction as to what is needed for such a program, utilizing ground, airborne, and existing space assets.

The request for TSAT was $836 million. SASC recommended a cut of $200 million; HASC and the House Appropriations Committee cut it by $400 million. SASC expressed support for TSAT, but noted that GAO found that only one of its seven critical technologies is mature (p. 200). Thus, SASC recommended that a fourth AEHF satellite be procured

(adding $100 million for that satellite) while the TSAT technologies are developed, and that some could be incorporated into that fourth AEHF satellite if feasible. HASC also supported the concept of TSAT, and commended the Air Force on its vision for revolutionary solutions (pp. 216-217). However, it cited the recent history of cost overruns and schedule growth associated with other Air Force space programs as cause for skepticism about the ability of the current acquisition system to accommodate the risks associated with revolutionary technologies. The committee directed that the focus of the TSAT program shift to technology development rather than acquisition. It added that it did not believe additional funding for AEHF would be needed until FY2007.

In addition to discussing problems with DOD's space acquisition system in connection with specific requests for programs such as TSAT, SASC and HASC included a number of recommendations about DOD's acquisition system (SASC, Title VIII; HASC, pp. 13-14, 202). HASC also expressed concern about the need to develop closer relationships between "black" (classified) and "white" (unclassified) space activities (pp. 208-209)

Developing New Space Launch Vehicles

Government and private sector launch vehicles are discussed in CRS Issue Brief IB93062. There are two types of launch vehicles: Expendable Launch Vehicles (ELVs, which can only be used once) and Reusable Launch Vehicles (RLVs). The space shuttle is the only RLV in the world.

NASA began its attempts to develop a new RLV to replace the space shuttle in the 1980s that would cost less and improve safety. Several programs were started and later abandoned: the National Aero-Space Plane (NASP), jointly with DOD; X-33; X-34; and the Space Launch Initiative (SLI). SLI was terminated following President Bush's January 2004 announcement of the Vision for Space Exploration, The Vision involves sending astronauts back to the Moon, but NASA officials have not yet determined what launch vehicles are needed to take crews there, or cargo. NASA has concluded that it is preferable to separate the functions of crew transport and cargo (the shuttle does both).

Under a 1994 Clinton policy, NASA was the lead agency for developing new RLVs, while DOD was the lead agency for ELVs. DOD initiated the Evolved Expendable Launch Vehicle (EELV) program to upgrade U.S. expendable launch vehicles to reduce launch costs by at least 25%. Lockheed Martin and Boeing each built EELVs: the Atlas V and the Delta IV respectively, which are now in operation. The companies and DOD shared the development costs, with the expectation that the companies would recoup their costs through selling launches to commercial customers. Market demand did not materialize as expected, however, and the companies now are seeking additional funds from DOD. DOD has been supportive of industry's position, asserting that by ensuring the health of both companies, it will have "assured access to space" should technical problems arise with one of the vehicles. DOD notified Congress in 2004 that the EELV program breached a "Nunn-McCurdy" limit of 25% cost growth, which required DOD to cancel or restructure the program, or certify that it is essential to national security. In April 2004, DOD certified that the program is essential for national security. Questions began to arise, however, about whether the government could afford both EELV service providers. In May 2005, Boeing and Lockheed Martin announced they would merge their EELV launch services for U.S. government customers.

In January 2005, the Bush White House released a new U.S. space launch policy [http://www.ostp.gov/html/SpaceTransFactSheetJan2005.pdf]. Under the new policy, DOD is the lead agency for the national security space sector, and NASA is the lead agency for the civil sector. DOD is directed to maintain the capability to develop, evolve, operate and purchase services for the space transportation systems, infrastructure, and support activities necessary to meet national security requirements. NASA is directed to do the same for the civil sector, but is permitted to engage in development activities only for requirements that cannot be met by capabilities being used by the national security or commercial sectors. Regarding the EELV program, DOD is directed to fund the annual fixed costs for both launch service providers unless or until the Secretary of Defense (SecDef) certifies to the President that a capability to reliably assure access to space can be maintained without two EELV providers. No later than 2010, the SecDef, Director of Central Intelligence, and the Administrator of NASA are to evaluate the long term requirements for the EELV, including a recommended "proportionate shift" of funding responsibility to reflect any change in the balance between national security and civil missions requiring an EELV. Any department or agency seeking to modify or develop new launch systems derived from the EELV, including human rating (such as may be needed for NASA to accomplish the Vision for Space Exploration), is responsible for related funding.

NASA Administrator Griffin has emphasized in several public fora that he believes a "shuttle derived launch vehicle" (SDLV) is a promising option for supporting the Vision. There are several versions of an SDLV under consideration. In one concept, the shuttle's orbiter — the airplane-like section that carries the crew and cargo — would be replaced with a cargo pod, which would be mounted to the side, like the orbiter. Another version would use a single Solid Rocket Booster (the shuttle uses two, one on each side of the orbiter), augmented by a new "upper stage," with a spacecraft on top. One potential use of this vehicle is to launch the new Crew Exploration Vehicle. Still another concept would modify the External Tank (the large cylindrical tank that carried fuel for the orbiter's main engines) and use it alone or in conjunction with SRBs, with a spacecraft on top.

Several private companies are attempting to develop their own launch vehicles. One focus today is building suborbital launch vehicles that would take passengers into space (though not to orbit). The first successful launch of a person into space on a craft (SpaceShipOne) that was developed with private capital was conducted on June 21, 2004 (discussed earlier). The 2005 Bush policy calls both for continued government support for space transportation capabilities, and for capitalizing on the U.S. private sector's "entrepreneurial spirit." NASA is hoping that the private sector can field systems to take cargo to and from the ISS after the space shuttle is retired in 2010.

International Relationships

The shifting world political situation has allowed new relationships to evolve in international space cooperation. Increased cooperation is the result not only of changed political circumstances, but also of constrained budgets throughout the world. All the major space-faring countries are questioning how much they should invest in space. The same budget constraints may preclude the initiation of new programs if a critical mass of funding is not available. Other countries are responding cautiously to President Bush's invitation to join in the new Vision for Space Exploration. Some of the partners in the ISS program say they want that program completed before agreeing to further cooperation. Still, many of

NASA's current partners, as well as potentially new partners such as China, are participating in NASA-led discussions about the Vision. Also, European companies are teaming with U.S. companies in bids for the CEV contract. Thus, international cooperation at both the government and industrial levels may be part of achieving the Vision.

LEGISLATION

H.R. 1815 (Hunter)/S. 1042 (Warner). FY2006 DOD authorization bill. Reported from House Armed Services Committee May 20, 2005, H.Rept. 109-89; passed House May 25. Reported from Senate Armed Services Committee May 17 (S.Rept. 109-69); floor debate began July 20.

H.R. 2420 (Kucinich). To prohibit weapons in space, and the use of weapons to destroy or damage objects in orbit. Introduced May 18, 2005; referred to House Science, Armed Services, and International Relations Committees.

H.R. 2862 (Wolf). FY2006 Science, State, Justice, Commerce appropriations bill (includes NASA). Reported from House Appropriations Committee June 10, 2005 (H.Rept. 109-118); passed House June 16. Reported from Senate Appropriations Committee June 23 (S.Rept. 109-88).

H.R. 2863 (Young). FY2006 DOD appropriations bill. Reported from House Appropriations Committee June 10, 2005 (H.Rept. 109-119); passed House June 20.

H.R. 3070 (Calvert)/S. 1281 (Hutchison). NASA authorization bill. H.R. 3070, as reported from the House Science Committee on July 18, 2005 (H.Rept. 109-173), authorizes funding for FY2006-2007. S. 1281 authorizes funding for FY2006-2010; ordered reported by Senate Commerce Committee June 23.