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NASA R&D in the FY 2001 Budget

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HIGHLIGHTS

- The President's FY 2001 budget for the National Aeronautics and Space Administration (NASA) would represent a modest increase from the FY 2000 level, and would increase every year after that with the budget reaching $15.6 billion in FY 2005. The FY 2001 budget would increase to $14.0 billion, a 3.2 percent increase over last year's enacted budget of $13.6 billion.

- Total FY 2001 NASA support of R&D would increase by 2.7 percent to $10.0 billion. Science, Aeronautics and Technology would increase by 6.2 percent to $5.9 billion. Within this category, R&D in the Mission Communications Services account would increase by 30 percent, up from $406 million in FY 2000 to $529 million in FY 2001 (see Table II-12).

- Although the Space Shuttle program is not classified as R&D since it is has been operational for many years, NASA plans to invest $2.1 billion, up from its current FY 2000 investment of $600 million, in shuttle upgrades over the next six years.

- NASA has requested several new initiatives in FY 2001. The first new start would be a Space Launch Initiative which would invest $4.5 billion over five years for a second-generation reusable launch vehicle (RLV), with NASA supporting a competition in 2005 for development of a full-scale RLV. In FY 2001, NASA would provide $290 million for the project.

- Other new starts in FY 2001 include: a new Space Science program, called Living With a Star, which seeks to understand the Sun's impact on the Earth and space environment ($20 million); a five-year Small Aircraft Transportation System (SATS) Program, which is aimed at developing vehicle and infrastructure technologies to help reduce the accident rate of small aircraft ($9 million); and the Bioastronautics Initiative to research ways to improve crew safety and health aboard future missions requiring prolonged stays in space ($45 million).

AGENCY OVERVIEW AND POLITICAL ENVIRONMENT

The National Aeronautics and Space Act of 1958 established NASA to conduct aeronautical and space activities for the benefit of all humankind. As part of that mission, one of NASA's key functions as the lead agency for civil space R&D has been to preserve U.S. leadership in aeronautics and space science and technology.

NASA's research efforts have, in part, helped lay the foundation for economic growth and competitiveness in the aerospace sector, which today generates over $40 billion in annual exports and nearly $30 billion in positive balance of trade each year. Aviation products are the largest positive industrial contributor to the U.S. balance of trade.

Last year, NASA recorded many achievements but also experienced some disappointments. The achievements extended from improvements in aeronautics applications benefitting the Federal Aviation Administration (FAA) and the air-traveling public to discoveries at the far reaches of the universe, which addressed scientific objectives ranging from the environmental to the cosmological.

The year 1999 started off with the launch of Deep Space One, a mission to test 12 revolutionary technologies including spacecraft autonomy and ion propulsion. The first two Space Station (ISS) assembly missions were launched in November and December. In July, the Space Shuttle Columbia deployed the Chandra X-ray Observatory. The Mars Global Surveyor provided the first global three-dimensional map of Mars and the Compton Gamma Ray Observatory enabled the first ever optical image of one of the most powerful explosions in the universe. A test version of

the X-34 rocket plane made its first captive-carry flight toward certification in preparation for testing new technologies and methods of operation needed to develop low-cost reusable space vehicles.

But NASA also experienced some highly public disappointments last year. The Mars Surveyor program lost two of its probes, the Mars Climate Orbiter and the Mars Polar Lander. The Space Shuttle program experienced wiring problems with all of the Orbiters, resulting in grounding of the entire fleet from August until December. A hydrogen leak was also found in one of the Space Shuttle's main engines. The TERRIERS and Wide Infrared Explorer missions failed. The X-33 composite hydrogen tank did not pass its qualification tests and the launch plans for the assembly of the ISS were delayed. The failures of the Russian Proton also significantly impacted launch plans for the ISS Service Module.

Due to these problems, a number of independent reviews were conducted to examine what went wrong, search for the root causes, and recommend changes. NASA worked closely with the Department of Defense (DOD) and others on the Broad Area Review. NASA chartered reviews of the Shuttle wiring problems, the TERRIERS failures, and Mars Surveyor program failures. As a result of the Mars failures, NASA Administrator Dan Goldin appointed a Mars Program Independent Assessment Team in December, 1999. Results and recommendations are due in late 2000.

On the legislative front, NASA also had a rough year. Early last year, the House proposed cutting NASA's budget by $1.4 billion, leading NASA to warn of possible closings of several NASA facilities. By the fall, however, the cuts were restored and the final NASA budget for FY 2000 was $13.6 billion, $64 million or 0.5 percent less than FY 1999. Total NASA R&D increased slightly by 0.6 percent to $9.8 billion.

BUDGET OVERVIEW

NASA's $14.0 billion FY 2001 request marks the first time in several years the Clinton Administration has sought increased funding for the agency, adding $435 million to last year's amount as the agency undertakes new Space Shuttle safety upgrades, kicks off some science and technology programs, and adds almost $5 billion to planned

investments in advanced space launch technology over the next five years. (See Table II-12 for details of the NASA budget.)

Also in the budget are funds for an additional 500 employees in human space flight jobs, plus another 50 or so in other areas, marking the end of a hiring freeze. Some 1,850 new full-time, part-time, and term employees will be hired to gain the increase on top of normal attrition.

By FY 2005, NASA expects to seek $15.5 billion in total spending, almost $2 billion over the $13.6 billion it will spend this fiscal year. By then, NASA hopes to be able to run a competition for next-generation launch vehicles in which NASA will provide the basic technology through its X-vehicle program and the private sector will provide integrated vehicles. Some $6 billion will be available by 2005, including a $1.2 billion "placeholder" for advanced space transportation already in place. Funding will also include about $4.7 billion through FY 2005 for "focused technology," including about $600 million for "Pathfinder" vehicles. Another $1.3 billion will support space transportation technology.

INTERNATIONAL SPACE STATION (ISS)

A year ago, NASA celebrated the birth of the ISS, as the first two elements were successfully launched and mated. Also, the agency completed the most comprehensive systems integration test and evaluation on ISS since STS-1.

The goals of the ISS are to establish a long-duration habitable residence and laboratory for science and research and permanently deploy a crew to this facility. The ISS mission is to expand the human experience in living and working in space, encourage and enable commercial development of space, and provide a capability to perform a wide range of space-based research in biology, physics, and other disciplines.

NASA also plans commercial research programs to take advantage of new opportunities for space flight operations. NASA is looking for ways to encourage commercial users of the research facilities to help subsidize costs. Congress has directed NASA to commercialize the ISS to the fullest extent possible to get NASA out of the business of operating ISS and funding all the research.

Compared to the FY 2000 budget, the FY 2001 budget request reflects an overall reduction in the budget from $2.3 billion to $2.1 billion and runout estimates through FY 2005 of about $1.2 billion. Rougly $0.8 billion of this reduction is due to the movement of funding for the Phase 2 production of the ISS Crew Return Vehicle (CRV) to the Science, Aeronautics and Technology (SAT) account. The FY 2002-2005 funding estimates will reside in the SAT account pending a decision in the next two years on whether to rely on a planned Russian CRV or to proceed with an X-38 based CRV design, in the context of broader decisions that NASA and the Administration will make regarding future space transportation architectures. Another $0.4 billion reduction in other ISS funding over five years will be carried out in order to fund additional agency needs and other high priority activities such as the Bioastronautics Initative.

The amount of research funding for ISS in FY 2001 is up from FY 2000 figures by 15 percent, from $394 million to $455 million. Although this rate of increase is healthy, it is lower than earlier projections.

SCIENCE, AERONAUTICS AND TECHNOLOGY (SAT)

The SAT appropriation has the majority of R&D programs, accounting for nearly half of NASA's total R&D. Its activities extend our knowledge of the Earth, its space environment, and the universe. SAT also provides investments in new aeronautics and advanced space transportation technologies that support the development and application of technologies critical to national economic, scientific, and technical competitiveness. The FY 2001 request for SAT is $5.9 billion, an increase of 6.2 percent.

Space Science: The FY 2001 Space Science budget of $2.4 billion represents an increase of 9.4 percent over the FY 2000 enacted level of $2.2 billion. The Space Science Enterprise is the arm of NASA that looks up, out, and back in time at planets, stars, galaxies, and other phenomena that populate our Universe. The ultimate goal of NASA's Space Science missions and research can be narrowed down to pursuing answers to three fundamental questions: How did the Universe begin and evolve? How did we get here? Are we alone?

Long-term goals include establishing a virtual presence throughout the solar system, pursuing future human exploration beyond low-Earth orbit,

developing revolutionary technologies for missions impossible in the past, and contributing to achieving national science, mathematics, and technology education goals.

One of the most exciting Space Science events of the past year was the launch of the long-awaited Chandra X-ray Observatory (CXO, formerly known as the AXAF), the third of NASA's four Great Observatories. With its launch this past year, CXO has been phased out of the NASA budget for FY 2001. Another mission slated for launch in May, 2000, is TIMED (Thermosphere, Ionosphere, Mesosphere Energetics and Dynamics).

A new program, Living With a Star, would receive $20 million. This initiative seeks to understand the Sun's impact on the Earth and space environment. Living With a Star is a set of missions and enhancements to current programs designed to study solar variability and its effects on satellites, the Earth, and humans in space. For more coverage of Space Science, please see Chapter 16.

Space Operations: Beginning in FY 2001, SAT will be home to this new account. With NASA facing an increased demand for reliable electronic communications for every flight mission, from planetary spacecraft to aeronautical flight tests, NASA would consolidate many of its communication services in Mission Support and SAT's Mission Communications Services into one account ($529 million in FY 2001).

Life and Microgravity Sciences: The Office of Life and Microgravity Sciences and Applications (OLMSA) conducts ground and space based investigations to gain new knowledge to advance the health and safety of astronauts in space. This research would be used to increase fundamental knowledge of biological, physical, and chemical processes; enable the development of space for human enterprise; and create new products and services. This program will conduct many experiments aboard the ISS.

The FY 2001 request of $302 million is 10.1 percent higher than FY 2000. Within OLMSA, a new program called the Bioastronautics Initiative would commence. This initiative would research ways to significantly improve crew safety and health aboard the ISS and on future missions that would require prolonged stays in space. This program, which would

receive $45 million in FY 2001, would be funded through existing OLMSA programs. Other R&D programs within OLMSA include Biomedical Research and Countermeasures ($77 million), Microgravity Research ($129 million), and Space Medicine Research ($11 million).

Earth Science: The budget for Earth Science in FY 2001 is $1.4 billion, down $38 million. This budget reflects a decrease in funds for observing systems and an increase in research and technology as we pass the peak of development of the Earth Observing System (EOS). Still, EOS ($447 million) continues to represent the largest activity within Earth Science.

Aero-Space Technology (AST): In FY 2001, AST is requesting a budget of $1.2 billion, an increase of $68 million over FY 2000. AST's goal is to provide revolutionary advancements in science and technology that sustain U.S. leadership in civil aeronautics and space. Since last year, The Office of Aero-Space Technology has restructured to reflect new priorities and to maximize the benefit arising from synergy between aeronautics and space transportation technologies. These changes represent expanded investments in existing programs and new programs. AST is now focused into three subcategories: Research & Technology (R&T) Base, Focused Programs, and Commercial Technology.

In FY 2001, funding for R&T Base would decline by almost 8 percent to $539 million. R&T Base provides a high-technology, multidisciplinary environment that enables the development of new, revolutionary aerospace concepts and methodologies for applications in industry.

In FY 2001, the Focused Programs category would undergo several changes. The role of this program is to address clearly defined customer requirements and deliverables and to ensure that national needs are met. The bulk of the research performed in this program already offers numerous potential civil and commercial applications. Beginning in FY 2001, there would be two new initiatives. The first is a program called the Small Aircraft Transportation System (SATS) Program. Over the five year period from FY 2001 through FY 2005, the program would be funded at $69 million, beginning with $9 million in FY 2001.

The second new program is the 2nd Generation Reusable Launch Vehicle (RLV) Program, funded at $290 million in FY 2001. This RLV program is

aimed at substantially reducing the technical, programmatic, and business risks associated with developing a safe, reliable, and affordable second-generation RLV architecture. This initiative will invest in the technology development, business planning, design, and advanced development efforts to enable at least two competitive options for a new architecture. It is hoped that full-scale development of any new systems from the program will be initiated no later than 2005.

The Focused Programs budget, beginning in FY 2001 and lasting though FY 2005, will also support a funding increase of $100 million for noise and emissions research. Although the research is to be performed through a "new" program called Quiet Aircraft Technology (QAT), noise and emission research has been performed in previous years under different accounts within the Focused Programs area. QAT would be funded at $20 million in FY 2001.

Funding for the X-33 program, the first-generation RLV, would come to a halt in FY 2001 due to the failure of a hydrogen tank during testing. After an investigative team releases a report in 2000 on the causes of the failure, NASA and industry will then proceed with the development and execution of a recovery plan and schedule.

The last major program area is Commercial Technology Programs, which would decrease to $135 million. The focus of this program area is to ensure that NASA-developed technology is transferred to U.S. industry to improve U.S. economic competitiveness. This account also includes funding for Small Business Innovation Research.

Academic Programs*:* NASA promotes excellence in the U.S. educational system through enhancing and expanding scientific and technological competence. The FY 2001 request is $100 million, a decrease of almost 28.0 percent. (See Chapter 6 for more information.)

MISSION SUPPORT

The FY 2001 budget request for Mission Support is $2.6 billion, up from the FY 2000 figure of $2.5 billion. This account provides for mission support for Human Space Flight programs and SAT programs.