

Cuts to NASA budget gut space research

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In a far-reaching reorientation of its programs, the US National Aeronautic and Space Administration (NASA) budget has effectively capped science spending for the five-year period from 2007 to 2011. Programs designed to investigate more fundamental scientific questions about the character of the solar system and the universe are being sacrificed to enable NASA to carry out President George Bush's grandiose scheme to establish a permanent settlement on the moon in preparation for a manned mission to Mars.

NASA's announcement in February was part of Bush's budget cuts to federal science spending by 1 percent to \$59.8 billion. The changes to NASA's program are mirrored in the overall science budget, which is focussed more narrowly on projects with commercial payoffs or to strengthen the US military. Bush's "American Competitive Initiative," which is aimed at bolstering US corporate interests at the expense of their rivals, will consume \$5.9 billion. Presidential science adviser John Marburger bluntly declared: "The point is, we're prioritising."

Several NASA programs have been delayed, including:

- * The Global Precipitation Measurement (GPM) mission would have launched a satellite to accurately measure all forms of precipitation on Earth. The study was aimed at developing a more accurate scientific understanding of earth's weather system and its response to natural and human-induced changes. The satellite was due for launch in 2010 and will now be delayed by 30 months.

- * The Space Interferometry Mission PlanetQuest (SIM) planned for launch in 2015, which has now been delayed by three years. SIM is designed to more accurately map the positions and distances of stars throughout the galaxy and to probe nearby stars for Earth-sized planets with the possibility of life. The aim is to make a more accurate estimation of the size and age of the universe.

- * Other projects such as the Orbiting Carbon Observatory, the Landsat Data Continuity Mission, the Space Interferometry Mission and the Wide-Field Infrared Explorer (WISE) have been delayed for one to three years but their future is uncertain.

Many other NASA projects have been deferred indefinitely or scrapped altogether, including:

- * The Terrestrial Planet Finder (TPF) mission was to launch two space telescopes designed to explore the formation of planets in stellar dust clouds.

- * A mission to Europa, one of Jupiter's moons thought to possibly contain liquid water and life, has also been axed. The cancellation of the project is a huge blow to the science of astrobiology—the search for extra terrestrial life. NASA's budget for projects in this field has been slashed by 50 percent. Reta Beebe, an astronomer at New Mexico State University, commented: "The proposed budget transforms an existing, vibrant program into a stagnant holding pattern ... the damage is immediate and increasingly irreversible."

Four locations in the solar system are believed to have the potential to harbour primitive life forms: Mars, Jupiter's moon Europa, Saturn's moon Titan and Saturn's moon Enceladus, where scientists have just discovered a plume of water. Most of these discoveries have resulted from previous NASA probes. Any follow up will be impossible under the current funding regime.

- * The Laser Interferometry Space Antenna (LISA) was to search for gravity waves as predicted by Einstein's theory of General Relativity. Gravity waves could potentially be used to map the warped space-time around black holes and to further our understanding of the nature of space, time and gravity.

- * The Constellation-X Observatory was to have been a array of orbiting X-ray satellites linked together to act as one giant X-ray telescope. The observatory was to investigate black holes, galaxy formation and the evolution of the universe scales as well as more perplexing phenomena such as dark matter and dark energy.

- * The Mars Sample Return was intended to pick up rock samples from Mars and return them to Earth for analysis.

- * The NuSTAR project was a high-energy X-ray telescope intended to survey the sky in a section of the electromagnetic spectrum never before explored. It had the potential to find previously unobserved objects.

- * The Stratospheric Observatory for Infrared Astronomy (SOFIA) was a joint project with the German Aerospace Centre (DRL). The plan was to fly a 2.5 metre reflecting telescope to observe infrared radiation at a height of 12 kilometres, above any interfering atmospheric moisture. SOFIA was aimed at determining the composition of planetary atmospheres and surfaces; investigating the structure, evolution and composition of comets; determining the physics and chemistry of the interstellar medium; and exploring the formation of stars and other stellar objects.

* The Hydrosphere State (Hydros) mission has been cancelled. It was designed to provide the first global view of the Earth's changing soil moisture and the cycle of land surface freeze and thaw in cold climates. The aim was to understand more precisely the Earth's carbon, water and energy cycles.

* The Joint Dark Energy Mission (JDEM) was to place an observatory in space designed to detect dark matter. Some scientists believe that 70 percent of the universe is made up of dark matter and that its presence could explain why the universe is expanding at an accelerating rate.

One of the most insidious cutbacks is to funding of data analysis by students who work through the mountains of data accumulated by every space mission. Professor of planetary astronomy at the California Institute of Technology Michael Brown explained: "The fact that they're cutting the research budget means that I'm not going to be able to fund students... We're out there flying around Saturn, collected data at some incredible rate and most of it goes and sits in an archive."

Some projects have been decades in the making and involve extensive international collaboration. NuSTAR was being carried out in collaboration with the Danish National Space Centre and the Constellation-X Observatory was planned with the Brera Astronomical observatory in Italy.

Funds are being diverted to bolster the Moon exploration program, which will grow by 30 percent to \$3.98 billion in 2007. There is also an additional \$2.6 billion for the International Space Station (ISS). The plan is for a new generation of space vehicles to ferry scientists and astronauts back and forth from the International Space Station and replace the present aging and disaster-prone space shuttles.

Bush aims to establish a permanent manned lunar presence by the year 2020 to prepare for the future exploration and colonisation of Mars. In his announcement in January 2004, he cited the "spirit of discovery" and compared the US exploration of space with earlier American explorers. Bush's intention was to evoke John F. Kennedy's vision for the Apollo missions in the 1960s to given the impression his administration was embarking on a grand scientific quest in outer space.

In fact, the proposed missions are closely linked to military objectives and will be run in close conjunction with the Pentagon. In March 2005 Bush appointed Michael Griffin as NASA's administrator. Griffin joined the Reagan administration's Strategic Defense Initiative Organisation or "Star Wars" program in 1986 as the deputy for technology and led the efforts to develop a missile defence shield. Defence Secretary Donald Rumsfeld is known for his advocacy of American superiority in space warfare.

The NASA cuts produced a furore among scientists in the US and internationally. Executive Director of the Planetary Society, Louis Friedman commented in February: "Space science was not just cut; it was eviscerated. Planetary exploration was savagely pruned. The budget would delay or cancel several long-awaited missions and proposed major

decreases in scientific research." The society has launched a "Take Action Alert" to mobilise scientists against the measures.

An editorial in *Nature* entitled "NASA in reverse" stated: "NASA is undergoing a historic shift in direction without consulting scientists or paying attention to their advice. Projects with great appeal to scientists and to the public—including the search for planets around other stars and the study of dark energy—are being abandoned so that NASA can return astronauts to the moon half a century after the Apollo landings."

Associate Administrator for Science Mary Cleave justified the cutbacks in a statement on March 13, saying: "We all plan and conduct our scientific explorations in a constrained Federal budget environment made more so by recent events on the national and international stage largely beyond the realm of science." Her guarded reference to US occupations in Iraq and Afghanistan underscores the priorities of the Bush administration, which will have spent \$500 billion on these criminal enterprises by the end of 2006.

At a briefing for space scientists at NASA headquarters on March 14, Cleave declared: "We're going to have to do some surgery, so to speak." Curator at the Museum of Natural History in Washington, D.C. Glenn MacPherson, responded: "There has been no consultation with the science community. The science cuts hurt everyone in this room." The *Space.com* website commented on the meeting that "the fury... was not kept within US borders. Scientists from Europe also cautioned that the NASA budget is damaging international cooperation."

The elimination of programs that have taken decades to establish is a massive setback to scientific research, particularly into fundamental questions of physics and cosmology. The disbanding of teams of scientists, engineers and technicians will result in the loss of accumulated experience and expertise as well as significantly narrow the opportunities from training a new generation.



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