

NASA Under Scrutiny: The Columbia Disaster Sparks Debate Over NASA's Future

by Stephan Neuhäuser, May 2003

The loss of the Space Shuttle Columbia on February 1, 2003, and Ronald D. Dittmore's more-or-less immediate resignation as NASA's Shuttle Program Manager thereafter, has refueled the debate about the direction of U.S. space research policy and the future of NASA. There is widespread concern that NASA (<http://www.nasa.gov>) has lost much of the technical expertise that distinguished it during the "race to the moon." This renewed interest in NASA's future comes as investigators on the Columbia Accident Investigation Board (CAIB, <http://www.caib.us>) are taking a close look not only at the Columbia disaster, but at NASA's governance and culture as a whole.

There had been a number of warning signs leading up to the Columbia tragedy. The March 2002 Annual Report of the NASA Aerospace Advisory Panel (ASAP, <http://www.hq.nasa.gov/office/codeq/asap/index.htm>) stated that NASA's "current and proposed budgets are not sufficient to improve or even maintain the safety risk level of operating the Space Shuttle and the International Space Station (ISS). Needed restorations and improvements cannot be accomplished under current budgets and spending priorities [while the] risk that scheduled safety upgrades will never be completed [keeps growing]." These statements underscored an earlier ASAP-report from 2001 where similar safety issues were mentioned. Indeed, the widespread perception of NASA has been all but positive. It seems clear that NASA and its contractors continue their "corporate culture of denial", and, as a result, did not follow up accident reports from earlier incidents. At this time, NASA seems to live up to these allegations made in the ongoing investigations conducted by CAIB, as it has carefully limited public access to internal documents. NASA supervisors have warned employees and engineers not to communicate with journalists without getting formal approval to do so beforehand.

There have been quite a number of incidents involving Space Shuttles since the 1986 Challenger-explosion. In 1999 – the year in which NASA's Mars Polar Lander and Mars Climate Orbiter were lost – over 100 exposed conductors required new wiring protection and repair efforts on several Shuttles. The overhaul of electrical wiring on board the ill-fated Columbia alone took 17 months to complete at a total cost of \$145 million. Another incident, allegedly not followed up by NASA, occurred in August 2001 as technicians at Kennedy Space Center in Florida accidentally released a highly toxic gas from a Shuttle tank causing the evacuation of nearby buildings occupied by NASA staff. Such incidents are even more disturbing when the condition of the Space Shuttle fleet is taken into consideration. The Fleet, in its entirety, has a long history of impact damage during lift-off, also blamed for the Columbia tragedy, with the Shuttle Columbia suffering similar incidents at least twice before its final mission.

The "Space Race" Is Over

What has gone wrong with the one-time figurehead of American cuttingedge space research? Founded in 1958 as a result of the "Sputnik Crisis," the National Aeronautics and Space Administration (NASA) initiated successful projects such as the Mercury, the Gemini and the Apollo programs, and finally won the politically prestigious race to the moon in 1969. In the late 1970s, NASA undertook one of the United States' biggest space endeavors: the development of the Space Shuttle. Howard McCurdy, Professor at the School of Public Affairs at American University and author of "Inside NASA," claims that President Nixon's approval of the Shuttle Program in 1972 was not prompted primarily by scientific needs, but rather to get California's stagnant economy back-on-track in the wake of the Vietnam War.

The first Shuttle mission, "Space Transportation System-1" (STS-1), successfully took to the skies in 1981. Only 5 years later, the Space Shuttle Challenger was lost on mission "STS-51L". In 1989, after a total of 32 shuttle missions, NASA was deprived of its convenient geopolitical excuse for its consistent over-budget shuttle missions as a result of having lost its major competitor the Soviet Union.

Since then, various arguments have been used to justify the costly American human space flight program. Economical arguments dominated in the 1990s, but failed to convince the public. "Claims of miracle cures and mystery crystals were widely disbelieved, and rightly so," says John Pike, a space technology expert and director of [globalsecurity.org](http://www.globalsecurity.org) (<http://www.globalsecurity.org>), a Washington, D.C.-based research group.

The prevailing, scientific justification for the Shuttle Program by NASA is to help build the International Space Station (ISS). However, also the ISS is coming under closer scrutiny amidst a political climate becoming increasingly hostile to funding international programs. John Pike: "With the space station consuming several billion dollars each year, nearly as much as the entire research budget of the National Science Foundation," (the budget of the National Science Foundation, <http://www.nsf.gov>, for the fiscal year 2002 is \$ 4.77 billion; NASA's budget for 2003 is approximately \$ 15 billion), "logic alone dictated that the cost of the space station was unlikely to be justified by its scientific merits." In fact, every single Space Shuttle round-trip costs American taxpayers \$ 400 million – approximately ten times the price estimated in 1972. Considering that there are approximately 4-5 missions a year, the price tag of NASA's Shuttle Program is enormous.

Furthermore, the grounding of the U.S. Shuttle Fleet after the Columbia tragedy means reducing the ISS crew from three to two members in the near future. This is due to the smaller Russian spacecraft which can only adequately supply two ISS crew. It is important to remember that shuttle missions were halted for as long as almost two-and-a-half years following the Challenger explosion. The current situation also may warrant an extended pause in the Shuttle Program. This only strengthens the case of the growing number of Shuttle- and ISS-critics who maintain that a crew of at least seven astronauts is necessary to run the ISS as a top-quality laboratory for the purposes of life sciences and microgravity research. A report by the National Research Council (NRC, <http://www.nas.edu/nrc/>) ("Factors Affecting the Utilization of the International Space Station for Research in the Biological and Physical Studies") is quite clear about this: "Without a solution to the crew availability problem, and other limitations in facility access and operations, the ISS can never achieve the status of a world-class research laboratory. [The current situation] provides a space station with less time available for research than 30 years ago on the U.S. Skylab."

The Lower You Go, The Less Time You've Got

In addition to the crew-issue on the International Space Station, NASA is facing the major challenge this year of keeping the ISS in space. Until now, a Space Shuttle must occasionally nudge the ISS in order to lift it as high as 8 miles each time to keep it from sinking. If delays persist for a year or more, some experts say, it may even become difficult to prevent the station from falling into earth's atmosphere. "The lower you go, the less time you've got," says John Pike, "Maybe the answer is that there's more than enough, or just enough, or more than enough for this year, but after that there's a real problem."

Withstanding all difficulties – 5 Shuttle flights were planned for 2003 in support of the ISS – NASA is determined to see this through. "We're going to find this problem and we're going to fix it and we're going to get back to flight," says Michael C. Kostelnik, the NASA Deputy Associate Administrator for the ISS and the Space Shuttle Programs, as quoted in the New York Times. Kostelnik also emphasizes that the Bush Administration was committed to seeing ISS expand, as it is "a key and essential staging ground for what comes next."

NASA Crisis: Action Needed

NASA is not troubled only by the problem-ridden, and now grounded, Shuttles and having to maintain an obviously insufficient, but nevertheless, costly space station.

According to the General Accounting Office (GAO, <http://www.gao.com>), human capital management is one of the top challenges NASA faces now and in the near future: Since 1993, NASA has cut jobs down from 25,000 to approximately 19,000 today. About 25% of the remaining, highly-qualified workforce – 60% of NASA employees hold either a masters or doctorate degree in science and engineering – is eligible for retirement within the next 5 years. In some NASA Centers, expertise is only “one-deep,” meaning that even a single retirement can be critical. “NASA’s challenges will soon become its crisis in human capital management.... Today, NASA’s ability to maintain a world-class workforce with the talent it needs to perform cutting-edge work is threatened by several converging trends. Each trend in isolation is a concern; in concert, the indicators are alarming.” This warning was recently voiced by Sean O’Keefe, NASA’s current administrator.

A Troubleshooter For NASA: Sean O’Keefe

O’Keefe began his career on Capitol Hill as a key aide to Republican Senator Ted Stevens from Alaska. In 1989, O’Keefe was named Chief Comptroller of the Pentagon by then Defense Secretary, Dick Cheney, and earned a reputation of not only being a skillful accountant, but also of combining analytical abilities with networking and rhetorical talents. It was no surprise when he was promoted to the rank of a Navy secretary at the Pentagon at age 36. With his predecessor, Lawrence Garrett, forced to resign in the aftermath of the “Tailhook Affair” (the affair was about sexual harrasment in the Navy), O’Keefe was able to establish himself as a successful troubleshooter. His overall qualifications made him a prime candidate to take over the troubled Space Agency. O’Keefe’s appointment as NASA’s administrator in January 2002 was made in an effort to reestablish the Agency’s former glory.

The “Shrinking Scientist And Engineer Pipeline”

According to O’Keefe, NASA’s ongoing troubles reflect a general crisis of America’s science and technology capabilities. This crisis has been emerging during the last decade. The number of American students pursuing degrees in disciplines essential to NASA – science, mathematics and engineering – has been declining over the last decade, as the NSF’s Report on “Science and Engineering Indicators” proves:

- ❑ The number of students enrolling in undergraduate engineering decreased by more than 20% between 1983 and 1999; graduate science & engineering enrollment also dropped by almost 20% between 1992 and 1999.
- ❑ From 1995 to 2000, the number of doctorates awarded annually in engineering has declined by 15%, in physics by 22% and even in computer sciences the number of doctorates dropped between 1999 and 2000.
- ❑ A decrease in enrollments can also be seen in aerospace programs.
- ❑ Whilst the number of American science and engineering students is dwindling, foreign students now account for 40% of graduate students in the United State’s engineering, mathematics, and computer science programs; in the fields of natural sciences the number of non-U.S.-citizens has grown to almost 25%.

Harsh Facts...

The U.S. Commission on National Security for the 21st Century also known as the “Hart-Rudman Commission,” recently published some serious warnings considering the future of science and engineering in the United States: “The harsh fact is that the U.S. need for the highest quality human capital in science, mathematics, and engineering is not being met...There will not be enough qualified American citizens to perform the new jobs being created today – including technical jobs crucial to the maintenance of national security. We lack not only the homegrown science, technology, and engineering professionals necessary to ensure national prosperity and security, but also the next generation of teachers of science

and math at the K-12 level... The nation is on the verge of a downward spiral in which current shortages will beget even more acute future shortages of high-quality professionals and competent teachers.”

As a consequence of the “shrinking science & engineering pipeline,” (O’Keefe in his statement before the Senate’s Committee on Governmental Affairs’ Subcommittee on Oversight of Government Management, the Federal Workforce and the District of Columbia on March 6, 2003) increased competition for people with technical skills arises as a further nationwide trend. Simply stated, scientists and engineers are no longer limited to traditional technical companies, but are sought after by various industries such as the banking and the entertainment industries and even academic institutions now offering very competitive salaries to world-class academics. Making things worse for NASA is that highly qualified science and engineering graduates’ interest in government employment is steadily declining (“The Unanswered Call to Public Service”, <http://www.excelgov.org/displayContent.asp?Keyword=ppp100101>).

In addition to these trends shared by NASA with other employers, NASA is also troubled by internal skill gaps. Too few scientists work in new and emerging technologies (nanotechnology, systems engineering, propulsion systems, information technology etc) whilst too many are employed in the traditional aeronautics field where NASA is proposing to cut funding by 4.5% over the next five years.

Chronically over-spent budgets, especially in the Shuttle and ISS programs, and incomprehensive accounting add to NASA’s ongoing problems. Regarding NASA’s accounting practices, the “U.S. House of Representatives Hearing Charter on NASA’s Fiscal Year 2004 Budget Request” reads: “The problem in making comparisons is exacerbated by the frequent previous changes NASA has made in its budget presentation. These changes make it difficult for Congress to conduct oversight of various programs – particularly the Space Shuttle and the ISS by making it difficult if not impossible to make year-to-year budget comparisons. (This is one reason it is difficult to answer the seemingly simple question of how much has been spent on Shuttle safety).”

Beyond Einstein...

Looking past the fiscal, political and administrative problems, genuine research continues at NASA. Two astronomical telescopes are expected to be launched using rockets (Pegasus XL and Boeing Delta II, respectively) in the next three months. Launches are also scheduled in May and June of two “Mars Exploration Rover” spacecraft headed to Mars where they will arrive in January 2004. They may answer questions about water sources believed to once have existed there.

In April 2003, NASA announced that \$ 135 million for the development of an Orbital Space Plane (OSP) – a next generation space vehicle providing crew rescue and transport capabilities to and from the ISS – will be awarded to three companies (Boeing, Lockheed Martin and a team including Orbital Sciences and Northrop Grumman). Though the OSPs may be safer than the Shuttles, they lack the capability of carrying large payloads. Thus NASA’s OSP-concept has already met some criticism and only the future will tell if the concept is a viable one.

Finally, if NASA’s budget proposal of \$ 15.5 billion for the fiscal year 2004 (a 3.1% increase over last year’s request) is approved, the Agency will embark on a number of new activities including the development of nuclear power and propulsion systems (Project Prometheus), research on optical communication technologies, investigating questions left unanswered by Albert Einstein’s theories (“Beyond Einstein”), new initiatives in climate change research, research on the effects of radiation beyond low Earth orbit (ISS is in low-Earth orbit), research on aviation security, quiet aircraft technology, the development of the next generation national airspace system in cooperation with the Federal Aviation Authority (FAA, <http://www.faa.gov>) and the launch of a new educational initiative which would inter alia use scholarships to attract new employees.

Perhaps the future of NASA is not as uncertain as the controversy might suggest. The NASA Administrator's ties to his former boss, Senator Ted Stevens (R), who happens to be Chairman of the Appropriations Committee, bodes well for the future of NASA. The Appropriations Committee oversees the budget process that annually allocates more than a half-trillion dollars in federal funds to various government programs, agencies and departments, including NASA.

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