The Challenges of the Second 50 Years in Space

The U.S. space program, which inspired the world and was the science driver for our last real economic growth, faces its worst crisis since the end of the Apollo program. Marsha Freeman reports.

NASA's first half-century, which we celebrate on Oct. 1, has demonstrated that there are no limits to man's creative potential, and that the most visionary challenges can be met by a society that is determined to mobilize the necessary resources.

During the space agency's first 50 years, the tools were developed to explore near-Earth space, and then to apply those technological capabilities to revolutionize productivity in industry, agriculture, medicine, communications, transportation, and basic economic infrastructure.

The ability to place scientific instruments in space allowed man, for the first time, to "see" the universe in the parts of the electromagnetic spectrum that had been hidden from him by the Earth's atmosphere. NASA's robotic explorers have allowed us to observe, at close range, the outer planets, comets, asteroids, and other bodies that had appeared as mere specks of light from Earth-bound telescopes.

But the greatest legacy of the first half-century is the exploration of space by man. Manned space flight provides the indicative proof that there are no frontiers that cannot be conquer by man. It demonstrates the courage that men must summon to go out into the unknown, and the commitment to excellence by those who send him there. Its societal impact is reflected in the popular appreciation of the unmatched difficulty of the endeavor, in the way the success of the 1960s Apollo manned lunar landing program has become part of our culture. This is epitomized in the commonly-used expression: "If we could land a man on the Moon, why can't we . . . ?"

Today, for the second time in its history, the American space program is facing an existential crisis. The first came in 1971, when, in order to "save money," in the throes of the financial crisis that led to the dismantling of President Franklin Roosevelt's Bretton Woods agreements, the last three Apollo missions to the Moon were cancelled. The plan to industrially develop the Moon was scrapped. Manned missions to Mars were taken off the table. Only the development of the Space Shuttle was approved, and that, with a funding profile that led to a six-year hiatus in manned space flights.

The hundreds of thousands of scientists, engineers, highly skilled industrial workers, and managers—the greatest treasure that had been created through the mobilization to land a man on the Moon—were now unneeded, most becoming unemployed. The physical infrastructure, in factories, research laboratories, and NASA centers, that had been created for Apollo, was left to rot, or was physically dismantled.

Now, the second crisis comes, not due to a lack of technology, but a failed national policy. The U.S. space

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In this artist's rendering, the Orion crew vehicle is approaching the International Space Station. In a rational program, Orion would have been ready to fly in 2010 when the Space Shuttle is scheduled to be retired. Due to a failed policy, there will be a five-year gap between manned vehicles.

agency is facing a period of five years when it will not have the ability to transport astronauts into space. NASA Administrator Mike Griffin has described this situation as "unseemly" (an understatement) for a nation that considers itself a world leader, has any national pride, and any concern about its future economic and national security. At risk today, once again, are the talents of scientists, engineers, production workers, and managers, many with decades of experience, who could soon be out on the street.

There is no segment of our national government or our policymaking institutions that escapes blame for this situation. It is now time to learn the lessons of this crisis, and fix it.

Why We Have a Space Program

While it is important to consider how the current crisis in the nation's space program developed and how it can be resolved, this cannot be done without looking back 50 years, to a time when we were on the threshold of the Space Age.

Space visionary Krafft Ehricke laid out the ontological foundation for the second great age of exploration, in 1957, even before the Soviet launch of Sputnik would open this new frontier.

In his *Anthropology of Astronautics,* he promulgated three fundamental laws to govern mankind's coming exploration of space:

> **First Law:** Nobody and nothing under the natural laws of this universe imposes any limitations on man except man himself.
>
> **Second Law:** Not only the Earth, but the entire Solar System, and as much of the universe as he can reach under the laws of nature, are man's rightful field of activity.
>
> **Third Law:** By expanding through the universe, man fulfills his destiny as an element of life, endowed with the power of reason and the wisdom of the moral law within himself.

Laying the philosophical basis for space exploration was understood to be necessary, because it was clear to Ehricke and other astute observers that there would be

opposition to this view of exploration as a moral responsibilty and economic imperative for mankind. Just as the American colonists had to wage a fight against the British Empire to establish a culturally superior new world, space enthusiasts would have to engage in the cultural war that was going to take place over space exploration.

Just five months after President Kennedy announced, before a Joint Session of Congress on May 25, 1961, that the United States would mobilize its resources "to land a man on the Moon, and return him safely to the Earth," space visionary Arthur Clarke presented his paper on "Space Flight and the Spirit of Man," at the American Rocket Society's meeting in October that year, held at the New York Coliseum.[1] The Society was preparing its Space Flight Report to the Nation for policymakers, under a committee chaired by Ehricke.

Clarke had written in 1946, that "with the expansion of the world's mental horizons may come one of the greatest outbursts of creative activity ever known. The parallel with the Renaissance, with its great flowering of the arts and sciences, is very suggestive." But it was clear to Clarke that not everyone would see it this way.

"Unfortunately," he wrote in 1961, "altogether too many educators, intellectuals and other molders of public opinion, still regard space as a terrifying vacuum, instead of a frontier with infinite possibilities." Typical of this attitude, though rarely so clearly expressed, is the following passage from Prof. Lewis Mumford's *The Transformation of Man* (1956). Mumford (1895-1990) was an historian, who decried the "dehumanizing" effect of cities and of technology, and had a guiding influence on anti-technology gurus, such as Amory Lovins and small-is-beautiful kook E.F. Schumaker, and the environmentalist movement.

"Post-historical man's starvation of life would reach its culminating point in interplanetary travel.... Under such conditions, life would again narrow down to the physiological functions of breathing, eating, and excretion.... By comparison, the Egyptian cult of the dead was overflowing with vitality; from a mummy in his tomb one can still gather more of the attributes of a full human being than from a spaceman."

Clarke argued that to turn back from the road that lay ahead in space would be "treason to the human spirit." He added, that were mankind to choose the wrong path, "there will be none to carry our dreams across another dark age."

The creation of the Club of Rome in 1968, and its explicit call for limits to growth—the predecessor of today's calls by the British royals, Al Gore, and their followers, to turn back the clock of economic growth, and destroy mankind, supposedly in order to save the environment—sharpened the fight.

In the early 1970s, Krafft Ehricke described the exploration of space, leading to the industrial development of new resources, and the "urbanization" of space to extend human civilization throughout the Solar System, as the "Extraterrestrial Imperative." Why an "imperative?"

If life on Earth is condemned to remain on one planet, he explained, this "closed system" would eventually lead to the exhaustion of natural resources, geopolitical competition for what is left, the pauperization of most of the world's population, and, eventually, wars. Moreover, believing that mankind has inherent limits creates a "small-mindedness," Ehricke stated, which eliminates the very possibility of meeting challenges. Philosophically, he explained, the zero-growthers, the neo-Malthusians, "who think we have reached the end of our tether, live in an even more unreal world than those who, in the last century, advocated closing the patent offices because their mousy minds could not comprehend that there might be anything left to invent."

The Work of Generations

In an extraordinary speech on Jan. 19, 2007 in Houston, NASA's Griffin followed in Ehricke's footsteps, describing the "real reasons" for space exploration, as juxtaposed to the "acceptable reasons," like economic spinoffs, aid to education, improved national security, and the other justifications that are used before Congress.

Griffin came to head the space agency in 2005, with an academic background, as well as real-life experience, in science, engineering, and management, in industry, the defense establishment, and the space program, and is able to stand back and see the space program in its broader context. He is known for speaking his mind, even if it's unpopular.

"We like to do what I'll call monument building,"

1. Arthur Clarke, who passed away on March 19, 2008, became well known for his fictional writings, such as "2001: A Space Odessey," which was made into a film. From the 1930s through the 1960s, his writings focused on the coming applications of space technology, and the opportunities of space exploration.

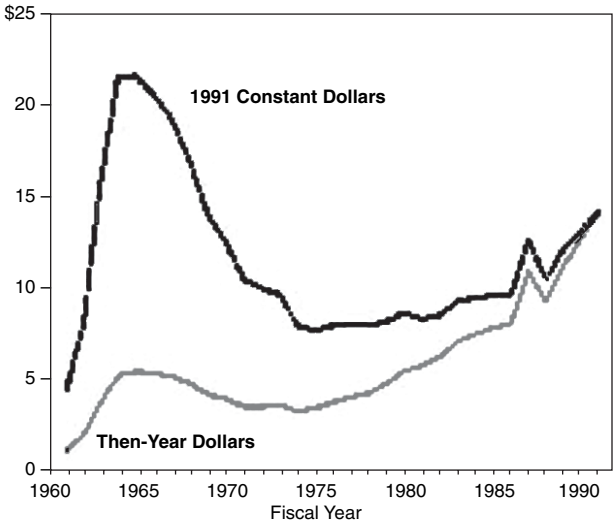
Griffin said in his speech. "We want to leave something behind for the next generation, or the generation after that, to show them that we were here, to show them what we did with our time here. This is the impulse behind cathedrals and pyramids, and many, many other things. . . ."

How does the space program fulfill this "real reason"? Griffin explained: "It is my contention that the products of our space program are today's cathedrals." Like the cathedral builders, Griffin stated, to work in the space program, "you have to value hard work. You have to be willing to defer gratification, and to spend years doing what we do, and then stand back and see if it works. We learn how to leave a legacy, because we work on things that all of us will not live to see—and we know it. And we learn about accepting the challenges of the unknown, where we might fail, and to do so not without fear or apprehension, but to master it and to control it, and to go anyway."

Griffin's favorite quote from President Kennedy, which he has repeatedly recalled, is that we go to the Moon, "not because it is easy, but because it is hard." In these ways, the space program stands apart from all other "line items" and agencies in the Federal budget. Its funds are not a "cost," but an investment.

If the nation's commitment to its space exploration program is a measure of its commitment to its future, the White House and the Congress both get failing grades.

FIGURE 1
NASA Budget Trend
($ Billions)



Source: NASA

The end of plans for manned space exploration following the Apollo program collapsed NASA spending, starting in 1966. The temporary up-tick in spending in 1987 represents the $1 billion President Reagan gave to NASA, to replace the Space Shuttle Challenger, which had been destroyed in an accident.

How We Got Where We Are

The current crisis has its origin in the the space policy that the Bush Administration asserted in November 2001, which was indicated by the appointment of Office of Management and Budget (OMB) bean-counter Sean O'Keefe, who was recommended by Dick Cheney to be NASA administrator.

In the face of a projected and predictable cost overrun in the International Space Station R&D program, O'Keefe stated at a Nov. 2, 2001 Congressional hearing that the OMB would not support any increases in the NASA budget, and that "technical excellence at any cost is not an acceptable approach." Apparently, O'Keefe had never read the 1958 act that created the space agency, which gives it the mission of technological excellence and leadership, and never mentions the word "cost."

The Administration's proposed "solution" to the station cost overrrun was to "downsize" the project, eliminating some of the planned U.S. elements. The most critical, in terms of the current situation, was the elimination of the emergency crew return vehicle, or Orbital Space Plane. This vehicle was to be ready by 2004, to transport crews of up to seven at a time, to and from the station. It would be parked at the station as an emergency return vehicle, ready in case any member of the crew needed to be returned to Earth, or should the station need to be abandoned.

The decision was made by the Bush Administration that, to "save money," the U.S., European, Japanese, and Canadian station partners, would instead rely on the Russian Soyuz capsule to provide emergency crew rescue capability. In itself, there is nothing wrong with this decision. Depending upon our Russian partners for access to the station was especially critical during the multi-year stand-down of the Space Shuttle following the Columbia accident in 2003, when, without the Soyuz, the station would have been left unmanned.

But refusing to provide a U.S. back-up rescue vehicle capability was penny-wise and pound-foolish. Should there be a technical problem with the Soyuz that

necessitated its stand-down, there would be no space rescue capability available, because the Shuttle cannot stay in space for more than a couple of weeks. With no Soyuz at the station, in accordance with safety rules, there could not be a crew on board.

Worse, cooperation with Russia in space is not immune to the political machinations and geopolitics that often characterize relations between the world's two leading space and nuclear powers. More than once, U.S.-Russian cooperative space projects have had collateral damage inflicted on them, when political tensions have occurred.

It was against this backdrop, of having already created a potentially untenable future for the space station and the Space Shuttle, that Bush promulgated his flawed "Vision for Space Exploration."

A Fuzzy Vision

Nothing focuses the mind, and allows new options, like a crisis. After the Space Shuttle Columbia broke apart on Feb. 1, 2003, during its reentry into the Earth's atmosphere, an investigation was conducted into the accident. The Columbia Accident Investigation Board (CAIB) looked beyond the circumstances of the accident itself, and recognized that one broader problem affecting the space program was the lack of a long-range vision. The Board also pointed to years of underfunding of the Shuttle program, which resulted in the delay or cancellation of planned safety upgrades, the lack of adequate spare parts, and other problems that created the circumstances that led to the loss of Columbia and its crew.

In response to that report, as well as the frequent reminders by the space community and some in Congress that NASA's capabilities were much greater than its resources, on Jan. 14, 2004, Bush announced his Vision for Space Exploration, at NASA headquarters in Washington.

The goals of the new program were to use the Space Shuttle to complete assembly of the International Space Station; develop a manned vehicle to replace the Shuttle, for missions to Earth orbit and to the Moon; develop the rocket needed to take astronauts back to the Moon; and later, to carry out a manned mission to Mars.

There is nothing new or original about these goals—they have been promoted by the space community since 1969. But each time this long-range plan has been put forward, the political will to realize it was absent. The program put forward by George W. Bush in 2004 was no exception. The way it was proposed to be carried out, from the very beginning courted disaster. It has compounded the mistakes made in cancelling the replacement for the Shuttle in 2001, and led to the crisis we face today.

In order to avoid providing the space agency with increased funds to develop the new manned vehicle, named Orion, to be ready when the Shuttle was scheduled to be retired, the Bush Administration mandated that the bulk of the money needed for the new development would come from the money that would be "saved," once the Shuttle stopped flying in September 2010.

At the five-year funding level for the space agency that had been proposed by the White House in 2004, NASA estimated that when the Shuttle stopped flying, it would take at least three more years to bring Orion on line. So for all of the recent loud complaining on Capitol Hill about the "gap" in U.S. manned space flights, and the fact that the U.S. will have to buy seats for its astronauts on the Russian Soyuz, this gap did not develop since the war between Russia and Georgia; the gap was built in to the original program! The rational approach, as Griffin has stated, would have been to have the replacement Orion vehicle ready to fly the day the Shuttle was retired.

Moreover, the fact that the Administration repeatedly refused to send up to Capitol Hill *even the budget level that had been promised to NASA*, has stretched the original three-year gap to five years.

The White House 'Jihad'

Over the past two years, astute observers could see, and Griffin kept telling anyone who would listen, that with constantly-reduced funding levels, the gap was going to increase. Leaders in the House and Senate made a serious effort to add $1-2 billion to the NASA budget during the past two budget cycles, to try to alleviate the problem. They explained that this increase in funding would help make up some of the shortfall that resulted from the cost of repairing the damage NASA centers suffered during Hurricane Katrina, and the cost of returning the Shuttle to flight after the Columbia accident. But this Congressional effort failed. Worse still, two years ago, the Congress abdicated its responsibility and never passed a budget—only a continuing resolution. That sliced $575 million from the already inadequate White House NASA budget request.

It is not only the manned part of our national space program that has been affected by perennial budget

NASA

NASA Administrator Mike Griffin describes space exploration as comparable to the building of the cathedrals of the Middle Ages, requiring the dedicated work of generations.

shortfalls. In order to keep enough money in the Orion and Ares rocket programs to show any progress at all (without which, NASA fears, the whole effort would be cancelled), the agency has had to make cutbacks in other areas. Space science and planetary exploration projects have been cancelled, delayed, or stretched out. Aeronautics research was cut to the bone. The only reason the Shuttle program has not suffered the same treatment is that no one has (yet) proposed risking the lives of the astronauts to save money.

Griffin took on the job three and a half years ago of implementing this flawed Vision for Space Exploration, because he passionately believed it necessary to put the U.S. back on the track of a visionary long-term program, even within the constraints imposed by the White House. Now his job has become more and more difficult, if not impossible. Griffin, who has refused to propitiate Congress with promises that could not be kept, or downplay the seriousness of this crisis, has plainly stated his view of the situation.

In an e-mail sent to NASA officials and agency advisors on Aug. 18, obtained by the *Orlando Sentinel*, Griffin states: "Exactly as I predicted, events have unfolded in a way that makes it clear how unwise it was for the U.S. to adopt a policy of deliberate dependence upon another power for access to ISS [the International Space Station]. In a rational world, we would have been allowed to pick a Shuttle retirement date to be consistent with Ares/Orion availability . . . and we would have been provided the necessary budget to make it so. . . . The rational approach didn't happen, primarily because for OSTP [the White House Office of Science and Technology Policy] and OMB retiring the Shuttle is a jihad rather than an engineering and program management decision. Further, they actively do not want the ISS to be sustained, and have done everything possible to ensure that it would not be."

In his e-mail, Griffin provided his view of the prospects of obtaining the Congressional waiver needed in order to buy seats on the Russian Soyuz, and continue an American presence on the ISS: "We might get relief somewhere well down the road, if and when tensions [with Russia] ease, but my guess is that there is going to be a lengthy period with no U.S. crew on the ISS after 2011."

No Good Options

At this point, there are no "good" options for resolving the loss of American space transportation capability, and possibly, U.S. access to the space station.

Members of Congress of both parties, and both Presidential candidates, suddenly horrified that there will be the five-year manned space gap between the Shuttle's 2010 retirment and the deployment of the new Orion craft, during which only the Russians can take people into space, have jumped on the bandwagon of proposing the extension of Space Shuttle flights past 2010. However, whether or not this is done, it does not solve the problem.

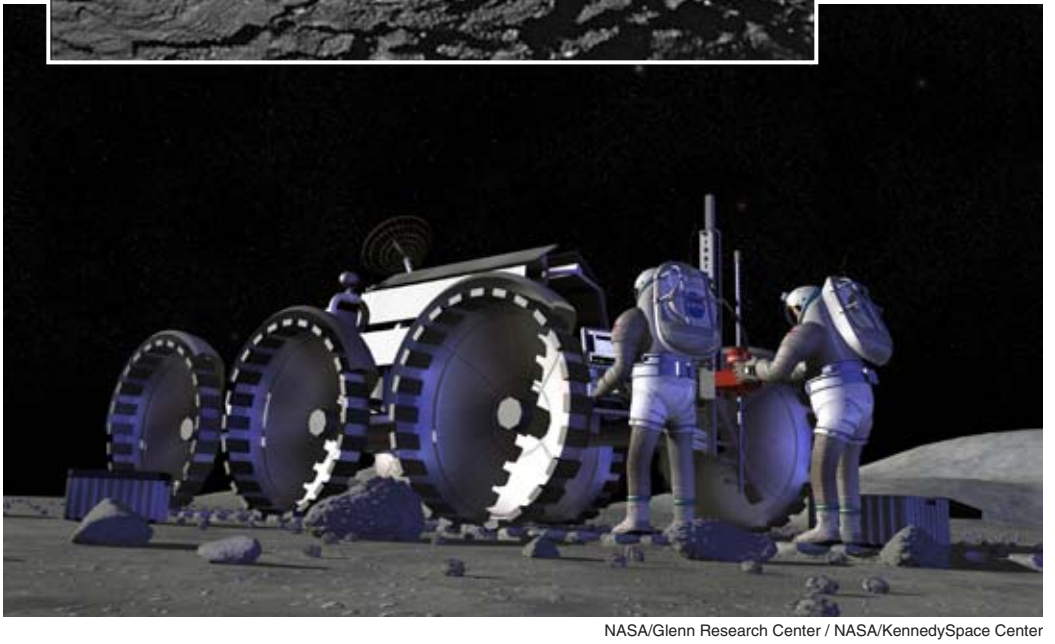
There are well-reasoned differences in judgment on whether Shuttle flights should extend beyond the now-scheduled retirement date. NASA has explained that, while this *can* be done, because none of the critical manufacturing or launch infrastructure for the Shuttle program has yet been irrevocably dismantled, the question is whether it *should* be done.

In August, Griffin asked Shuttle managers to carry out a study to determine what it would take to keep flying the Shuttle. This is not Griffin's preferred option, but he anticipates that question will be asked by the next President and the next Congress. In August, Sens.

John McCain (R-Ariz.), Kay Bailey Hutchison (R-Tex.), and David Vitter (R-La.) sent a letter to President Bush, asking that he direct NASA to take no action that would preclude operating the Shuttle beyond 2010.

As a first estimate, Griffin has stated that to keep the Shuttle ready to fly will cost in the ballpark of $3 billion per year. But if "new money" is not appropriated to cover that cost, it will come out of the already underfunded Orion and Ares rocket programs. This would push their development further into the future, meaning that the gap would not be closed, but extended; Orion and Ares would still be waiting for the Shuttle to retire, to have sufficient funds to proceed.

Griffin has explained that, regardless of what the financial cost may be of a couple of Shuttle flights per year in order to rotate crews on the space station after 2010, a major concern is that the Shuttle is inherently a high-risk vehicle, and the more missions you fly, the higher the odds of another catastrophic accident.



Left: The Apollo 15 astronauts set up drilling equipment and scientific experiments during their stay on the lunar surface, during the Summer of 1971. Below: In this artist' rendering, two astronauts drill into the lunar surface, to retrieve samples for geologists to study.

NASA/Glenn Research Center / NASA/KennedySpace Center

The major motivation on the part of the Florida Congressional delegation in proposing the continuation of Shuttle flights is to reduce, or at least delay, the projected layoffs at the Kennedy Space Center, during the five years there is nothing to launch. In a commentary printed in the June 2008 issue of *Aerospace America*, Rep. Dave Weldon (R-Fla.) stated that the projection is for over 64,000 lost jobs. He has introduced H.R. 4837, to authorize additional funds to extend the Shuttle program and to bring the next-generation spacecraft on line sooner. In fact, only these two measures, combined, would have any palpable positive effect.

But in an interview with *Space News* on Sept. 2, Griffin said that with the refusal by Congress to act to accelerate the Orion program over the past three years, "time has essentially run out." Describing the situation as "water under the bridge," he said, "We really can no longer significantly accelerate" the programs.

For all of the political posturing that has occurred

since the conflict between Russia and Georgia, and calls for a "jihad" against U.S.-Russian space cooperation, no matter how long we fly the Shuttle, the United States, and its partners, will remain dependent upon Russian transport.

The Space Shuttle can only stay parked at the space station for about two weeks. In order for there to be a long-term crew aboard, there has to be a vehicle on site that can return them to Earth at any time, in case of emergency. Only the Russian Soyuz can do that. So, even if the Shuttle can deliver and return crews until Orion is ready to fly, the Soyuz will still be needed for emergency crew return.

As Griffin explained in a Sept. 4 interview with CBS News, in order for NASA to pay Russia for seats on its Soyuz, the Congress must waive the sanctions of the Iran, North Korea, Syria Non-Proliferation Act. This was done three years ago, but that contract expires on Dec. 31, 2011. Now another waiver to the law is required, to allow NASA to contract for the Russian transport in time.

According to the barter system among the station's international partners, in return for Canada, Japan, and Europe contributing hardware to the station, the U.S. is obligated to provide transportation for their crew members. Therefore, if the Congress does not grant the waiver, in 2012, we may have left the space station entirely to the Russians to operate and use—out of spite!

Time is of the essence. The Russians need three years to manufacture a Soyuz vehicle. If the U.S. does not have a contract in place soon, whether or not we fly the Shuttle, there will be no American, European, Canadian, or Japanese astronauts on the station three years from now.

One Global Solution

It should be no surprise that the only real solution to NASA's crisis, is the same approach required for reversing the financial blowout now devastating the globe: an agreement among Russia, the United States, China, and India to put the world financial system back under control, with an FDR-style New Bretton Woods, and to adopt shared missions for the common good of mankind—including space exploration.

Does that seem impossible? Not at all. It is still true that if we could land a man on the Moon, there is not any other challenge we could not meet.