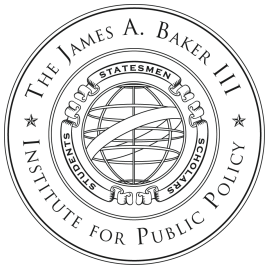

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Restore the Vision

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I. America's Space Program: An Overview

If one goes back a half-century in time, we find that 1961 was a year of some historical significance. The year brought forth events that have had a lasting effect on both the nation and the world. On January 20, 1961, John F. Kennedy was inaugurated as the 35th president of the United States. The election of the new young president symbolized optimism and youth in America, the rise of a new generation. The country was just coming out of the 1950s and had no idea what the 1960s would bring. In his inaugural speech, the new president set the bar high with his famous challenge, "Ask not what your country can do for you—ask what you can do for your country." And there were indeed challenges to be met ahead. Less than three months later, on April 12, 1961, a cosmonaut from the Soviet Union, Yuri Gagarin, was launched into orbit around the Earth. Five days later, on April 17, 1961, 1,400 Cuban exiles launched an ill-fated U.S.-sponsored invasion at the Bay of Pigs on the south coast of Cuba. The Soviet Union's spectacular orbital flight furthered the national concern that had been generated three and one-half years earlier when the Soviet Union launched the first man-made satellite, Sputnik, in October 1957. With this epoch event and the disastrous U.S.-sponsored invasion of Cuba, the new president's administration, while harboring great expectations, had gotten off to a very rocky start.

The Soviet Union, our Cold War adversary, had clearly demonstrated its technical prowess and capabilities. It was not until May 5, 1961, almost a month after Gagarin's epic flight, that the United States launched the first American in space, Alan Shepard—but only on a suborbital flight that went to an altitude of over 116 miles and traveled 303 statute miles downrange from Cape Canaveral, Florida. Nine months were to go by before John Glenn made the first U.S. orbital flight on February 20, 1962. Kennedy was feeling great pressure to have the United States "catch up to and overtake" the Soviet Union in the "space race." The earlier shocks of Sputnik in 1957 and Gagarin's history-making flight greatly embarrassed the United States. In addition, the Bay of Pigs fiasco put further pressure on the new president.

The president felt he had to initiate a program that the United States had a strong chance of achieving before the Soviet Union and that would clearly demonstrate America's technological

leadership. The president presented a special message to the Congress on urgent national needs on May 25, 1961. The message covered a number of critical areas. And then he spoke of space:

> "Finally, if we are to win the battle that is now going on around the world between freedom and tyranny, the dramatic achievements in space which occurred in recent weeks should have made clear to us all, as did the Sputnik in 1957, the impact of this adventure on the minds of men everywhere, who are attempting to make a determination of which road they should take. Since early in my term, our efforts in space have been under review. With the advice of the vice president, who is chairman of the National Space Council, we have examined where we are strong and where we are not, where we may succeed and where we may not. Now it is time to take longer strides, time for a great new American enterprise, time for this nation to take a clearly leading role in space achievement, which in many ways may hold the key to our future on Earth."

The president then identified his goals in space:

> "I therefore ask the Congress, above and beyond the increases I have earlier requested for space activities, to provide the funds which are needed to meet the following national goals:
>
> "First, I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the Moon and returning him safely to the Earth. No single space project in this period will be more impressive to mankind or more important for the long-range exploration of space; and none will be so difficult or expensive to accomplish. We propose to accelerate the development of the appropriate lunar spacecraft. We propose to develop alternate liquid and solid fuel boosters, much larger than any now being developed, until certain which is superior. We propose additional funds for other engine development and for unmanned explorations—explorations which are particularly important for one purpose, which this nation will never overlook: the survival of the man who first

> makes this daring flight. But in a very real sense, it will not be one man going to the Moon—if we make this judgment affirmatively. It will be an entire nation. For all of us must work to put him there.
>
> "Secondly, an additional $23 million, together with $7 million already available, will accelerate development of the Rover nuclear rocket. This gives promise of some day providing a means for even more exciting and ambitious exploration of space, perhaps beyond the Moon, perhaps to the very end of the solar system itself."

The "great adventure" had begun. That adventure for human spaceflight has continued for lo these last five decades, each decade bringing its own new challenges. In a little more than seven and one-half years after President Kennedy's historic speech, on Christmas Eve of 1968, astronauts Frank Borman, James Lovell, and William Anders were circling the Moon. And less than seven months later, astronaut Neil Armstrong was walking on the lunar surface. Five more landings on the Moon were to follow. And as the crew of the last lunar mission, Apollo 17, was on their voyage back to an Earth landing on December 19, 1972, the crew of the first manned mission to U.S. space station Skylab was well into their training for a launch in May 1973. In July 1972, five months prior to the launch of Apollo 17, the contract to build the space shuttle orbiter had been awarded to Rockwell International.

The year 1972 also heralded another historic event in the history of the space program. On May 24, 1972, shortly after the flight of Apollo 16, President Richard Nixon and Premier Alexei Kosygin of the Soviet Union signed the Agreement between the United States of America and the Union of Soviet Socialist Republics Concerning Cooperation in the Exploration and Use of Outer Space for Peaceful Purposes. Under the agreement, the United States and the Soviet Union agreed to carry out projects for developing compatible rendezvous and docking systems of United States and Soviet manned spacecraft and stations in order to enhance the safety of manned flight in space and to provide the opportunity for conducting joint scientific experiments in the future. The first experimental flight to test these systems was to be conducted during 1975, with the docking of a U.S. *Apollo*-type spacecraft and a Soviet *Soyuz*-type spacecraft.

The following year, 1973, saw the successful completion of three missions to the Skylab space station, one for 28 days, a second for 59 days, and a third for a duration of 84 days. This year also saw another historic event in human spaceflight as the United States and Europe agreed in August 1973 on flying a European built research laboratory, Spacelab, in the payload bay of the space shuttle orbiter for cooperative scientific research missions, and agreed to fly European astronauts in space.

The first joint U.S.-Russian mission, involving the docking of the Russian *Soyuz* spacecraft and an *Apollo* spacecraft using a commonly developed docking system, was successfully flown in July 1975. In addition to the successful docking, the mission furthered understanding between those involved in the preparations and execution of the flight. Lasting friendships were developed that were to be renewed in the 1990s with United States involvement in the shuttle-Mir program, and with Russian participation in the International Space Station (ISS).

The development and testing associated with the new space shuttle also dominated the 1970s. The new technology associated with the space shuttle main engine proved challenging as was the development of the new, large five-segment solid rocket boosters. A Boeing 747 aircraft was modified to carry the new shuttle orbiter. The first orbiter to be built, *Enterprise*, was carried aloft by a 747 in order to accomplish approach and landing tests at Edwards Air Force Base in California in 1977. These tests were invaluable in proving the approach and landing characteristics of the new spacecraft. Gulfstream II aircraft were modified to fly like the new orbiter and to serve as trainers for the astronauts flying the new spacecraft. New and major facility modifications of the Apollo facilities in Florida were undertaken to support the new vehicle.

With the testing, preparations, and training complete and the new revolutionary spacecraft ready for launch, the first flight of the space shuttle on April 12, 1981, was a success. The shuttle was the first reusable orbital spacecraft. That flight was followed by a second test flight, the first reuse of a manned orbital space vehicle and the first test of the Canadarm, the shuttle's mechanical arm. The next two flights would see the first landing of the shuttle at White Sands, New Mexico, and the flight of the first Department of Defense payload. The research and

development flights ended with the successful completion of the fourth flight of the shuttle. The fifth and sixth flights of the Shuttle saw satellite deployments, multiple Comsat satellites on the fifth flight, and a tracking and data satellite on the sixth flight. The seventh flight of the shuttle saw the first American woman flown in space, multiple Comsat satellite deployments, and the first retrieval of a satellite. The first flight of an African American astronaut occurred on the eighth flight of the shuttle, along with a Canadarm test with large payloads and the first night landing of the space shuttle.

On the ninth flight of the space shuttle in November 1983—a scientific research flight—the spacecraft carried for the first time the European-built spacelab, along with two European astronauts. Spacelab was to fly on 21 additional shuttle missions between November 1983 and April 1998. By the time the shuttle made its initial flight in 1981, the United States had flown 31 human missions in space in the previous 20 years. The 1980s were to see 32 flights flown from April of 1981 through November of 1989. One of the 32 was the tragic tenth flight of space shuttle *Challenger* in January 1986, with the loss of the shuttle and the seven-person crew. Seven flights were subsequently flown in the 1980s after the loss of *Challenger* and the implementation of the corrective actions resulting from the accident.

In his January 25, 1984, State of the Union address, President Ronald Reagan directed NASA to build a space station within a decade and to invite other countries to join the United States in the endeavor. The European Space Agency, Canada, and Japan were to all to join with the United States in the space station program with a formal agreement signed between the partners in 1988.

NASA originally estimated that the space station would cost $8 billion. It was envisioned as three separate orbital facilities: an occupied base for the crew and two automated platforms for scientific experiments and Earth observations. The cost estimate grew rapidly throughout the 1980s and redesign followed redesign. The automated platforms were deleted, and the occupied base was reduced in size. A capability to ensure that astronauts could return to Earth in an emergency had not been included in the initial design and had to be added to the configuration.

In July 1989, six months after taking office, President George H.W. Bush gave a speech commemorating the 20th anniversary of the Apollo 11 landing on the Moon. In that address, he committed the United States to returning humans to the Moon and going on to Mars, a program referred to as the Space Exploration Initiative. He also endorsed the space station as the cornerstone of that effort. NASA subsequently conducted a study in 1989 on the implementation of a very extensive program in response to the president's goals. They projected the proposed program would exceed $500 billion in costs over 30 years.

Subsequently, in 1991, General Thomas P. Stafford chaired the Synthesis Group, which was comprised of engineers and scientists, not only from NASA but from across the government. They did a comprehensive study evaluating the implementation of the president's proposal. Their report, *America at the Threshold*, recommended the creation, by executive order, of a multi-agency National Program Office. This organization would include NASA and personnel from the Department of Defense and Department of Energy. They proposed a less expensive approach than had been previously recommended, a national approach that would make use of resources throughout the government to implement the president's proposed program. Congressional concern, however, over a previous NASA study and its associated costs, and NASA's poor record on controlling space station costs, had weakened any congressional support for President H.W. Bush's plan, and it was not implemented.

By December 1990, the cost estimate for the space station had grown to $38.3 billion, and Congress directed NASA to again redesign it. NASA released its redesign of the station in March 1991 with a new cost estimate of $30 billion, including launches. There was, however, continuing congressional concern over the program and its cost growth.

In January 1993, as President William Clinton took office, NASA announced more cost growth in the program, and Clinton directed NASA to redesign the station to reduce costs. By the summer, a new design was beginning to emerge and it was released in September 1993. The Clinton White House announced, with the release of the redesigned station, that Russia would join the space station program as a partner. Russia had agreed to build several modules, including two that were integral to the station, and agreed to launch two *Soyuz* spacecraft a year

to serve as "lifeboats" and several *Progress* spacecraft per year to help the station maintain its orbit. Their participation was divided into two phases. Phase 1 involved space shuttle flights to the Mir space station, with Russian cosmonauts flying on the shuttle, and an American astronaut flying aboard a *Soyuz* spacecraft, and American astronauts engaging in long-duration expeditions aboard Mir.

Phase 1 allowed the United States to learn from Russian experience with long-duration spaceflight and fostered a spirit of cooperation between the two nations. It proved to be instrumental in ensuring the success of Phase 2, the construction and operation of the station. The first shuttle mission to Mir was flown in February 1995, and the tenth and last flight to the Mir was flown in June 1998. In addition, seven American astronauts spent almost 1000 cumulative days in space aboard Mir during the course of seven long-duration expeditions.

All together during the 1990s the space shuttle flew 63 missions, ten to the Mir station and two international space station assembly flights. The remaining missions were devoted to science and such tasks as the deployment of major science facilities, satellite repair missions, and Hubble Space Telescope servicing missions.

The new decade saw the space shuttle completing the assembly of the international space station and performing a number of supply missions to the new station. The shuttle flew a total of 35 flights from 2000 through 2010. The majority of these flights were devoted to the international space station. Two flights were flown to service the Hubble Space Telescope and one flight was devoted to flying a "spacehab" module outfitted for science; the module provides the shuttle with supplemental cargo space. That flight—STS-107, or the space shuttle *Columbia*—came to a tragic end during reentry with the loss of the seven-person crew and the orbiter. Twenty-five flights were subsequently flown during the remainder of the decade after shuttle flights were resumed in July of 2005, following the implementation of the corrective actions resulting from the accident.

II. Why the Space Shuttle Program Must Continue

The decision to end the space shuttle program was made in 2004 by President George W. Bush when he initiated a new program to return to the Moon. On January 14, 2004, he proposed that NASA refocus its programs and resources with the objective of returning humans to the Moon and plan for the prospect of humans going to Mars sometime in the distant future. The plan, referred to as the Vision for Space Exploration (VSE), had three goals. The first one was to complete the International Space Station by 2010.The second goal was to develop and test a new spacecraft, *Orion*, by 2008 and conduct its first manned mission no later than 2014. The third goal was to return to the Moon by 2020, and use it as a launching point for missions beyond the Moon. The president said the shuttle's task over the next several years would be to help finish the assembly of the International Space Station, and in 2010 the space shuttle would be retired from service.

In a paper I co-authored with Neal Lane, Baker Institute Senior Fellow in Science and Technology, published by the American Academy of Arts and Sciences in 2005, we stated that President George W. Bush's NASA plan was incomplete, in part because it raised serious questions about the future commitment of the United States to astronomy and to planetary, earth, and space science. We felt it was unrealistic from the perspectives of cost, its timetable, and the related technological capability. The plan raised expectations that were not matched by the administration's commitments. Indeed, we stated that pursuit of the NASA plan, as formulated, was likely to result in substantial harm to the U.S. space program. The first part of the NASA plan, as proposed, was to be funded by adding $1 billion to the NASA budget over five years, and reallocating $11 billion from within the NASA budget during the same time frame. These amounts were within the annual 5 percent increase the administration planned to add to the NASA base budget (approximately $15 billion) starting in fiscal year 2005. This budget, however, was very small in comparison to the cost of going to the Moon with the Apollo program. The cost of the Apollo program was approximately $25 billion in 1960 dollars or $125 billion in 2004 dollars, and the objectives of the NASA plan were, in many ways, no less challenging. The U.S. Congress made it clear with its NASA appropriation for fiscal year 2005 that it had serious questions about the NASA plan. The administration's budget request for fiscal

year 2006 fell more than $500 million short of what the president committed when he announced his plan. Over the period 2006-2009, the administration's out-year projections fell $2.5 billion short of what NASA had said would be required to implement the plan. It became clear in the 2006 budget that space science would be given a low priority. While the overall NASA budget increased by 2.4 percent, the basic research portion was cut by 7 percent. NASA's contributions to interagency initiatives were also cut: nanotechnology by 22 percent, networking and information technology research and development by 70 percent, and the Climate Change Science Program by 8 percent. Even with these dramatic cuts in science programs, and equally alarming cuts in Earth observations, which were vital to weather and climate forecasting, the NASA budget did not allow for serious progress toward the ambitious mission to send humans to the Moon, then eventually to Mars.

In a subsequent paper, "United States Space Policy: Challenges and Opportunities Gone Astray," published in July 2009 by the American Academy of Arts and Sciences—again co-authored with Neal Lane—we stated that "If we were correct in our earlier paper to assert that the space program and NASA were at a critical juncture in 2005, in 2009 the future of the U.S. space program is very much in doubt. The narrow vision of the Bush administration in launching VSE and its subsequent failure to fund the effort adequately have led to serious questioning of the nation's commitment to space and, consequently, to a steady erosion of NASA and the aerospace industry that supports its missions."

We recommended that space shuttle flights be extended through 2015, thereby reducing reliance on Russia for transportation to the ISS and providing the large up-and-down mass capability needed by all ISS partners. NASA studies had shown that the space shuttle could be safely flown, at a reduced flight rate, through 2015. This would preserve America's independent access to space and would also preserve much of the current workforce and provide a smoother transition between programs. These flights would provide essential support to the ISS and would allow the United States to meet its commitments to its international partners.

With the change of administrations in 2009, President Barack Obama established "The Review of U.S. Human Spaceflight Plans Committee," chaired by former Lockheed Martin chairman and

CEO Norman Augustine, to assess the current status and possible future of the lunar program, the Constellation program. The 2004 plan to develop and test a new spacecraft by 2008 was not accomplished. The original 2005 schedule for the Constellation program had projected that the Ares I rocket and *Orion* capsule, two essential elements, would be available to support the ISS in 2012, two years after the scheduled retirement of the shuttle. The revised program schedule in summer 2009 showed that date had slipped to 2015. An independent assessment of the technical, budgetary, and schedule risk to the Constellation program performed for the committee indicated that an additional delay of at least two years was likely. This meant that Ares I and *Orion* would not reach the ISS before the space station's planned termination date, which in the summer of 2009 was projected to be 2015. Continuing the Constellation program would have resulted in a gap of at least seven years in America's ability to launch astronauts into space. The United States would be totally dependent on Russia for that time period for transportation to send our astronauts to the ISS.

The committee, in considering the allocated budget for the exploration program, felt that for meaningful human exploration to be possible it would be necessary to increase NASA's base budget by $3 billion above the FY 2010 figures, and human exploration beyond low-Earth orbit was not considered to be viable at all. Most major vehicle-development programs face technical challenges as a normal part of the process, and the committee felt Constellation was no exception. While significant, the committee expected the engineering problems could have been solved. However, they also felt that the solutions would add to the program's cost and delay its schedule even further.

As author and Naval War College professor Joan Johnson Freese has stated,

> "Constellation (the Vision for Space Exploration) was doomed from its inception as a mismatch between the ways-means-ends required for any kind of programmatic success. As the Augustine Commission said, 'NASA's budget should match its mission and goals.' President Obama was therefore faced with the choice of continuing to pretend that in the worst economic times faced by the U.S. since the Great Depression and while U.S. troops are still fighting on foreign

> shores, an infusion of new money would be feasible to allow programmatic completion anywhere near the timelines laid out in President Bush's 2004 Vision for Exploration speech that led to Constellation; or pulling it off life support."

Since the plan was announced in 2004, a sizeable gap in the United States' capability to send humans to space has been created, and with that gap there are serious concerns regarding the nation's capability to retain the talented engineers and scientists, "the best and the brightest," that have been so essential to successfully flying humans in space. The Augustine Committee did not identify any credible approach to employing new capabilities that could shorten the flight gap to less than six years. With a down period of that length, it is doubtful that this essential talent could be retained. The Augustine Committee felt that the only way to significantly close the U.S. human spaceflight gap was to extend the life of the shuttle program.

Now after 50 years of continuity and overcoming the challenges of each of the successive decades, the United States space human spaceflight program is facing a period of great uncertainty. When the space shuttle completes its last flight this year, the United States will no longer have a capability to fly humans in space, a capability it has basically had since Alan Shepard's flight on May 5, 1961. Americans will continue to fly in space but they will be flying in a *Soyuz* spacecraft, thanks to the support of their Russian colleagues. The United States will go from flying and operating the most advanced and capable spacecraft in the world to flying as passengers on another nation's spacecraft, albeit a very reliable one.

A new spacecraft is, however, being developed by the United States—the *Orion* spacecraft, which a presidential review committee said could, at best, be ready to fly in 2017. It is a spacecraft with very limited capability that takes us back to the space capsules of the 1960s, landing in the ocean. There is also a new initiative that is to be funded by the government: assisting new start-up companies to develop spacecraft. The new space vehicles being developed by these companies, with the exception of one concept, also return us to the space capsules of the 1960s by once again recovering with parachutes in the ocean. With this major change in direction, one might conclude the course we have pursued over these past 30 years—with all its attendant investments, flying with a reusable winged vehicle and landing on a runway—has

taken us down the wrong road. And now we are going to go back in time to try to recapture the uncertain benefits and the disadvantages of the designs and concepts of the past. And yet at the same time it is the nation's desire to maintain its leadership in space. We have successfully worked with 15 other nations of the world to build the International Space Station, the world's most complex technological project. And now when we can gain the benefits of this significant investment, unfortunately we will not be able to provide the up-mass or the down-mass needed to operate the station and accomplish the desired science and experiments. That the country is faced with this situation does not reflect well on the nation's planning and vision. The problem did not develop overnight. An honest and realistic assessment of current and planned future activities could have led to an acceptable solution.

With the termination of the space shuttle program there is an obvious need to get astronauts and supplies to the International Space Station in low-Earth orbit. Present planning places the future of the nation's human spaceflight program and the support of the space station on new start-up, nontraditional, and largely unproven companies being funded by the government. There are expectations on the part of some of those involved that we are entering an era of commercial space flight, and that somehow that will enable these new companies to make activities advance more dramatically and faster than in the past. There are those who even say this new commercial approach could get Americans to Mars in the current decade. The new approach is referred to as "commercial" and yet the only significant customer for these new companies is the U.S. government. The commercial spacecraft are not yet rated as safe for carrying humans to space and in order to become "man rated," new safety requirements and government oversight will have to be levied on these new companies. This historically, in the view of the aerospace industry, brings additional costs and schedule delays.

The director general of the European Space Agency (ESA), Jean-Jacques Dordain, has stated that the International Space Station is facing lean times as a result of the U.S. shuttle phaseout and has said project planning for transport to the ISS had been "anarchy." The shuttle has been the key means to take humans and freight to and from the ISS, and Dordain stated that NASA made a unilateral 2004 decision to stop the shuttle.

The space shuttle's retirement after the mission launched on July 8, 2011, means that the station will depend entirely on the Russian Soyuz system for transporting astronauts. The European automated transfer vehicle (ATV) and the Japanese H-II transfer vehicle (HTV) are unmanned supply ships, as is Russia's Progress freighter. These three cargo systems are all designed to be one-way systems, which mean they burn up in the atmosphere after leaving the station. The *Soyuz*, which does return for a landing, cannot take large nonhuman payloads, such as large experiments or equipment that needs to be returned to be repaired on Earth. Dordain has said the scheduled phaseout of the space shuttle meant "we are not in a very comfortable situation, and that's just a euphemism." The International Space Station was designed to be not only built and assembled with the space shuttle, but it was designed to be logistically supported by the shuttle. The uncomfortable situation cited by Dordain is an understatement.

On June 12, 2011, the *New York Daily News* printed an opinion article by Christopher Kraft, former director of NASA's Manned Spaceflight Center in Houston, and Scott Spencer, a transportation management consultant, that emphasized the need to continue to operate the space shuttle in support of the station. As they state in their article, "For more than 10 years, space crews from the United States, Russia, and other countries have successfully lived and worked year round, in six-month shifts, on the International Space Station, where they have conducted scientific research. In the coming years, that work will continue—but with a crucial safeguard missing: the space shuttle fleet that gives human beings a unique capability to fix the space station's guidance system and rocket thrusters in the event of a terrible failure."

They point out what will become a clear and present danger: "Loss of control of the space station would mean a catastrophic reentry into the Earth's atmosphere of the massive structure—the largest object ever placed in orbit around the Earth, measuring over three football fields long and weighing more than 400 tons. The tons of falling debris that would survive reentry would pose an unprecedented threat to populated areas around the world." They point out that the space station does have redundant life support and control systems that might make such a failure unlikely. But to say it is so redundant that it could never happen ignores the tragic lessons learned due to overconfidence in fail-safe technology in disasters throughout history, from the sinking of the Titanic to the nuclear reactor crisis in Japan. Such a catastrophe would have

significant international ramifications and liability for the United States, Russia, and the other space station partners.

In the event of damage from a fire, space debris, or a potential collision from the frequent docking of manned or unmanned commercial resupply spacecraft, the space station backup systems offer little margin of safety. If the life support or guidance systems or rocket thrusters are damaged, the station could need a rapid rescue mission to stay in orbit.

The shuttles have unique capabilities as repair vehicles. They are the only spacecraft that have the vital airlocks and life-support supplies, and the robotic arm that is needed to move the equipment necessary for spacewalking repair crews. Spare parts needed for critical repairs have been taken up by the space shuttle, and stowed on the station—but none could be installed to repair and regain control and use of the $100 billion space station if it is deemed uninhabitable for repair crews. The *Soyuz* and other potential commercial spacecraft that are intended to support the station all lack the life support systems needed for the multiple six-hour repair spacewalks.

Kraft and Spencer urged that before the last scheduled shuttle flight lifted off on July 8, an urgent discussion needed to take place between the United States and its international space station partners to keep the shuttle fleet in service to provide a vital safety margin for repairing the space station in the event of a critical systems failure. They also urged, to prevent any gap in this crucial repair capability, that NASA delay the last shuttle launch so that additional external fuel tanks and other parts can be built to support additional shuttle flights in 2012. In addition, they requested congressional hearings on the subject, as the space shuttle fleet provides the only insurance against a catastrophic reentry of the space station. Those discussions and the requested congressional hearings did not take place before *Atlantis*' launch. That only increases the urgency that they be held now.

It would appear that Jean-Jacques Dordain of ESA shares some of the same concerns pointed out in their article. With the significant investment that has been made by all the partners in the international space station, and its potential loss, or the inability of the partners to support it

logistically without the shuttle, consideration should be given to Kraft and Spencer's recommendation. As they say, "It is never wise to play Russian roulette in space."

Responsible leadership demands a more positive and enlightened course for the nation's space program. Our space policy should be based on building on the foundation of our major programs. Our programs should all be portions of a fabric that together represents our overall space policy. It should not be politically based or based upon corporate interests, but represent a way forward that is not only in the best interest of the country but also the world community. The uncertainties and risks facing the nation's civil space program today clearly show the absence of such a policy. Ending a very successful space shuttle program that is the envy of the space faring nations of the world, when it is clearly needed to support the International Space Station and our partners, and to avert the possible catastrophic reentry cited by Chris Kraft and Scott Spencer are prima facie evidence that such a policy does not exist. As reporter Dennis Overbye wrote in his *New York Times* essay on July 4, 2011, when commenting on the end of the shuttle program and the last space shuttle Hubble Space Telescope servicing mission, "Hubble is alone now with the stars, its vision as peerless as designed. But America still has no vision at all for its space program, no plan for where to go next or how."

On September 12, 2012, it will be 50 years since John F. Kennedy spoke these words at Rice University Stadium:

> "We mean to be a part of it—we mean to lead it. For the eyes of the world now look into space, to the Moon and to the planets beyond, and we have vowed that we shall not see it governed by a hostile flag of conquest, but by a banner of freedom and peace. We have vowed that we shall not see space filled with weapons of mass destruction, but with instruments of knowledge and understanding.
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> "Yet the vows of this nation can only be fulfilled if we in this nation are first, and, therefore, we intend to be first. In short, our leadership in science and in industry, our hopes for peace and security, our obligations to ourselves as well as others, all

> require us to make this effort, to solve these mysteries, to solve them for the good of all men, and to become the world's leading space-faring nation.
>
> "We set sail on this new sea because there is new knowledge to be gained, and new rights to be won, and they must be won and used for the progress of all people. For space science, like nuclear science and all technology, has no conscience of its own. Whether it will become a force for good or ill depends on man, and only if the United States occupies a position of preeminence can we help decide whether this new ocean will be a sea of peace or a new terrifying theater of war. I do not say that we should or will go unprotected against the hostile misuse of space any more than we go unprotected against the hostile use of land or sea, but I do say that space can be explored and mastered without feeding the fires of war, without repeating the mistakes that man has made in extending his writ around this globe of ours.
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> "There is no strife, no prejudice, no national conflict in outer space as yet. Its hazards are hostile to us all. Its conquest deserves the best of all mankind, and its opportunity for peaceful cooperation may never come again."

The course of the nation's human space program today will not continue to fulfill the vision that young president spoke of that fall afternoon 49 years ago, and no degree of rationalization can change it. Chris Kraft and Scott Spencer's recommendations merit acceptance. But over and above those recommendations, a space policy and the programs that support President Kennedy's vision are urgently needed by the nation today.