FINAL REPORT
of the Commission on the Future of the United States Aerospace Industry

November, 2002

Commission on the Future of the United States Aerospace Industry

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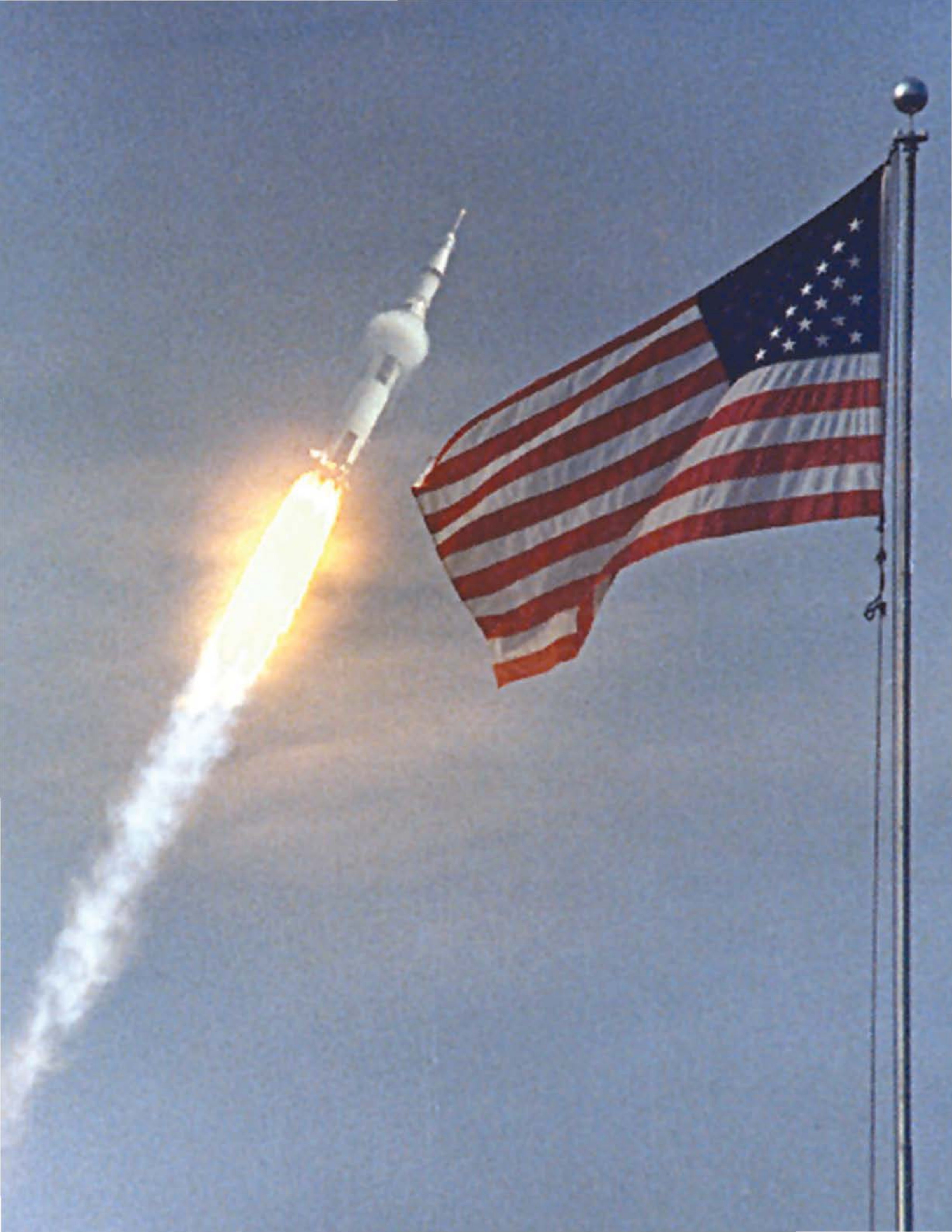
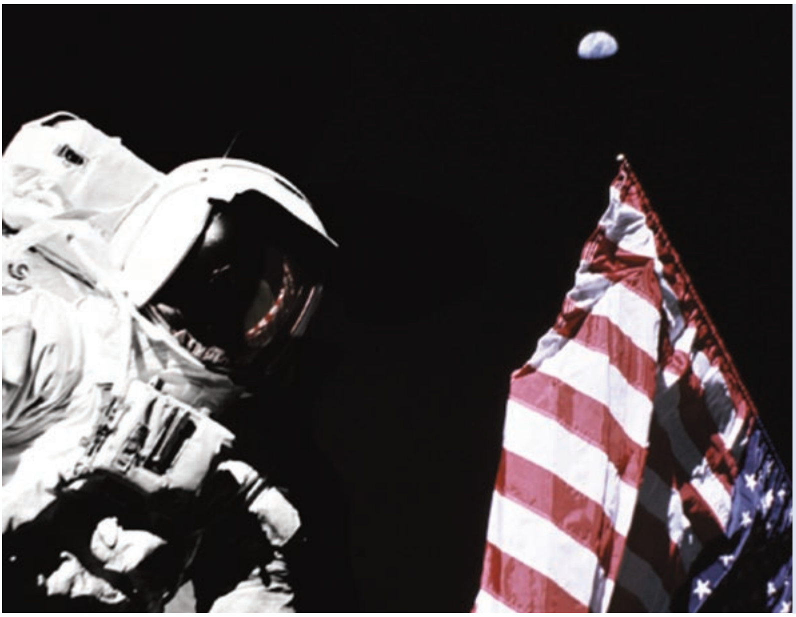




RECOMMENDATION #3: The Commission recommends that the United States create a space imperative. The Department of Defense, the National Aeronautics and Space Administration and industry must partner in innovative aerospace technologies, especially in the areas of propulsion and power. These innovations will enhance our national security, provide major spin-offs to our economy, accelerate the exploration of the near and distant universe with both human and robotic missions, and open up new opportunities for public space travel and commercial space endeavors in the 21st century.

Chapter 3

Space: Its Special Significance

Nations aspiring to global leadership in the 21st century must be space-faring. Freedom, mobility, quality of life and the ability to do the difficult things that define leadership will be enhanced and discovered on the space frontier. For the vision and the commitment that leadership requires, space is an imperative.

The United States should recognize the space imperative from its own history. The global legacy we achieved in the latter half of the 20th century was in large part tied to space successes. Humans on the moon, orbiting in space laboratories, space science discoveries and profound new military capabilities all played a role in showing the world our technological prowess and helped us succeed in Cold War competition.

Today, however, a sense of lethargy has infected the space industry and community. Instead of the excitement and exuberance that dominated our early ventures into space, we at times seem almost apologetic about our continued investments in the space program. Yet Japan, China, Russia, India and France, to name a few, see space as a strategic and economic frontier that should be aggressively pursued.

So should we.

Objective: The Ability to Do Great Things

The challenge we face on the space frontier is to build from dreams and concepts, to new technologies and destinations, to the political will to move forward. For nearly two decades, we have been satisfied to limit our dreams, rely upon proven technologies and invest little in building public or political support for space initiatives. But the potential to do great new things has never been clearer.

The truth is that the limitations to space progress are real: significant expense to get to orbit, a hostile and highly limited environment once on-orbit and a lack of strong public advocacy for moving ahead. We must overcome these limitations and move forward.

Issues

Access to Space: Cost to Orbit is High

Clear consensus exists in the space community that reducing the cost to orbit is an essential ingredient for progress. The expense per pound of lifting humans, cargo and satellites into orbit has effectively limited us to utilizing space for only the most critical national missions. The result has been a narrowing, rather than a broadening, of our space ambitions.

Decreasing launch costs has been a fundamental goal for the space launch industry. However, little progress has been made to date. A heavy lift Expendable Launch Vehicle (ELV) costs approximately $10,000 per pound to orbit. The Space Shuttle, although originally designed to reduce costs per pound to orbit from $10,000 to $1,000, never achieved its promised cost savings.[1]

Survey data indicate that launch demand has significantly decreased. We would expect that significantly lowering the cost to orbit might reverse this trend. A second or third generation launch vehicle based on new, advanced technology could phase out today's expensive ELV and Space Shuttle operations and open new commercial markets. Associated technology could also: improve control center operations and operational security; reduce environmental concerns; and mitigate launch, flight and recovery operational and environmental constraints. The operational model for a next generation space launch vehicle needs to move incrementally closer to the turnaround capabilities of today's passenger airline operations.

ISSUES

- Access to Space
- Propulsion for the Solar System and Beyond
- Power for Space Operations
- National Security
- Space Launch Infrastructure
- Commercial Space
- Science

Figure 3-1 NASA Derived Cost Estimate per Pound to Orbit

AVERAGE / MEDIAN US LAUNCH COSTS PER POUND					
Vehicle	LEO (lb)	GTO (lb)	Cost Median ($M)	Avg. LEO Cost/lb	Avg. GTO Cost/lb
Pegasus XL	975	N/A	$25	$25,652	N/A
Minotaur	1,406	N/A	$13	$8,892	N/A
Athena I	1,804	N/A	$17	$9,146	N/A
SSLV Taurus	2,904	880	$19	$6,543	$21,591
Taurus 2X10	3,036	986	$34	$11,199	$34,497
Titan II	4,180	N/A	$35	$8,373	N/A
Athena II	4,543	1,298	$24	$5,283	$18,490
Delta II 73XX	6,151	1,960	$56	$9,023	$28,313
Delta II 74XX	7,042	2,508	$56	$7,881	$22,129
Delta II 79XX	11,224	3,483	$63	$5,613	$18,090
Delta II 79XX Heavy	13,517	4,807	$70	$5,142	$14,458
Atlas IIA	16,095	6,745	$80	$4,970	$11,860
Delta III	18,238	8,382	$85	$4,661	$10,141
Delta IV M	18,920	8,580	$97	$5,127	$11,305
Atlas IIAS	18,960	8,182	$98	$5,143	$11,917
Atlas IIIA	19,008	8,881	$95	$4,972	$10,640
Atlas IIIB	23,580	9,849	$95	$4,008	$9,594
Atlas V 400	27,500	11,000	$99	$3,582	$8,955
Delta IV M+	29,920	13,464	$97	$3,242	$7,204
Atlas V 500	44,110	18,040	$114	$2,584	$6,319
Titan IVB	47,696	19,000	$400	$8,386	$21,053
Delta IV H	56,760	27,280	$155	$2,731	$5,682
Average Cost/lb				**$6,916**	**$15,124**
Median Cost/lb				**$5,213**	**$11,888**

LEO: Low Earth Orbit **GTO: Geostationary Transfer Orbit**

Reducing the cost to orbit could change the economic calculus of space. The use of revolutionary reusable launch vehicles (RLV) is well within our grasp in this decade. Developing the next generation of RLVs (in low, medium and heavy lift configurations) could dramatically improve both the affordability and reliability of access to space. The National Aeronautics and Space Administration (NASA) and Department of Defense (DoD) have begun discussions to achieve this goal.

Space Shuttle Launch from the Kennedy Space Center, Florida.

NASA's Space Launch Initiative (SLI) is a funded development effort intended to look at more reliable, cheaper and more frequent access to space through the development of a second generation reusable launch system. However, to date, NASA's SLI program does not include funding for demonstration flights.

Whereas the National Aerospace Initiative (NAI), a joint DoD and NASA program, is focused on exploiting and developing new and innovative technological capabilities in the areas of high-speed/hypersonics, access-to-space and space technology. The NAI will develop and demonstrate a portfolio of critical technologies that will enable the achievement of many common DoD and NASA goals such as: supersonic/hypersonic capabilities; safe, affordable, launch on demand space access; and responsive payloads for quick deployment and employment of space capabilities.

Prototype of a NASA X-38 Crew Return Vehicle.

Integrating the SLI and NAI initiatives could provide the nation with RLV technologies needed to enable the development of revolutionary air and space systems. The DoD could contribute significantly to air-breathing propulsion technologies, serving air mission needs and simultaneously providing a first stage platform for an RLV. NASA is working toward a next generation spacecraft that could provide a powered crew vehicle as a second stage of a two-stage RLV.

> "Attempts at developing breakthrough space transportation systems have proved illusory."
>
> Commissioner Buzz Aldrin

The Commission believes that the nation would benefit from a joint effort by NASA and DoD to significantly reduce the cost and time required to access space by integrating NAI and SLI. Such an effort would not only build on the capabilities of both organizations but also provide the "critical mass" of funding needed to create the necessary breakthroughs in propulsion.

Propulsion for the Solar System and Beyond: In Need of Breakthrough

To date, all spacecraft that have left Earth have simply coasted to their destination on ballistic trajectories. After they leave low-Earth orbit, their engines generally do not turn on again until it is time to slow down at the destination. In some cases the spacecraft gain additional energy along trajectories that "sling shot" them past other planets. Transit times will be significantly reduced if fuel were burned along the way, vastly increasing the craft's speed.

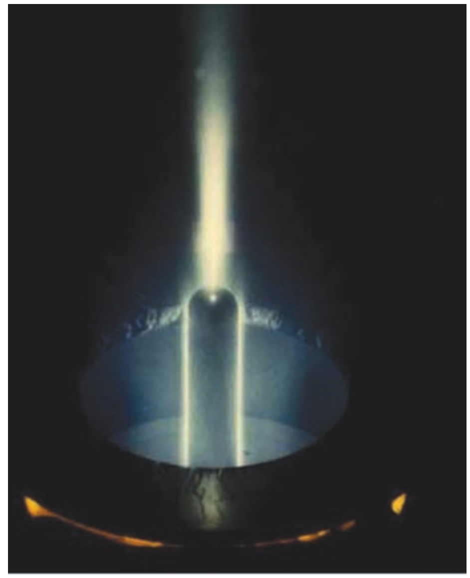
Over the longer term, investment in the development of more advanced propulsion systems (e.g., nuclear—by splitting or fusing atoms—to produce hot plasmas, matter/anti-matter annihilation reactions) will lead to faster transit times, improve operational flexibility and reduce the radiation impacts for long duration human exploration missions.

Nuclear energy could produce a high-temperature plasma that would potentially reduce the transit time for a manned mission to Mars from seven or eight months to about twelve weeks. Since powered flight would be much less dependent on orbital mechanics, the crew would also benefit from having the flexibility to return to Earth on their own schedule. A successful plasma design would reduce transit times and also result in a tremendous advantage for spacecraft payloads since less weight would have to be allotted

Figure 3-2 Example Transit Times to Mars for Different Propulsion Types

Destination	Propulsion	Transit Time - One Way
Mars	Chemical / Gravity Assist	28 - 32 weeks
Mars	Nuclear / Plasma	12 weeks
Mars	Antimatter	6 weeks

Source: NASA



Plasma propulsion will help reduce transit times through the solar system.

for fuel. NASA and the Department of Energy (DOE) currently conducts antimatter research. Although matter/antimatter reactions as a source of propulsion are far from being reality, the initial research results are encouraging. See Chapter 9 for additional information on propulsion.

The Commission believes that, once the time to explore many parts of the solar system has been reduced to reasonable durations—months instead of years—the political imperative to do so will follow.

Power for Space Operations: A Limiting Factor

What limits the performance of most spacecraft, including the International Space Station (ISS), is the amount of power that can be generated from solar energy. Increasing available power, both on orbit and beyond orbit, could expand opportunities in military, civil, and commercial space applications.

The Commission believes that the nation would benefit from a joint effort by NASA and DoD to significantly reduce the cost and time required to access space.

International Space Station, October 16, 2002.

The concept of using solar power satellites to beam power to Earth has been a distant dream. But, the use of such satellites as a "refueling station," to collect solar energy and beam it to on-orbit assets is worth exploring.

Solar or nuclear power stations capable of supplying on-orbit power could also have commercial potential. Selling power as a space utility is the kind of business arrangement that the space community has long needed. The enhanced power would prove to be a huge benefit to ISS. It could provide sufficient energy to conduct commercial activities not now possible within the station's limited power capabilities.

In addition, others looking to commercial use of space could design their own free-flyer modules equipped with an antenna to receive power, thus needing little more than an emergency backup capability on board. See Chapter 9 for additional information on power.

The Commission believes that once there is affordable, abundant power in orbit, public and private investments in space systems and exploration will follow.

National Security: Not Capitalizing on Space-Based Opportunities

The U.S. military continues to benefit from a generation of satellites that were built during the Cold War. Advanced technologies, however, will open up opportunities for a new generation of space capabilities, such as laser communications, space-based radar and on-demand access to space. These would transform military operations while simultaneously addressing other national needs, such as homeland defense and air transportation.

MILITARY USE OF SPACE. The military will increasingly rely on space-based communications, navigation, surveillance and reconnaissance systems for: moving its forces around the world; conducting global, precision power projection operations; and defending the homeland. The military and intelligence community will also use global reconnaissance and surveillance systems to continuously monitor the intentions and actions of terrorists, rogue nations and emerging world powers. The civil aviation system should use these same capabilities to improve dramatically the safety, security and capacity of the nation's air transportation system.

The Titan IVB is the largest unmanned space booster used by the Air Force.

Planetary Defense. Near-Earth Objects (NEOs) pose a potentially serious threat for humankind. Scientists are now certain that a major asteroid or comet was responsible for the mass extinction of the dinosaurs.

The U.S. Air Force (USAF) is currently conducting concept exploration studies for a constellation of satellites designed to detect and track man-made satellites in Earth's orbit.[2] The Commission believes that these studies should be broadened to include detection of asteroids. U.S. Strategic Command officials are also reviewing a concept for a clearinghouse that gathers and analyzes data on potential Earth impacts from asteroids. In addition, the National Security Space Architect is currently, as part of the Space Situational Awareness Architecture, integrating the use of space and ground-based surveillance systems. Given these actions, planetary defense should be assigned to DoD in cooperation with NASA.

The Commission believes that the nation needs a joint civil and military initiative to develop a core space infrastructure that will address emerging national needs for military use and planetary defense.

Space Launch Infrastructure: Aging

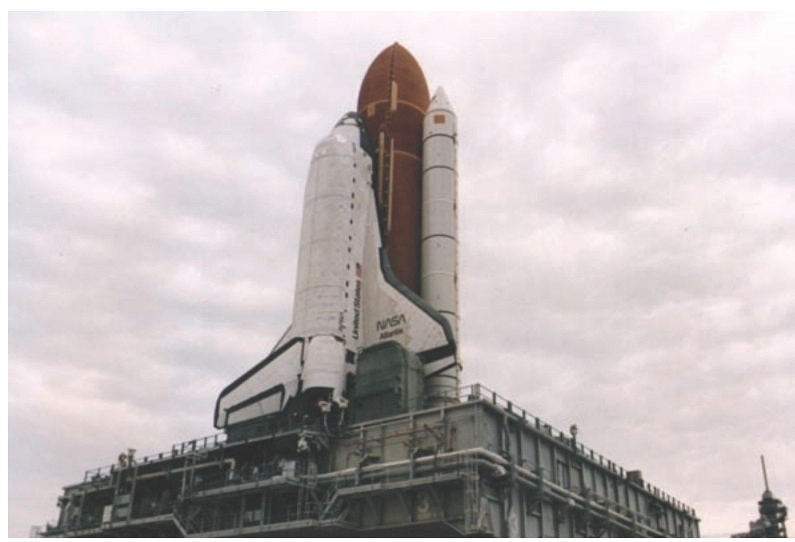
The current replacement value (CRV) of infrastructure at NASA's Kennedy Space Center (KSC) is estimated to be $3.9 billion; and $3.0 billion at DoD's Cape Canaveral Air Force Station (CCAFS). Current maintenance funding at KSC is below the National Research Council's recommended minimum of 2 to 4 percent of CRV. NASA's investment has been about 1.5 percent of CRV.

As a result, at NASA's KSC:[3]

- The cable plant has 275 miles of tar-paper ducts that are collapsing; the air pressurized cable jackets are failing to keep water out thus producing shorts; and cable insulation in the plant is deteriorating leaving bare wire exposed.
- The Vehicle Assembly Building has sustained siding and bolt failures due to hurricanes and seasonal high winds. Its 35 year-old roof requires frequent external patching, and platforms and nets have been installed below the roof deck to catch falling debris. Overall, the structure is badly deteriorated and severely corroded.
- Ten miles of 4-inch high-pressure gaseous nitrogen and helium pipelines to the Space Shuttle launch

Artist's concept of a catastrophic asteroid impact with the Earth. Life near the impact would be instantly wiped out from the effects of high temperatures and pressures.

The Crawler/Transporters, used to move the assembled Space Shuttle system to the launch pad, are over 30 years old.



complexes are also 35 years old and severely corroded.

- The Crawler/Transporters, used to move the assembled Space Shuttle system to the launch pad, are over 30 years old, reaching the end of their useful life, and many subsystems are unsupportable due to age.
- The checkout, control and monitoring subsystem developed in the 1970s for shuttle testing and launch is so old that there aren't enough spare parts for 10 percent of its components. NASA began to upgrade this subsystem in 1996, but it will not be completed until 2007.

DoD support infrastructure at CCAFS has similar problems:[4]

- Many systems have numerous components that have exceeded their life expectancy. This includes electrical distribution; water distribution; waste water system; heating, ventilation and air conditioning; and fire protection systems; as well as the airfield.
- Some supporting infrastructure systems are 45 to 55 years old.
- Multiple components have no replacement parts due to either obsolete technology or no manufacturer.
- A corrosive environment leads to unplanned failures.

The Commission believes that clearly a new structure for operation and management structure for these space facilities would be desirable. Such a structure would have to take into account the different missions of the USAF and NASA while at the same time assuring timely and consistent upgrades of vital infrastructure. Therefore, the USAF and NASA should explore privatization and "municipalization" options to deal with their space infrastructure problems. NASA should also consider encouraging additional public and private investment in its field centers by turning over day-to-day management responsibilities to state government, universities and/or companies. This could also help deal with the problem of operational costs.

Commercial Space: A Capacity and Demand Mismatch

In the future, the civil and commercial sectors will look to space for new products and services that will create new markets, much as they did for telecommunications and commercial remote sensing. The scientific community will have the opportunity to explore the universe and gain access to information about our planet, its atmosphere and the solar system. The public will benefit by having the opportunity some day to live, work, and vacation in space.

But the reality is that today we are not even close to achieving those opportunities and dreams. Domestic launch vehicle capacity and satellite manufacturing capabilities far exceed both domestic and international launch market demand. The U.S. commercial space industry continues to lose access to markets as demand decreases and international competition increases. This industry segment will not overcome these obstacles without government support. New regulations and incentives will be necessary to bolster this important market until there is a turnaround in demand, not unlike what was done in the early rail and airline industries. Additionally, if government expects industry to be a partner in developing the

Kennedy Space Center's Vehicle Assembly Building.

tremendous expensive supporting infrastructure, then there must be an expectation that these investments will result in a strong business case. Data from the Federal Aviation Administration (FAA) shows a decline in launch activity since 1967. See Figure 3–3.

The launch activity forecast shows that most organizations expect launch service demand to continue to decrease. While the ability to forecast launch demand is not an exact science, the agencies and organizations providing this information all agree on the declining trend.

Launch demand trends hold little promise for resurgence in the U.S. space launch industry.

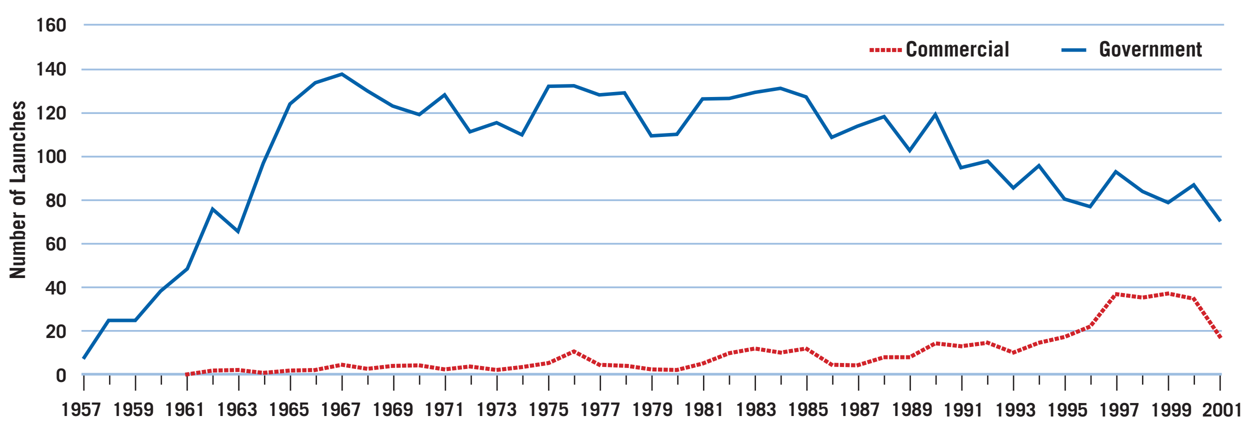
Both launch activity and their associated revenues are declining. Overall, the FAA recorded 16 worldwide commercial orbital launches in calendar year 2001. (See Figure 3-3.) This number is significantly less than in prior years. There were 39 in 1999 and 35 in 2000. Arianespace captured 50 percent of the world market during 2001. In that year, the United States and Russia each had 19 percent, while the Sea Launch Company had 12 percent. Revenues from the 16 commercial launch events in 2001 were an estimated $1.5 billion, a 44 percent decrease from the 2000 total of approximately $2.7 billion. European revenues were estimated at about $948 million, while Russian revenues were about $178 million, Sea Launch earned approximately $170 million, and U.S. commercial launch revenues were about $167 million. Launch revenues are attributed to the country in which the primary vehicle manufacturer is based, with the exception of Sea Launch, which is a multinational company.[5]

The FAA continues to scale back its forecast of commercial launch activity over the next decade. It expects that 268 commercial launches will take place during the next decade—a figure that is 16.5 percent lower than the agency's forecast in 2001.[6]

The Teal Group, a national research organization, publishes an annual forecast of "proposed payloads" for launch. While this is a slightly different approach to the FAA model, the data show a corresponding decrease for the next decade of about 18.4 percent for these four worldwide categories of payloads: commercial, military, civil, and university/other. The Teal Group outlook for just the commercial sector shows a "23 percent decline compared to last year , and a 47 percent drop compared to our 2000 model."[7]

Space Tourism and Launch Markets. To understand future dynamics for launch markets, NASA commissioned the ASCENT Study as part of the

Figure 3-3 Historical Commercial and Government Launches (1957-2001)



Source: FAA

SLI. This study concluded that the only space launch sector with growth potential over the next two decades is passenger space travel. All other sectors—both commercial and governmental—have flat-line outlooks.

Throughout the period 2002 through 2020, the forecast for launches is, in essence, constant at between 60 to 80 launches per year. The figure below provides a forecast for public space travel over that period. The forecast assumed a cost of $20 million per seat for an orbital flight and was based on a highly credible survey of public space travel, where a statistically valid sample of high net worth individuals was interviewed. Seven percent of the sample indicated that they would be willing to pay $20 million for an orbital flight, if available.

Respondents to the ASCENT Study survey were aware that it would be necessary to go to Russia for a six-month training period and would be a risky venture. To arrive at projected launch forecasts, the survey responses were discounted for a number of considerations, such as health, and in order to allow a build-up curve for this new industry to become established. Even with these caveats, there is a potential demand for 50 passengers a year at current prices. Most of the respondents, however, indicated a preference for training and flying from the United States. The survey results also showed that demand for a 15-minute sub-orbital flight costing $100,000 could produce a market for up to 500 passengers per day by 2020.[8]

While today there is an extremely limited number of people in the world who can afford a $20 million vacation, we should marvel not at the price but at the fact that the demand exists at all. Given what people do spend on vacations and amusement park rides and adventure travel, we have no reason to doubt that the demand will rise without limit as the price drops.

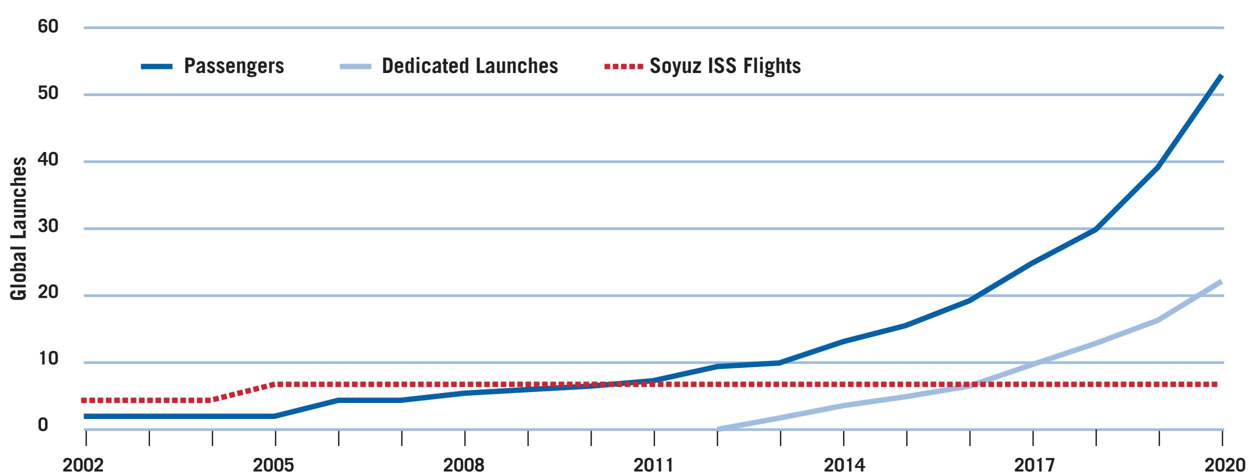
The Commission believes that there are opportunities to help alleviate the capacity and demand mismatch in the commercial launch market. Space tourism markets may be key to help fund the launch industry through the current market slump by providing increased launch demand and thus helping to drive launch costs down.

Science: Untapped Opportunities

The quest for knowledge, which has universal appeal, brings with it the need for attendant technological and engineering feats that make discovery possible.

These feats will afford the scientific community the opportunity to explore the universe and gain access to information about the planet, its atmosphere and the solar system. Basic science can produce more and

Figure 3-4 Public Space Travel Forecasts (Orbital)

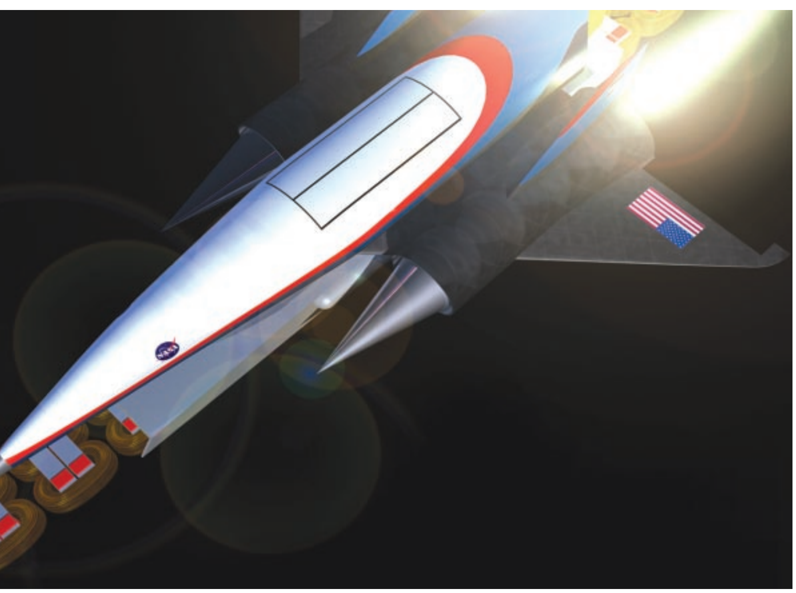


Source: NASA

more insights about our relationship to the universe through increasingly sophisticated astronomical missions. Science can help us find laboratory solutions to high-end technologies, such as anti-matter and anti-gravity propulsion concepts. Science can use on-orbit assets to develop consumer products in pharmaceuticals and materials. The frontiers of science are extended significantly by expanding our reach into new environments and shrinking the boundaries of the unknown. What follows is a short list of what could be done.

Access to space allows us to answer some of the basic questions about our universe and ourselves. With the discovery of sub-surface water on Mars and billion-year-old oceans beneath frozen ice sheets on Jupiter's moon Europa, the prospect of finding life in places other than Earth are higher than ever. If life once thrived on Mars but is now extinct, planetary geologists will need the services of paleontologists.

Why did the running water once on the surface of Mars disappear? What atmospheric instability destroyed its ecosystem, leading to this catastrophe? Why does the planet Venus, often called Earth's twin for its similarity in size and mass, have a runaway greenhouse effect? What went wrong there? How will the answers to these questions help us protect the stability of our own atmosphere?



Space tourism could create a demand for a commercial spaceliner, like this artist concept.

Asteroids are remarkable resources of minerals and heavy metals. While not all of their material is economically feasible to mine and return to Earth, it may be possible to extract materials for delivery to other planets, where expeditions are underway. In any case, we will want to learn how to land on asteroids and analyze their makeup. The day will arrive when an asteroid is discovered on a collision course with Earth. The more we know about their orbit and structure, the more effective we can be in attempting to deflect it from harm's way.

Space also provides science with the opportunity to look at the origins and future of the universe. Earth's surface is one of the worst places to build a telescope. Our atmosphere is largely opaque to gamma rays, x-rays, and ultraviolet light, and wreaks havoc with the infrared spectrum. Furthermore, our turbulent atmosphere, and the radio and light emanations of civilization are incompatible with high-quality observational data. Earth orbit, such as where we operate the Hubble Space Telescope, provides a much better environment for such research. But other orbits are also possible, such as the stable Lagrangian points of either the Earth-Moon or the Sun-Earth systems. Another location for telescopes is the far side of the Moon, which is completely shielded from Earth's cacophony of radio signals. This radio-quiet zone would enable astrophysicists to observe all windows to the universe, pollution-free, and continue a century of cosmic discovery unmatched in recorded history.

The Commission believes that this search for cosmic knowledge will not only answer fundamental questions, but also inspire our children and provide a source of future products and services. This will require that the U.S. government sustain its long-standing commitment to science and space technology and continue to focus on internationally cooperative efforts in the future.

Mining the moon for ores and isotopes might make sound commerical business opportunities in the future.

Conclusions

The Commission concludes that the nation will have to be a space-faring nation to be the global leader in the 21st century—our freedom, mobility, and quality of life will depend on it. America must explore and exploit space to assure national and planetary security, economic benefit and scientific discovery. At the same time, the United States must overcome the obstacles that jeopardize its ability to sustain leadership in space.

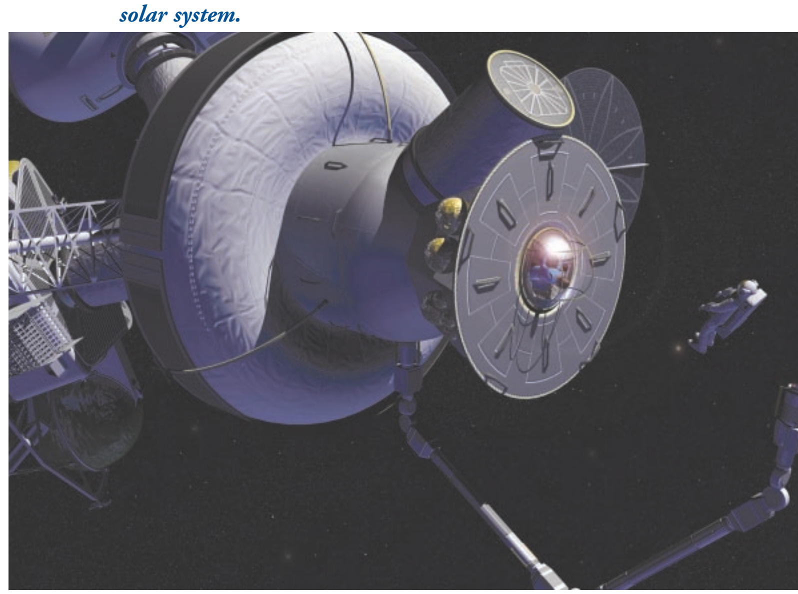
ACHIEVE BREAKTHROUGHS IN PROPULSION AND SPACE POWER. The ability to access space and travel through the solar system in weeks or months instead of years would help create the imperative to do so. Propulsion and power are the key technologies to enable this capability. Future progress in these areas will result in new opportunities on Earth and open the solar system to robotic and human exploration—and eventual colonization. The nation would benefit from a joint effort by NASA and DoD to reduce significantly the cost and time required to access and travel through space.

DEVELOP A NEXT GENERATION COMMUNICATION, NAVIGATION, SURVEILLANCE AND RECONNAISSANCE CAPABILITY. The nation needs real-time, global space-based communications, navigation, surveillance and reconnaissance systems for a wide range of applications. These capabilities will provide the military with the ability to move its forces around the world, conduct global precision strike operations, defend the homeland, and provide for planetary defense. The civil and commercial sectors will also benefit from these capabilities for air transportation management, monitoring global climate change, weather forecasting and other applications. The federal government needs a joint civil and military initiative to develop this core infrastructure.

REVITALIZE THE U.S. SPACE LAUNCH INFRASTRUCTURE. NASA and DoD must maintain and modernize their space launch and support infrastructure to bring them up to industry standards. They should implement our recommendations contained in Interim Report #3 concerning federal spaceports, enhanced leasing authority, and utility privatization and "municipalization." We recommended that DoD and NASA should:

- Investigate the feasibility of establishing a national spaceport structure at KSC and CCAFS under a single management system; and

A logistics depot in space for human exploration of the solar system.



- Seek Congressional approval for
  - Enhanced leasing authority that allows them to lease real property at fair market value and retain lease proceeds to cover the total costs incurred at KSC and CCAFS; and
  - Privatization of NASA utilities at KSC and CCAFS to overcome the budget burdens associated with capital improvements to outdated infrastructure.

In addition, NASA and DoD need to make the investments necessary for developing and supporting future launch capabilities. To deal with the problem of operating costs, NASA should also consider turning over day-to-day management responsibilities for its field centers to state governments, universities, or companies.

Provide Incentives to Commercial Space. Government and the investment community must become more sensitive to commercial opportunities and problems in space. Public space travel may constitute a viable marketplace in the future. It holds the potential for increasing launch demand and improvements in space launch reliability and reusability. Moreover, it could lead to a market that would ultimately support a robust space transportation industry with "airline-like operations." The government could help encourage this by allowing NASA to fly private citizens on the Space Shuttle.

Sustain Commitment to Science and Space. The U.S. government should continue its long-standing commitment to science missions in space and focus on internationally cooperative efforts in the future.

RECOMMENDATION #3

The Commission recommends that the United States create a space imperative. The Department of Defense, the National Aeronautics and Space Administration and industry must partner in innovative aerospace technologies, especially in the areas of propulsion and power. These innovations will enhance our national security, provide major spin-offs to our economy, accelerate the exploration of the near and distant universe with both human and robotic missions, and open up new opportunities for public space travel and commercial space endeavors in the 21st century.

II. Space Infrastructure

A. Establish Federal Spaceports

1. Issue

The National Aeronautics and Space Administration (NASA) and the United States Air Force (USAF) currently manage the space launch infrastructure at Kennedy Space Center (KSC) and Cape Canaveral Air Force Station (CCAFS) each according to its own distinct agency processes and procedures, even though both share the same infrastructure. A new paradigm to manage infrastructure is necessary to further increase efficiency and reduce cost.

2. Background/Findings

Significant strides have been made in unifying KSC and CCAFS through the Joint Base Support Contract and a joint planning and customer service office to coordinate customer space launch needs. Merging KSC and CCAFS into one facility, then creating a quasi-federal entity (QFE) to manage it, might well further improve efficiencies, reduce costs, and provide a simplified "single face" to the users of and suppliers supporting these two facilities. This would support both Government and commercial customers.

While the government could retain ownership of all land, the QFE could operate, maintain and upgrade the facility under the leadership of an executive director and Board of Directors comprised of the government owners of the facilities. The QFE should be allowed to operate more freely than traditional federal agencies through streamlined rules and regulations with respect to appropriations, real property and procurement. An appropriate model might be that of the Metropolitan Washington Airports Authority. The unified spaceport facility (KSC and CCAFS) would operate under a unified set of procedures rather than the two different sets of procedures (NASA and USAF) used today, incorporating the best practices of each. As tenants on a unified spaceport facility, NASA and the USAF could shed the direct responsibility for base operations in the expectation that this could result in more efficient operations and cost savings. Traditional government roles, such as range and airspace safety, could be left in the hands of NASA and the USAF, or transferred to other agencies, such as the Federal Aviation Administration (FAA).

Interim Report #3, Recommendation 1

NASA and the USAF should immediately begin a short-term study, to be completed prior to May 2003 to support the FY 2004 legislative process. The study should build on the recommendations from the February 2000 Interagency Working Group report "The Future Management and Use of the U.S. Space Launch Bases and Ranges." It should investigate the feasibility of establishing a national spaceport structure at KSC and CCAFS under a single management system. The study should identify the advantages of a common management for the national spaceport system, potential cost savings, and process improvements above and beyond the current level of cooperation. Recognizing that the USAF today provides a significant subsidy to other users of CCAFS and KSC, the study should also consider the economic feasibility of a quasi-federal corporation in light of the current economic climate for space launch in the event that the USAF subsidy was unavailable to support range operations. The study should include representatives from Edwards Air Force Base (AFB), the Dryden Flight Research Facility and other government agencies, as appropriate. The results of the study should be delivered to the Administration and the U.S. Congress.

B. Enhance Leasing Authority

1. Issue

Currently, NASA and the Department of Defense (DoD) have only a limited ability to lease real property and, in the few instances in which they can, the proceeds generally return to the U.S. Treasury. Thus, there are few incentives for NASA and DoD to lease their property. At the same time, NASA and DoD are having difficulty adequately maintaining their space operations infrastructure due to budget constraints and/or competing priority operations. NASA and DoD should have expanded leasing authority and retain the proceeds from these arrangements to reimburse the impacted organization for operations and maintenance costs.

2. Background/Findings

Real property is liberally defined as land (including undeveloped land), facilities, capabilities and other resources provided to NASA and DoD customers under an official lease agreement. Currently, lease proceeds/rents are deposited in the U.S. Treasury as miscellaneous receipts rather than returned to the agencies for costs attributable to the lease. This inhibits NASA and DoD from entering into long-term agreements with state and commercial entities that would result in substantial state and private investment.

In early calendar year 1999, NASA proposed enhanced leasing authority legislation for consideration in Congress. Subsequently, Senator Bob Graham (D-FL) introduced the "Commercial Space Partnership Act of 1999" in the U.S. Senate in March 2000. The Senate postponed action on the bill at the Office of Management and Budget's request to allow the General Services Administration (GSA) one year to investigate similar legislation for all agencies. However, GSA's umbrella legislation for all agencies was not approved that year.

Since KSC and CCAFS still saw great potential for this legislation, they redrafted legislation that was included in NASA's proposed FY 2003 Authorization Act. KSC's proposed legislation is supported by Senator Graham and Congressman Dave Weldon (R-FL) and is consistent with the original bill, with the following significant exceptions. It deletes the reference to the lease of personal property, increases the term for which a lease could be executed from five to 75 years, and adds new language on the flexibility of lease proceeds usage.

Interim Report #3, Recommendation 2

Congress should approve an Enhanced Leasing Authority bill that allows NASA and DoD to lease real property at fair market value and retain lease proceeds to cover the total costs incurred in supporting the development and operation of the KSC and CCASF facilities. This legislation should grant the individual organizations the widest and most flexible interpretation and authority.

C. Provide NASA Utility Privatization Authority

1. Issue

The electrical distribution infrastructure at KSC and CCAFS is 40 to 50 years old and frequently fails. There were 22 unscheduled outages last year alone. The current infrastructure is obsolete and many parts are no longer manufactured or available. The infrastructure should have been replaced 20 to 30 years ago but has not been upgraded due to lack of funding. Absent a new source of funding for upgrading the system, it is only a matter of time before a power failure delays a launch.

2. Background/Findings

Replacement of the electrical distribution infrastructure at KSC and CCAFS is long overdue but is now quite an expensive undertaking. There are 360 miles of primary and secondary electrical distribution lines. Some 170 miles of these lines are overhead/aerial and exposed to lightning strikes, which can propagate through the system causing extensive damage. It would cost $500,000 per mile or $85 million to relocate these lines underground in concrete-encased duct banks. An additional $17.7 million would be required to repair power cables on KSC. Replacing the power distribution on CCAFS and KSC would cost approximately $400 million. DoD and NASA budget priorities have precluded adequate maintenance and upgrade of the system. There is an urgent need for a new source of funding. In the commercial world, these upgrades would have been accomplished long ago (perhaps twice) through loans amortized over 30 years.

Congress enacted utility privatization legislation for DoD in 1994. The legislation authorized DoD to sell its utility systems, including electrical distribution and water and sewer to private companies. The USAF planned to sell its power and water utilities and had several bidders. If implemented, the companies would have owned, operated, and improved the systems, recovering the costs of operations and improvements from the CCAFS and KSC through monthly utility service charges. However, since CCAFS and KSC share the same electrical distribution system and NASA did not have the same legislative authorization, the USAF could not move forward with this plan until NASA received similar legislative authority, except at prohibitive expense to NASA.

Interim Report #3, Recommendation 3

Congress should grant NASA utility privatization authority. Privatization (whether to private, state or municipal utilities) holds great potential for NASA and DoD facilities (specifically KSC and CCAFS) to overcome the budget burdens associated with capital improvements to outdated infrastructure. This legislation should grant the individual organizations the widest and most flexible interpretation and authority. The legislation could also be a model for other government agencies.