

DR. ROBERT H. GODDARD HISTORICAL ESSAY

ASSURED ACCESS: "THE BUREAUCRATIC SPACE WAR"

E. C. Pete Aldridge, Jr.

The Policy Mistake

The United States made a tragic policy decision in the late 1970's when President Jimmy Carter decided that the Space Shuttle would be the exclusive means for the United States to launch satellites into space.¹ This decision was based on highly optimistic data on the cost effectiveness of the Shuttle over the unmanned expendable launch vehicles (ELV) being used at the time. The information presented to the President was that:

- the Shuttle would cost about one-third the cost of the expendable launch vehicles with comparable payload capacity;**
- the Shuttle could be ready for a reflight only after seven days of maintenance and check-out, resulting in a flight rate of about 55 launches per year for the entire Shuttle fleet; and**
- all five Shuttles to be built would be identical and would have performance capability sufficient to fly the largest US payloads.**

There were, however, those in the Department of Defense (DOD) who were skeptical about these performance estimates and who were worried about the "Shuttle only" space launch policy. They were overruled by those in the Pentagon in leadership positions who were convinced that the only way that Congress would approve the development of the Shuttle would be to tie the Shuttle to the imperatives of launching payloads essential to the security of the United States. In addition, even the skeptics thought that if only the flight cost estimates came true, the cost savings could be put back into the military space program in the form of improved satellites, on-orbit satellite spares and enhanced reliability and on-orbit lifetime. Their fears about having only a single launch vehicle would be offset by having a more redundant and capable satellite system for a variety of military missions

1 Presidential Directive No 37, May 11, 1978.

The first Shuttle, Columbia, was planned to be launched from Kennedy Spaceflight Center (KSC) in 1979. To hedge against the uncertainties of Shuttle performance or reliability, the plan was to maintain the production of expendable launch vehicles to back up the Shuttle for two years after the first launch from KSC. In the meantime, satellites were being redesigned to take advantage of the larger cargo volume and weight that the Shuttle offered. In addition, since the price charged by the National Aeronautics and Space Administration (NASA) to launch satellites was based on the length of the cargo bay they occupied, satellites tended to become wider and shorter, filling the 15 foot width of the Shuttle bay. This also had a profound and direct impact on the future of the launch vehicle business---satellites were becoming larger and heavier than the current class of ELVs could lift. Congress making sure DOD had no way out, stated that they would not approve of any future DOD satellite unless it was designed exclusively to fly in the Shuttle.²

The Shuttle Flies--And America Cheers

Columbia's first flight did not occur until April 1981, three months into the Reagan Administration. The flight was a remarkable national and international success. In spite of the delay, all Americans, and indeed people all over the world, felt pride in America and her technological achievement. The intensity of this pride was particularly great since the US was just beginning to exit a period of the late 1970's that was embarrassing to the status, power and prestige of the country.

The Shuttle was supposedly declared "operational" by the fourth flight in July 1982. President Reagan attended the landing at Edwards Air Force Base, California, on July 4, 1982 and announced his first National Space Policy.³ In that policy he noted that the "Space Transportation System" would be the primary US national launch system and he called for expansion of the private sector involvement and investment in civil space and related activities.

In reality, major support problems plagued the Shuttle program. These problems were primarily the lack of spare parts and technical problems which caused long reflight preparation times. The real costs to launch the Shuttle were becoming apparent and low launch

²Personal knowledge of the author, based on conversations with Congressional staff.

³National Space Policy, July 4, 1982.

rates forced these large overhead costs to be spread over fewer flights. While the original plan called for each of five orbiters to be essentially identical, in reality each of the orbiters were different and the performance of each was substantially below the design specifications. NASA had promised that each orbiter would 65,000 pounds of payload to low earth orbit from Kennedy Center and 32,000 pounds to a polar orbit⁴ from Vandenberg AFB, California. The final Shuttle capabilities were nearly 20% short of these goals.

Since DOD had committed satellite designs to take advantage of the promised weight and volume capabilities of the Shuttle, two upgrade programs had to be developed by NASA--a filament wound case for the Shuttle solid rocket motors and an improvement to the Shuttle main engines permitting them to perform at a higher thrust. Both of these performance upgrades would be demonstrated with the first flight from Vandenberg AFB, with Discovery, planned for July 1986.

Even though the cost, performance and flight rate problems with the Shuttle were of concern to DOD, there was still some optimism that they would be overcome. In March 1983, in testimony before the House Subcommittee on Space Science and Application, the Air Force, the executive agent for DOD's Shuttle launch operations continued to express optimism about the Shuttle.⁵ Indeed, it would be very difficult at this point to show any concern over a program that was receiving so much praise and admiration from Americans and the world public. However, the Air Force, somewhat meekly, outlined a "Back-up Strategy" for the Shuttle. If the sixth Shuttle flight was successful, the Air Force would not proceed with the procurement of the 17th and 18th Titan 34D currently in the budget and would terminate the existing Titan production line--the "workhorse" of the DOD space launchers--at the end of the year. The Air Force noted that there were offers from the aerospace to "commercialize" the existing Titan, Atlas and Delta expendable launch vehicles and to use the current government-owned facilities and ranges for this purpose. The Air Force believed that

⁴A polar orbit is defined as an orbit around the earth in which the satellite ground trace would come close to each pole of the earth on each orbit. These orbits have also been called "high inclination" orbits.

⁵Hearings before the House Subcommittee on Space Science and Applications, 1983

this idea was worthy of study since, if implemented the government would not have to pay for a natural backup to the Shuttle.

The Optimism Fades

A series of events In the Summer of 1983 began to seriously erode the optimism of the Air Force and many in DOD about the ability of the Shuttle to be the exclusive US space launch vehicle. The real costs to launch the Shuttle were more apparent, and more visible to NASA and to the Congress. In an internal memorandum, the Deputy Administrator of NASA admitted that “During the 1970’s, NASA inflated the mission model far beyond any realistic limits in order to reduce the apparent cost per flight of the Shuttle. In fact, the mission model used to arrive at the agreement with DOD, was developed by NASA in the mid 1970’s and was designed solely to push the cost of Shuttle flights below that of the cost of expendable launch vehicles.”⁶ The realities of this statement had become obvious.

Congressional pressure on NASA about the cost of Shuttle operations was forcing consideration of DOD paying for the upgrades to reach the original performance levels promised, to pay a higher flight charge to NASA, and even to pay for the procurement of an additional orbiter. There was also discussions in the Administration to direct NASA to increase the Shuttle flight charges to non-government users so as to recover some of the real flight costs. However, NASA and many in Congress thought that this “full cost recovery” policy would drive commercial satellite users off the Shuttle to “commercial” expendable launch vehicles, primarily foreign, and thus raise the cost per flight for DOD payloads even more. The cost issue was also causing some friction among NASA and Air Force personnel working the interface between the Shuttle and future DOD payloads. As the real launch cost of the Shuttle was becoming known, NASA started moving costs, previously agreed to be borne by the Shuttle and included in the “standard” Shuttle flight cost, over to the payload “user”, in this case the Air Force. This was particularly frustrating to the Air Force since these new costs had

⁶Memorandum from Deputy Administrator, NASA to Assistant Administrator For Legislative Affairs, NASA. “Pricing Policies for the Department of Defense Payload Missions”; February 16, 1983.

to be absorbed from budgets already approved by the Air Force leadership and the Congress.⁷

Performance of the orbiter, in terms of the amount of payload that could be delivered to low earth orbit had also been reduced. The total empty weight of the Shuttle was larger than originally expected, resulting in lower payload capacity, reduced cross range maneuverability and more stringent demands on launch abort procedures. In addition, NASA was requiring more liftoff weight margin, thus further reducing payload weight.

The Shuttle continued to raise doubts that the projected flight rates would ever be achieved. The first problem was that instead of five orbiters, only four had been built. Furthermore, the Shuttle turnaround time, projected to be seven days, was actually closer to sixty days. Also, it required in excess of 6,000 people, which was nearly four times the expected number. With this recycle time each orbiter could only fly six times a year, resulting in a maximum flight rate for the fleet of four orbiters of 24 flights per year. There was a concern that if any problems occurred, the combined demand for flights by DOD, commercial and civil users would not be achieved. This condition could result in DOD being close to the exclusive user of the Shuttle, with the total cost being born by DOD, or DOD payloads would be delayed in order to launch important scientific payloads. Neither of these options were acceptable to the Air Force or DOD.

These concerns continued to grow during the later part of 1983. But on December 27, 1983, the Air Force presented a classified briefing to the Joint Chiefs of Staff and the Secretary of Defense outlining a "Net Assessment" of US and Soviet space capabilities.⁸ A key part of this presentation was a comparison of the space launch capabilities of the two nations and a description of the concerns about the "Shuttle only" policy of the US. In a meeting with the Secretary of Defense the next day, the Air Force outlined a plan to resolve the concerns of this policy. The Secretary agreed with the Air Force plan.

To implement this plan, Secretary Weinberger sent a letter to the President on January 23, 1984 advising him that DOD and the

⁷Personal knowledge of author.

⁸Net Assessment-US. and Soviet Space Capabilities, December 1, 1983.

Intelligence Community were concerned about the current plans to rely on the Shuttle for sole access to space, and that the country had made a "serious mistake" in adopting this policy.⁹ He recommended that a limited number of expendable launch vehicles be procured to complement the Shuttle. He stated that "DOD remains committed to STS. Our limited use of ELVs will not undermine the validity of the STS program nor will the effort significantly increase the total cost to the US government in meeting its essential launch requirements."

On February 7, 1984, DOD issued the new DOD Space Launch Strategy, as outlined in the letter to the President.¹⁰ The key part of that strategy was that the US must possess an ELV capable of launching Shuttle-class payloads to geosynchronous orbits.

The Bureaucratic Space "War" Begins.

NASA, especially its Administrator, was furious. They thought that DOD had indicated, incorrectly, a lack of confidence in the Shuttle, and that this was "only a ploy of the Air Force to abandon the Shuttle"¹¹. With DOD no longer a user, they claimed that the cost to other commercial and civil users would go up and they too would be less inclined to fly the Shuttle. There were even those inside DOD who were against this move, not wanting to pay the price for the additional expendable launch vehicles and who believed the Shuttle would ultimately achieve its full potential. NASA supporters in the House and Senate also criticized the Air Force for this plan and called for hearings on the issue.

The Air Force again appeared before the House Subcommittee on Space Science and Applications on February 23, 1984, but this time it is before a much more hostile audience.¹² In the testimony, the Air Force outlined its need for a complementary launch system to hedge against unforeseen technical and operational problem with the Shuttle. They stated that the DOD was concerned that only a four orbiter fleet did not represent an assured, flexible and responsive

⁹Letter from Secretary of Defense to the President, January 23, 1984

¹⁰Memorandum from Secretary of Defense to Secretaries of the Military Departments, et al. "Defense Space Launch Strategy February 7, 1984.

¹¹Personal conversation with Administrator, NASA.

¹²Hearings before House Subcommittee on Space Science and Applications, February 23, 1984.

access to space, and that was an unacceptable national security risk. The Air Force stated that the solution to this problem must be affordable and effective and have low technical risk and reasonable schedule availability. They also noted that unmanned expendable launch vehicles met these criteria. The DOD was studying the use of commercially procured ELVs to meet its requirements, consistent with the President's encouragement of commercial space ventures. They would continue to fly eight to ten missions a year on the Shuttle, but would complement this with two ELV flights per year. The Air Force stated that the advantages of such a plan would be as follows; it would:

- reduce DOD "launch on demand" pressures on STS for critical national security payloads;
- reduce chances that DOD would preempt other important customers flying commercial and scientific payloads;
- permit the Shuttle to continue to be the primary launch means for other more routine missions which required a man interface;
- permit NASA to schedule more effective and more routine multiple payload flights; and
- extend the life of the four orbiter fleet.

The Air Force also stated that the decision to pursue the complementary launch vehicle program must be made "now". At the end of that year the launch vehicle production lines would start shutting down causing the production base to erode.

NASA responded to the Air Force plan with a memorandum from the Administrator to the Secretary of Defense³, in which he made the following arguments: The Air Force flight requirements would be met with the Shuttle and that a back-up or a complement was not needed. If the Air Force felt compelled to have a Shuttle complement, it should be based on components of the Shuttle. In this way both the Air Force's needs would be met and the Shuttle program would benefit from higher component production rates. Lastly, a Shuttle derived launch vehicle would have growth potential to meet future space launch requirements of the nation not only the Air Force.

¹³Letter from Administrator, NASA to Secretary of Defense, May 18, 1984.

This debate put the Air Force in a very difficult and unpopular position since it had to defend its position by stating publicly why it had concerns over placing exclusive reliance on the Shuttle for space access. The questions on cost, performance, turnaround and flight rates were brought to the attention of the public, as well as the concern that the loss of one Shuttle would eliminate 25% of the total launch capacity of the US.

The First “Battle” --Confidence

As in any “war” there are numerous battles, and this one was no exception. One of these battles dealt with Shuttle confidence. NASA interpreted the Air Force defense of its assured launch as a lack of confidence in the reliability of the Shuttle, considered the Air Force defensive statements as a “slap in the face” of NASA and the engineers and technicians who built and launched the system. NASA stated that nothing is “assured” and presented data showing that unmanned expendable launch vehicles were not as reliable as the Shuttle, which at that point was showing 100% reliability.¹⁴

On March 7 1984, those more friendly to DOD interest enter into the fray. The Air Force was called to testify before the House Armed Services Committee, a key oversight committee to DOD’s programs to explain the new Assured Launch Strategy.¹⁵ The Air Force tried to avoid criticizing the Shuttle by noting that if the Shuttle worked perfectly, the DOD needs would be met with the current Shuttle fleet. However, the Air Force noted that things do not perfectly--launch schedules change, unpredictable failures in spacecraft occur, even on-orbit success, requiring delays in launching replacement satellites, complicate the Shuttle launch planning process. The Shuttle was particularly sensitive to launch schedule changes since each orbiter had to meet multiple launches per year. Any schedule changes had a “ripple” effect on subsequent launches. It also became apparent that because of the loss of performance, Atlantis and Discovery were the only orbiters capable of launching all the DOD payloads.

¹⁴Personal discussions between author and NASA Officials.

¹⁵Hearings before House Armed Services Committee, March 7, 1984

The Air Force, in an attempt to pacify the negative attitude of NASA and their Congressional supporters stated that the complementary ELV plan was not a substitute for a viable orbiter fleet. The Air Force and DOD must have both the Shuttle and the ELV fleet to meet its requirements.

The Air Force outlined the approach to implement its plan of launching two ELVs per year, in addition to the Shuttle launches it planned to use. The approach called for the contractors to pay the development cost for a “commercial” ELV capable of carrying Shuttle-sized payloads, and then they would be permitted, to amortize these costs over the total number of launch vehicles sold over the 1988-92 period. The government would pay for the total launch cost a year in advance of the launch, as they had done for the Shuttle. Such an approach would minimize the near-term cost to the government and encourage industry to compete with ELVs being developed by foreign countries.

The Request For Proposal was issued to industry by the Air Force in March 1984 to develop and procure the complementary ELV. During March and April, 1984 the Air Force leaders met with NASA staff, Congressional staff, Congressmen, Senators and Administration officials to “sell” the plan. Nobody was impressed with the plan and, in particular, the Office of Management and Budget, the Executive Office’s chief financial spokesman, did not support the approach.¹⁶ Without their support, there was no chance of Congressional support.

In late June 1984, the Air Force noted that it had hoped that industry would have been able to develop and build a commercially viable ELV without a large near-term investment by DOD. “Neither industry nor Congress were sold on that approach, so we are now planning to pursue a conventional development and procurement program¹⁷. The required funds were included in the DOD’s Five Year Defense Program and \$5 million was requested by the Air Force and approved by Congress in FY85, beginning in October 1984. This was to initiate the design of the new complementary ELV, known then as the CELV. As part of the approval process, Congress requested a joint study of the requirements, options and costs of the CELV concept. They

¹⁶Letter from Associate Director, National Security and International Affairs, Office of Management and Budget to Under Secretary of the Air Force, March 15, 1984.

¹⁷Under Secretary of the Air Force’s speech at Air Force Association’s Salute to Space Division, Los Angeles, June 29, 1984.

required that the study be coordinated with NASA and DOD and approved by the President by January 15, 1985.

The Second Battle--Competition

An interesting and unique situation occurred as a result of the competition for an expendable launch vehicle. It became the second "battle of the "war". NASA tried to eliminate the Air Force's competition by getting Congress to demand that any unmanned vehicle must be a large, heavy lift vehicle of 100,000 to 150,000 pounds to low earth orbit.¹⁹ Naturally this system would be based on Shuttle-derived components and developed by NASA. The Air Force rejected this approach based on the fact that there was no requirement for such a system. They stated that "we should not substitute a near-term ELV, based on known satellite launch requirements, with a new expensive space booster development based on undefined satellite launch requirements."²⁰

NASA also decided that it wanted to compete with industry for the new system that would meet the Air Force requirements. They wanted to submit a design for an ELV based on the use of Shuttle components--primarily the solid rocket motors and a modified center core stage.²¹ The Air Force, with great Congressional pressure, agreed to accept the NASA proposal, but it had to be done so that the government was not in direct competition with American industry.²² The Air Force decided that a winner of the industrial competition would be selected and then compared with the NASA submission. This would permit the government to decide whether it would buy from itself or go to industry. This approach was viewed as the only legal way to conduct such a unique competition.²³

¹⁸ Joint Conference Report on Department of Defense Appropriations for FY85, October 9, 1984.

¹⁹ Letter from Chairman, House Committee on Science and Technology to Chairman, Subcommittee on Procurement and Military Nuclear Systems, House Armed Services Committee. April 12, 1984.

²⁰ Letter from Under Secretary of the Air Force to Chairman, House Committee on Science and Technology, et al, July 10, 1984.

²¹ Op cit, See Footnote 12.

²² Letter from Under Secretary of the Air Force to Administrator, NASA, June 12, 1984.

²³ General Counsel, Office of the Secretary of the Air Force to Under Secretary of the Air Force, "Standardized Launch Vehicle (SLV-X)", May 11, 1984.

It was a bitter competition. First, NASA officials placed a great deal of pressure on the contractors not to bid the Air Force competition, since, they were told, their relationship with NASA would be jeopardized. Failing that, they put pressure on the contractors--a few who were also bidding directly with the Air Force with their launch vehicles to support NASA's submission.²⁴

NASA continued to fight the Air Force's plan, openly and underground. But a major setback occurred in NASA's argument. The National Research Council study, requested by Congress and released during the week of September 7, 1984, fully supported the Air Force's requirement to have a complement to the Shuttle.²⁵ The report also noted that it was supportive of a plan to launch small payloads such as weather satellites, on the converted Intercontinental Ballistic Missile, known as the Titan II.

The Air Force received four proposals for the complementary ELV--a modified Titan III, an improved Atlas Centaur, and two NASA entries--an SRB-X and a heavy lift SDV-1E. The SRB-X design was based on two of the Shuttle's solid rocket motors strapped to a core vehicle. The other NASA proposal was a large heavy lift vehicle using the Shuttle's main engines attached to the external tank and the solid rocket motors. Both designs would use the existing Shuttle launch pads.

The modified Titan III, called the Titan 34D7, was the winner of the industrial competition. The rest of the so-called "competition" was a "farce", and should have been an embarrassment to NASA and its highly competent engineering team.

The SRB-X was evaluated by the Air Force Space Division and its technical experts and determined to be uncontrollable during the boost phase of flight.²⁶ If this proposal had been submitted by industry, it would have been returned immediately and eliminated from the competition as incompetent and unresponsive to the requirements. The second NASA proposal was a better design but far exceeded the Air Force's requirements since it would lift payloads which did not exist, even conceptually. In addition, the cost of a

²⁴Personal knowledge of author, based on private discussions with contractors.

²⁵Under Secretary of the Air Force to Secretary of Defense, "National Research Council Report on Expendable Launch Vehicles"; September 11, 1984.

²⁶Personal knowledge of author, based on discussions with Air Force's evaluation team.

heavy lift system would far exceed any other alternative due to the extensive development and flight cost. But to avoid further controversy and friction that existed between the Air Force and NASA, the Air Force completed the evaluation of both of NASA's proposals.

The Titan 34D7 was selected as the winner of the CELV competition. It met the Air Force's requirements to place 10,000 pounds into geosynchronous orbit from the Kennedy Spaceflight Center at the lowest cost. It could meet the Air Force's first flight date requirement of October 1988. The Titan would be truly independent and would complement the Shuttle.

To begin the Titan CELV program and to meet its required launch date, the Air Force needed to reprogram a total of \$30 million additional funds (\$5 million was already approved) in the FY85 Defense Budget. This request was submitted to the four Congressional Committees having DOD oversight in the House and Senate.²⁷ The Air Force started a concerted "do-or-die" effort to get the approval for the additional \$30 million.

Truce and The Treaty

Numerous "skirmishes" occurred throughout Washington on the CELV issue. NASA supporters were trying to undermine the Air Force's position by getting their Congressional supporters to bloc the allocation of resources for the project, or to call for additional study. NASA refused to coordinate on the CELV study that was requested by Congress and due on January 15, 1985. They knew that the Shuttle-derived ELV had lost the Air Force competition and took the position that another year of study was required before a correct solution could be found.²⁸ This delaying tactic would of course kill the effort since, without a commitment within the next year the ELV production lines would close down and the cost to reopen them would be prohibitive.

²⁷Secretary of Defense to Chairman, House and Senate Committees with oversight responsibilities for DOD, February 28, 1985.

²⁸Secretary of Defense to Assistant to the President for National Security Affairs "Assured Access to Space Initiative"; February 14, 1985

There were those in NASA who wanted to find a compromise to this

problem and to return to a more compatible relationship with the Shuttle's best customer. The strength and value of this relationship had just been demonstrated with the first Shuttle launch of a DOD operational satellite in January 1985--on STS 51-C. While there was a great deal of press speculation over the classified nature of the launch, the degree of cooperation between NASA and the Air Force on this mission clearly indicated that a better relationship throughout all levels of both organizations was possible.

The National Security Council was also concerned with the "war" between NASA and the Air Force and wanted to find a solution. Therefore a meeting was called between the Air Force, NASA and the NSC Staff to determine a way to resolve the problem. Unfortunately, the NASA representative at the meeting felt that his hands were tied as a result of the NASA Administrator's strong position on the subject²⁹. The only way to resolve this problem would be for the NASA Administrator to be involved personally with the solution.

The Solution

On February 14, 1985 the critical meeting occurred in the Old Executive Office Building, hosted by the National Security Council. That meeting resulted in a major agreement between the Air Force, represented by the Under Secretary of the Air Force, and NASA, represented by its Administrator. The agreement stated:

--NASA and DOD will work together to ensure Shuttle is a viable operational system heading toward 24 flights per year.

--NASA will agree with the need for a CELV, with US Air Force buying ten ELVs and fly them at a rate of two per year in 1988-92. The type of ELV will be determined through a competitive process.

-- DOD will commit to one-third of the available Shuttle flights over the next ten years, independent of the number of ELVs to be flown over that period.

-A new pricing policy will be developed for Shuttle flights that will give positive incentive for DOD flights on the Shuttle

²⁹Personal knowledge of author, based on discussions with participants.

--And, that DOD and NASA will work together on a second generation Space Transportation System using manned and unmanned capabilities to meet all user needs.

This historic and important agreement was incorporated into a National Security Decision Directive, known as the “National Launch Strategy”, and signed by the President on February 25, 1985.³⁰

The "Treaty" Goes Into Effect.

The House Subcommittee on Space Science and Applications called for the first public hearing on the National Launch Strategy on March 7, 1985.³¹ The committee members were pleased with the fact that the fighting between NASA and the Air Force had ceased and a more positive relationship would exist.

The Air Force was elated with the agreement and, with the approval of the Congress, started the new program to complement the Shuttle. The “Shuttle-only” policy had shifted to a “mixed-fleet” strategy. The US space launch vehicle fleet for launching the major satellites would include the Shuttle and the new CELV, a Titan 34D7, later to be called the Titan IV. The Air Force also announced that they were going to proceed with the modification of a small number the Titan II ICBMs to convert them into a space launch vehicle for launching small satellites, classified and unclassified, from Vandenberg AFB.³² This was not a critical issue for NASA an there was little argument over its implementation.

Then disaster struck. On August 29, 1985, for the first time in eighteen years of flying Titans from Vandenberg AFB, a Titan 34D failed during the second stage of flight. A massive oxidizer leak caused the booster to fail before it reached orbit and tumble out of control. The Range Safety Officer destroyed the booster and its classified payload fell into the Pacific Ocean. The first reaction

³⁰**National Security Decision Directive 164, “National Launch Strategy”; February 25, 1985.**

³¹**Hearings before House Subcommittee on Space Science and Applications, March 7, 1985.**

³²**Ibid**

from the Air Force was that while the single failure was tragic, the real fatality would be the CELV program. But that prediction was in error. The question on whether or not we should proceed with the CELV program was never raised. The only question was what went wrong and what are you going to do to fix it? The remaining part of 1985 was devoted to resolving the Titan problem and preparing for the next launch scheduled for April 1986.

Epilogue

Tragically, on January 28, 1986, over the sunny and cold skies of Florida, all of the worst-case predictions which supported the need for assured access to space and a complement to the Shuttle came true. The Shuttle Challenger exploded during the boost phase killing the entire flight crew.

And then again on April 18, 1986, a second Titan 34D exploded shortly after launch from Vandenberg AFB--the second in a row.

This was a devastating time for America's space program. There was no means to launch our major military and civilian spacecraft. And the time it would take to recover was unknown.

But, eventually there was a positive outcome to these events. The nation recovered from the events of 1986 with a stronger and more robust space launch capability than would have existed without these tragedies. The Shuttle has become more reliable and focused on its unique capabilities. The Air Force's Titan program has been expanded and additional launch vehicles, based on Atlas and Delta configurations have been procured for the government. In addition, the expanded ELV production has permitted a new US commercial space launch vehicle business to emerge.

If failures occur in the future--and they will in spite of our best efforts--the nation will not be left in the same position that existed in 1986, 1987 and parts of 1988--with no assured access to Space.