The Seventies

Readings
1. Chap. 1, "Spaceflight and the Myth of Presidential Leadership."
2. Chap. 4 and 5, " Beyond Horizons."
3. Chap. 1 and 2, Wheelon.

Strategic Themes:

1. Retrenchment for NASA – NASA and the country out of sync.
2. A truck to nowhere – the seeds of the Challenger disaster
3. The growth of big science – Viking, Hubble and beyond
4. The seeds of use of space in war
5. The ABM treaty and the MIRV debacle
6. Détente verses competition with the Soviets
7. Growth in international and commercial space.

When President Nixon took office in 1969, NASA funding was already going down. The first Moon landing occurred in July 1969. The race was won! It was like the dog that caught the truck. What would it do now? To some extent NASA was caught in a time warp. NASA felt that after the first lunar landing it should get whatever funding it needed. In September 1969, a Space Task Group chaired by Vice President Agnew reported three possible long-range space programs for NASA. The first was a manned mission to Mars by mid-eighties, an orbiting lunar station and a fifty man Earth orbiting station served by a reusable shuttle. Funding for this option was $8 to $10 billion/yr. (Recall that at its peak NASA had received 5 billion/yr.). The second plan postponed Mars until 1986 and limited funding to $8 billion/yr. The third plan chose only the space station and shuttle, with annual spending between $4 billion-5.7 billion/yr. However relative to the long gone days of the early sixties, the mood of the country and of the President had changed. Nixon came from the Eisenhower mentality that saw the big manned effort as stunts. He was also much more interested in promoting cooperation rather than competition with the Soviets and the Chinese. Further he strongly believed in frugality in government spending. All these combined to make him cast a skeptical eye on the NASA requests. The country also had changed. In 1969, we had reached the Moon. The national mood was to turn to other issues especially in light of riots in cities, the war in Vietnam, etc. Flights to the Moon seemed boring. For NASA it was a boom or bust cycle. As a measure of this, the Congress reorganized the standing space committees out of existence and Nixon abolished the PSAC. Space became a secondary issue for the political establishment. Thus the last two Apollo flights were cancelled, the Apollo Application Program was reduced to one SKYLAB and in a blow to the Air Force the MOL was cancelled. President Nixon refused to support any of the options that NASA wanted. There was no congressional support for any big new initiative so NASA started to wither. It was only the 1972 election that saved something for NASA. The declining population in the aerospace industry in the big states of California, Texas and Florida forced the President to approve something for NASA. He chose half of half of option 3. The choice was for a Space Transportation System (STS), a space truck but the place it was to go to was cancelled. Thus a space truck to nowhere. It was even worse than that.

NASA had suggested a completely reusable design based around liquid rocket engines. The idea was to stop throwing away expensive hardware. Nixon would only give them half the money requested. Thus they did away with the completely reusable design and even worse with the liquid rocket engines. In a compromise to fit within a fixed $3.2 billion NASA budget, they chose a non-reusable main tank and worst of all, to make up the thrust they chose solid rocket motors. As an aside, Von Braun had said that no human should ever ride on solid rockets. They were just too dangerous. One in twenty-five blew up due to defects. They could not be stopped once lighted and thus had the potential for a major loss of life. However, to reduce development costs, NASA chose to go with solid rockets. In another first, they chose to go with Morton Thiokol, from the home state of the NASA administrator. Morton Thiokol was in Utah, which is where it manufactured the solid rocket segments. However a completed solid rocket would be too big to transport by road to a port to get it over to Cape Canaveral. Thus it had to be built in segments and integrated at Cape Canaveral. Thus the seeds were sown for the Challenger disaster of a decade or so away. As a continuation of the sixties mindset of higher, faster and farther, NASA chose to develop shuttle main engines which had the highest thrust to weight of any ever built. They would be wonders of technology. It was argued that each engine would be reusable for 100 flights and that the shuttle would fly 100 times a year. In the operational phase the cost for launch was supposed to be only $10 million a flight. Since its payload was 40000 lbs. To LEO it would give cost of $250/lb to LEO.

However even then some issues were seen. Since the STS could only go to LEO (~250km) it would have to carry an upper stage for it to be useful for any other obit. NASA thus sold itself to other organizations to get the support it needed. The Shuttle payload bay was sized for various military missions as well as the payload carrying capacity to LEO. It persuaded the Air Force to develop a solid propellant upper stage (IUS) to put 500 lbs. into LEO. It persuaded McDonnell Douglas to build two upper stages in return for a monopoly position. These were the PAM-D and PAM-A upper stages. It also started a cryogenic upper stage based on Centaur technology. NASA was in the desperate position (as it saw it) of having to do a big project to keep itself going and it was selling itself to get approval for the big project. The cost projections which finally sold the administration were based on a large number of flights a year which was based on a market which did not yet exist- (even today ~50 flights /yr worldwide). Thus there was a classic chicken and egg problem. In retrospect the fundamental problem was forcing a pioneering technical program to be justified in economic terms. In this sense there was a huge disconnect between NASA and the administration. Note that Apollo was never justified on economic terms.

The facts are that NASA has never managed more than eight STS flights a year, the SME needed to be replaced every flight and the cost estimates per launch range from $80 million to $500 million. There are three ways to estimate cost. The first is to take the total amount spent so far on STS and divide by the number of flights. This gives about $500 million/yr. The second is to take the annual amount in the NASA budget and divide by the annual flight rate. This gives about $250 million/yr. The last is to ask how much is saved when an STS flight is cancelled. This is about $80 million/yr. This last figure is telling since what are saved are only the consumables. Most of the cost is in the standing

army necessary to operate and maintain the shuttle. This cost and the low reliability of the shuttle were not appreciated in the initial estimates. There was also some specious thinking at NASA about markets and either wishful thinking or an underappreciation of the difficulty of developing a new engine. The new engine contributed to the delays of the first STS launch until 1981 and have contributed greatly to the poor reliability of the STS. A truck it is not, it is much more like a finely tuned racecar.

President Nixon never saw space as a race or as a competition with the Soviets. In his mind, space and defense were much more clearly linked going back to the Eisenhower policy. Unhappily, the NASA administration under him, Tom Paine never seemed to appreciate where the President's position came from. Paine felt that Agnew was important in the administration and paid much attention to him rather than building a constituency in the OMB. This is a mistake that Webb would not have made. Paine kept trying to persuade the President of the value of doing things like a space station before the Soviets built there own. He never appreciated that the President actually wanted détente not competition with the Soviets. Paine left in 1970 and was replaced by Fletcher. Fletcher however seemed to have completely bought the NASA position of needing to do the next big thing and he made the critical decision on STS.

The Nixon emphasis and choices led to the first Apollo-Soyuz mission in 1975 as well as the Skylab (the first space station). Unhappily, the SME caused delays in STS meant that Skylab literally crashed to the ground in Australia while the STS was unable to get up and save it. The Apollo-Soyuz mission was pursued at Nixon's insistence (although after he left). It was almost an after thought in the space program and given the worsening relations with the Soviets that occurred by 1979 ultimately did not lead far. In any case, it's real objective was foreign policy not space policy.

Since Nixon thought of space as defense first, an especially important agenda item for him was the ABM program. The ABM treaty in 1972 had important implications for space policy. The ABM treaty restricted both sides to limited ABM systems, one deployed around the national capital and one at an ICBM site (Grand Forks). It formally recognized the role of satellite reconnaissance and agreed that verification could be carried out by national technical means consistent with international law. It thus made credible the policy of mutual assured destruction (MAD). It had another provision that later proved contentious for SDI and today. It restricted each party not to develop, test or deploy ABM systems or components that are sea-based, air-based, space-based or mobile land based. The space-based piece is the one that has proven difficult as technology has marched on.

The ABM treaty had the effect of making the whole system of reconnaissance, warning and communication satellites even more important. They were necessary to verify Soviet compliance and warn of any possible attack.

Something else that happened in the seventies that had a profound effect on future thinking on space policy was the development of MIRV technology for ICBM's. The US developed the technology for MIRV's first and in an example of where

technology overtook policy, decided to MIRV its missiles and put multiple warheads on each missile. This was seen as destabilizing by the Soviets who rushed to develop their own MIRV capability. This capability on both sides led to a racketing up of the arms race and a destabilizing tension. Long detailed treaty negotiations then resulted which eventually succeeded in de MIRVing strategic missiles. Thus Pandora's box was barely closed. The implications for future space policy flow from the lessons learned from this. The doves on space weaponization quote this widely as an example of technology run amok. Where the opening of a technological door forced us down a path that in retrospect we wished we had not traveled down and from which we barely escaped. Thus it is feared the same thing will happen with space weapons.

The late sixties and early seventies also saw the seeds of what was to come in the first use of satellite systems in war. In the Vietnam War, there was extensive us of the directly downlinked weather data from DMSP and use of communication satellites. The DMSP data was to help target planners for figure out when to schedule raids on North Vietnam. The early DCCS satellites and COMSAT provided real time communications between Saigon and Washington. This enabled high-resolution imagery to be interpreted in Washington and sent back to Saigon. Whether this was a boon or a blessing is questionable because it later led to Washington based control of intelligence which was a handicap in the Gulf War. It also enabled command and control from DC of operations in Vietnam.

What also happened in the early seventies was the design of the GPS was laid down. It was conceived as a system to provide navigation data for long range bombers on the way to attack the Soviet Union. As a testament to the times, it had a large secondary payload of a nuclear detection monitor. Since it was only for long-range guidance it had a weak signal. It also had a civilian signal as an after thought. It was never intended for use in hostile regions, for precision use or for primarily civilian use.

The seventies were a period when several big science programs were started or came to fruition. Viking landed on Mars in 1976 and failed to find life. It cost almost $4 billion in today's money and represented another of the higher, faster, farther thinking. The Hubble Space Telescope and Galileo were started in this era. Each of these was a billion-dollar class program intended to do big science in a big way. While very successful the long time they took to come to fruition was instrumental in the calcification of NASA. No longer was it a big agency doing big things quickly; it became a small agency doing big things slowly. In a sense its heyday had passed and it was left mainly with past glories. NASA spending was down to 36% of its peak.

Under Presidents Ford and Carter, the space program continued at a steady but low pace. The urgency was gone and other issues e.g. energy now occupied the national agenda. This period has been called the NASA snooze. In the meantime, a space program was growing in Europe that would ultimately have significant consequences for American launch dominance.

As a matter of policy, the US was eager to share in scientific endeavors with the Europeans but refused to provide launch vehicle data unless the French agreed not to use any in military projects or do anything to undercut INTELSAT. To add insult to injury, the US sold the Thor-Delta technology to the Japanese when they had refused to do so for the French. Thus in 1972 a new European Space Agency was formed from the remains of the national programs. ESA developed an independent launch capability the Ariane that in 1979 succeeded in putting a European satellite in orbit from Korou. The French then formed a quasiprivate company to market the services of Ariane and the US launch share steadily eroded and after Challenger was lost for good.

In the meantime the Soviets turned their attention to space stations. They launched Salyut I in 1971 then a series of space stations staying for up to 6 months in space. They did experiments and learned how to live and survive in space. In contrast these were no US astronauts in space from 1975 to 1981. The Soviets also developed a Shuttle, used it once and then decided it was too expensive to operate and never used it again. The Soviets also developed satellite interceptors and had an operational ASAT system. The US never did develop an ASAT but did develop an F15 launched missile that destroyed one old satellite as a test in the 80's.

The commercial industry continued to grow under INTELSAT and the Open Skies policy in the US. The first domestic Comsat was launched in 1974 using C-band. By 1980, Ku band satellites were available. These ultimately enabled the now ubiquitous private networks (e.g. at Shell stations for card authorization). Once again the commercial market was growing.

Space Policy discussion

The President has approved the development of the Shuttle program. In order to build an economic base for it, NASA now wants as a matter of policy all US government payloads to fly on the Shuttle.

Break up into groups with each group representing an agency position (DoD, NASA, OSTP, Commerce etc). Articulate to the class the choice the President should make. You should couch your response in terms of the known intent of the president which is to make the space program an economically viable entity.