

The Nineties

Reading

1. Chap. 5 and 6, Spaceflight and the Myth of Presidential Leadership.”
2. Chap. 7 and 8, “Beyond Horizons.”
3. “National Space Policy.”
4. “The Satellite Remote Sensing Industry.”
5. “Long Range Plan; Executive Summary of US Space Command.”
6. “State of the Space Industry 1999.”
7. “LEO Commercial Market Projection.”

Themes

1. The collapse of the Space Exploration Initiative
2. Reshaping of the space station as a foreign policy tool and the marginalization of human space flight.
3. The growth of commercial space
4. The internationalization of the space launch and satellite industry & the beginning of a backlash.
5. The integration of air and space in the military & growth of debates on space weaponization.
6. Faster, cheaper, better, it's growth and the beginning of a backlash.

The eighties ended with a bold proposal from the Bush Administration to return to the Moon and mount a human expedition to Mars. In 1990, President Bush set an explicit goal of a manned landing on Mars by 2019. At last NASA had a presidential commitment to this. In its 1959 long range plan, NASA had called for this and Apollo, the Shuttle and the Station would all be seen as attempts to move in that direction.

In contrast with President Kennedy's famous announcement however the President's announcement contained no specific funding requests. What Bush actually requested was for the Space Council (headed by VP Quayle) to report back to him with concrete recommendations to chart a new course to the Moon and Mars. NASA was careful not to let any specific cost estimates get to the Vice President. However, NASA did anticipate in its planning that their budget would double to approximately \$30 billion a year after inflation. NASA also was unwilling to reconstruct ongoing programs in any fundamental way. Thus they conceived that the budget would just go up. Thus the budget request to Congress for FY91 asked for an increase of 47%. This was indeed back to Apollo days.

In contrast to Apollo, there was a very different climate. At a personal level, VP Quayle was nowhere near the equal of VP Johnson. He did not have the ability to build consensus in the Congress. Furthermore he became the object of derision with silly statements that Mars is in the same orbit as the Earth and has canals on it. This undermined his credibility as a spokesman for space. Perhaps most important, the Cold War was over. The Wall came down in 1989 and the

Soviet Union collapsed shortly afterwards. There was no space race to engage in. Third, as a result of the Reagan/Bush era of tax cuts and increased defense spending, there was a huge deficit and the Congress was in the mood for budget cuts not increases. The President's announcement was seen as "just another space speech" without a clear rationale for undertaking such a large undertaking. What also helped sink it was that when NASA did do a cost estimate with its "90 day" study, the number out of JSC was approximately \$500 billion for the mission. By any measure, this is a lot of money (even spread over 30 years) and requires a national commitment to such an undertaking (by contrast at its peak the DoD budget was over \$400 billion a year but there was a national consensus that we needed to oppose the Soviets). The Congress objected to the idea of such a large undertaking especially while existing programs like Space Station were ongoing. The Chair of the House Appropriations Subcommittee zeroed out the funding for Moon-Man in 1991 with the statement "This is the camel's nose under the tent. All those space wackos they want to get started." This revealing comment suggested that the NASA camel's nose under the tent was recognized for what it was (once burned, twice shy) and that the space community was seen as a special interest group without wide popular support. The Bush White House was unwilling or unable to fight for it and the whole program collapsed. In a sense, it was a remake of Apollo but the underlying mood and drives in the country had changed so now instead of being right program at the right time, it was the wrong program at the wrong time.

The Clinton Administration came in, in early 1993. This administration had its focus on the domestic economy. NASA was so far down their list of priorities that they did not even change the NASA administrator. In February 1993 looking for ways to cut the federal budget the administration suggested that the Space Station would face the budget axe. This was after \$9 billion had been spent and almost nothing was actually built. In a masterful tour de force, NASA Administrator Dan Goldin persuaded the Clinton Administration to keep supporting Space Station as a means of keeping Russian scientists occupied and as a means of saving money. The argument was that if Station was restructured to involve the Russians then it would keep Russian scientists from going off to do things we wouldn't like (like work on Iranian missiles) and by taking account of all the Russian expertise and hardware, NASA would save over a billion dollars on Station. Thus Space Station went from being a stepping stone to Mars (the next logical place) to being a scientific lab (microgravity and life sciences) to being explicitly a foreign policy mechanism for international engagement. This was accepted by the administration and Station was again repurposed, descoped and restructured. The size and power was reduced, the name was changed from Space Station Freedom to International Space Station, the orbit was changed to accommodate the Russians and most critical (in hindsight), the Russians were put in the critical path for the construction of the ISS. They would build the first two modules. The first under NASA funding and the second under their own funding. The lifetime was also reduced from 30 to 10 years partly because NASA now recognized how difficult it was to build something that would last thirty years in space. NASA also entered into agreements with the Russians to send US astronauts to MIR for extended times in order to learn how to live in space. This led to some hair raising adventures. The Clinton administration also made NASA agree to a lifetime cap on funding for construction of approx. 19 billion and a cap of \$2 billion a year in the NASA budget. This set of agreements (along with the personal work of Dan Goldin) proved enough to sell the program with the Congress. Congressional support for the Space Station soared and the votes for it were overwhelmingly favorable. This was due both to the fixed budget

and the clear purpose for which it was intended. This was not achieved cost free. The European, Canadian and Japanese partners were barely informed but were just expected to go along. This led to hard feelings and over the course of the decade the perception that human space flight to ISS would be increasingly irrelevant. In 1999 both the French and German governments said they would only pay the ISS costs because they had agreed to but they had lost interest in the program. The Canadians withdrew some of their resources and their involvement had to be redefined. The Russian involvement with ISS in the critical path eventually was a disaster. While the work on the first module proceeded on schedule (it being paid by the US), the second module was continually delayed. The Russian government kept promising to pay the contractors to do the work but the money never arrived. This was due to the chaos in Russia and the fact that Russia also, space had become ancillary policy rather than primary policy. The delays in the second module and all the subsequent delays in the succeeding modules eventually pushed up the cost of ISS. By 1998 NASA admitted that the Russians involvement actually ended up costing NASA more than if they had not been involved. Of course by 1998, it was too late to go back. The first module was launched at the end of 1998 and the second module has still not been launched. The objective of involving the Russians is still intact (in the sense the policy succeeded) and we enter the 21st century with an international space station (except for Chinese involvement). The ISS enters the 21st century as a monument to big project and without a clear sense of when it will go and who is interested. During the mid 90's, NASA tried repeatedly to build commercial interests in ISS with relatively little success. To cap off the century, the Chinese launched an unmanned spaceship and announced that they intended to become the third country able to put a man in orbit. Their announcement made it very plain that they wanted to do this for reasons of national prestige.

While human space flight NASA was involved in space station, the rest of NASA was involved in remaking itself. The decade of the nineties was not kind to the NASA budget. It started the decade at \$15 billion and ended up at \$13 billion. This substantial reduction forced NASA to rethink how it did business. It decided that it should return to being primarily a R&D agency rather than an operations agency. Thus it encouraged the formation of a private company (US Alliance) to operate the Shuttle and it turned over all of its space system operations to Lockheed Martin. It announced that the days of the big mega spacecraft was over and it would focus on faster, cheaper better space systems. This was helped by the (embarrassing) revelation that Hubble was "nearsighted" (its mirror was ground to the wrong specification), Galileo had a stuck antenna and the loss of Mars Observer. All these were \$1 billion class spacecraft done under the old style of management. The FBC philosophy led to the declaration that Cassini would be the last of big monster spacecraft. It led to the stunning success by the late nineties of Mars Pathfinder which put the Sojourner buggy on Mars for \$145 million and returned widely watched pictures. By the end of the nineties, JPL was launching one new deep space mission every six months in contrast to one every six years. NASA also lived up to its commitment by canceling the Clark spacecraft when it went over its budget. However by the end of the decade when two FBC space systems were lost around Mars (Mars Climate Orbiter and Mars Polar Lander), a backlash started to develop that FBC meant throwing away money. The biggest phenomena, however, in the nineties was the mixed growth of commercial space. In 1989 in response to a Motorola executive's wife's desire, Motorola announced they would develop a constellation of global commercial low Earth orbiting satellites. These would provide global cellular service to anyone of means. They would do this through a constellation of 77 (hence

Iridium) LEO satellite. This bold venture led to an explosion of new thinking about communications and the uses of space to enable it. The key mindset change was that space infrastructure was seen as critical to providing market drivers information services to everyone. In the early nineties, Hughes started its Direct TV service which used high power GEO birds to provide home users with their own satellite TV stations. This immediately proved to be successful because it offered many more channels at much better quality than cable services. The Iridium announcement set off a huge flurry of interest in both personal communication services as well as broadband information services. Teledesic, backed by Gates and McCaw, was formed and announced it would build a 980 satellite system to provide internet in the sky services and enable worldwide interactive games to be played. Hughes, Lockheed Martin and Loral all countered with announcements of their own systems. Not to be outdone the Europeans announced several of their own systems. In addition to PCS & broadband systems, several companies (Lockheed Martin, Orbital Sciences) announced constellations to provide imaging services from space. The US government decided to adopt a policy that restricted such systems to 1 meter resolution although the technology to do better is well in hand. It also restricted the locations where such pictures could be taken. Thus current policy does not allow imaging of Israel. The 1 meter restriction was felt to balance the national security interests with the ability to build the market. All of this commercial activity was to be driven by the capital markets. By the mid nineties the cumulative amount of capital to be raised was \$500 billion to cover all the announced systems. The Wall Street Journal called this the second Apollo era. Through the mid nineties, the companies raised money and started building. Iridium was the first of the big systems out of the block. It launched its service in late 1998.

Within a year, it filed for bankruptcy. The service was a technical success and a marketing disaster. Iridium was selling big, bulky handsets for \$3000 and charging \$3/min. It did offer global service but in high density areas it was inferior to cellular service. Basically the market shifted faster than Iridium could respond. In 1989 there were no small triband phones. In 1999, one could buy a small high quality triband phone that would work in Europe, the US and Japan. It was much cheaper to use than an Iridium phone. Thus a key part of the Iridium market vanished. Iridium could not sell enough handsets to the rest of the global mobile market and declared bankruptcy.

The failure of Iridium had a huge impact on the capital markets. ICO went bankrupt, Teledesic was redefined and restructured. The 21st century starts with a great uncertainty as to whether market driven information services will be successful. The 1 meter resolution systems are just coming online and their impact remains to be seen.

This phenomenal bubble in the commercial use of space had a concomitant effect on launch. The launch market was projected to grow substantially by the end of the nineties with most of the launches being commercial launches. The launch market in the nineties was driven by the development of new launches for the commercial marketplace (the Boeing Delta III as well as the Lockheed Launch Vehicle, the Ariane 5, etc.). All of these arose from the speculation in the commercial marketplace. The US government after a seminal study by Gen. Moorman decided to fund the development of two new types of launch vehicles. An evolved expendable launch vehicle (EELV) to be funded by the Air Force and a reusable launch X-vehicle (X-33) through NASA funding. The goal of the EELV was to reduce launch costs by 20-30% and help the US

recapture the expendable launch vehicle industry from the Europeans. The EELV strategy was fundamentally based on the idea that these vehicles would be developed for the (large) commercial market and the Air Force could pay a fixed sum (\$1 billion) to get a few of these vehicles for itself. The Air Force would start as the anchor tenant in what would become a large commercial market. In 1997 the market seemed sufficiently rosy that the Air Force decided to fund two competing proposals at a cost of \$500 million each. By the end of 1999, this was on the verge of collapse as the launch projections for the business cases continued to erode after the Iridium failure. The NASA RLV was supposed to be a leapfrog approach to get US superiority for a long time. RLV was sold on the basis of \$100/lb. to LEO. In a shift, NASA decided to put a fixed amount into the X-33 with Lockheed Martin (~\$924 million). The strategy is that once the X-33 shows that RLVs can work economically, the commercial market will invest to develop them.

The other new element in the launch market is the cheap availability of Chinese and Russian launchers after the end of the Cold War. Both of these countries being non-market based, offered launch to orbit at significantly reduced prices relative to the US prices. The Chinese however, had significantly higher failure rates than the US, a fact that proved to be significant later in the decade. The US policy was to allow satellites with US components to be launched in these countries with the requirement that the security of the satellites not be compromised and with a limit on the number of launches allowed. This allowed some outlet for domestic satellite companies without allowing the launch market to be swamped by the cheap launchers. The failure of two Chinese Long March-3 rockets with Hughes and Loral satellites led to failure review boards where it was alleged that sensitive information was passed to the Chinese. Since this launcher technology is similar to missile technology, it was alleged that Chinese missiles were improved by this transfer. These allegations led to the reclassification of satellites as munitions and an attempt to rein in where US satellite manufacturers launched their satellites.

The international growth also led to one of the most innovative ideas which was Sea Launch by Boeing with the Ukrainian Zenit. This uses the (former) Soviet technology for rapid launch, puts it on a ship and allows launch from the equator. This is one of the advantages of international cooperation.

The decade of the nineties is also when the air and space pieces of the Air Force started to integrate in new ways. It started with the Gulf War. In this war, space systems were integral to the conduct of terrestrial operations. This happened in many ways. In the area of communications, 80% of all messages to and from the theatre were transmitted by space based communications. There was even a story of a tank in combat getting a software patch from the US via satellite. In navigation, GPS provided the ability for US units to move more freely in the trackless desert and undertake maneuvers that the enemy thought impossible. In an interesting use of strategic assets for tactical use, satellites surveyed bomb damage. In the most creative use, DSP satellites (designed for detecting ICBMs) were used to find theater ballistic missile launches, cue the Patriot battery radar's looking for them and also provide warning to potentially affected areas. By the end of the decade, in the Kosovo conflict almost all the weapons were dropped by Air Force aircraft were guided by GPS. The B-2 was able to overfly the target area and hit 16 targets in one pass with GPS guided bombs. The contrast with Vietnam could not be more stark. In Vietnam, it took 30 sorties and 176 bombs to hit one target. Thus, GPS which the

Air Force had cancelled twice had become so central to its operations that it allowed a new way to fight warfare. This stunning space derived precision brought new problems. The Chinese embassy in Yugoslavia was completely destroyed when it was misidentified by the CIA. Once the coordinates of the (mistaken) target went to the plane, its destruction was certain. This growth of military space led the Air Force to declare it was on the way from moving from an air and space force to a space and air force. By the end of the decade, there was serious talk of changing its name to the Aerospace Force as well as calls for a new Space force. There was much talk in the air of the parallels with the birth of the Air Force from the Army. The growth of commercial space and the growth of military dependence on space led to renewed discussion of the militarization of space. If it is so valuable, then others would realize this and may attack us there. By the end of the decade, there was renewed emphasis on the mission of space control and discussion of using space to place weapons. In particular, Congressional pressure forced the Administration to agree to a space based laser experiments early in the next century. This SBL experiment would show the feasibility of a space based laser weapon to shoot down ballistic missiles. Thus the US declared it wanted to renegotiate the ABM treaty with Russia. Both the Russians and Chinese have declared their concern about US space activities and condemned any thought of antisatellite weapons. Thus the decade ended with the US moving down the road of the militarization of space and suggesting it would counter any hostile use of space.

Space Policy discussion

GPS has proven to be a big winner in the Gulf War. It has also led to an \$8 billion industry in GPS receivers and related uses (Never lost by Hertz). The President is considering making permanent the policy of offering the signal free to the world and also removing selective availability.

Break up into groups with each group representing an agency position (DoD, DoT, 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 focus on the economy (it's the economy stupid!)