THE DREAM OF A NATION

Alfredo Martinez

"We can follow our dreams to distant stars, living and working in space for peaceful economic and scientific gain. Tonight, I am directing NASA to develop a permanently manned Spage Station and to do it within a decade."--President Ronald Reagan in the State of the Union Message, Jan. 5, 1984.

The clock is ticking. The President set the deadline: Do it within a decade.

The assignment: Develop a permanently manned Space Station.

The goal: Some 3,600 days from now, the United States will possess a permanent human-built island in orbit on which men and women can live and work.

PAST HISTORY

The history of America's manned space program for the past two and a half decades has been built upon a series of logical steps. Man's first trips into space were short, daring feats made by men of unsurpassed skill and courage. They went into space for one reason--to determine if man could survive in its hostile environment.

Spurred by presidential direction that America should land a man on the moon and return him safely to the Earth, longer space flights were conducted to prove that man could perform the intricate maneuvers that would be required to achieve a lunar landing. Finally, the goal was reached. Man, for a short period, inhabited another heavenly body.

At the twilight of the moon-landing missions, America's space program came to a crossroad. It was time to chart a new course--a course that would demonstrate man could not only function effectively in space, but could exploit it for the benefit of all mankind as well.

Even before man took his first cautious steps into space, he had dreamed of a permanent outpost in orbit which could be used for observing the Earth and the heavens, or as a jumping off spot for missions to other planets and galaxies. America's first space station was called Skylab, a converted third stage of a left-over moon rocket. The modest orbiting laboratory was in space three months, proving that man could live and work in space.

The cost of getting to orbit was expensive. Apollo had been performed with costly, one-shot throwaway rockets. For space to be fully exploited, a vehicle had to be built that would make it easier to get to space, and cheaper to put things up there. The Space Shuttle was developed, and today teams of men and women travel into space regularly. They manufacture pure drugs and grow large crystals that could lead

to medical breakthroughs, and work with supercomputers. They study the Earth's land mass and oceans, and observe the stars and the planets.

People have accomplished much in the brief span of time since they first began exploring space, yet they have really only scratched the surface. More than a quarter century has passed since the first rocket was launched from Cape Canaveral, yet the actual time spent in orbit, experimenting and learning, has been but a fraction of that. The visits are too brief. A permanent facility in orbit is necessary to permit the long duration of time that work in space requires. A permanently manned Space Station is the next logical step.

In the State of the Union message, President Reagan announced a new, imaginative and far-reaching plan for America's space program, a plan that will carry the program well into the 21st century.

He directed NASA to develop a permanently manned Space Station and to do it within a decade.

The President's Space Station directive underscores a national commitment to maintaining United States leadership in space. Such leadership is essential, for America has become dependent upon operations in space for communications, resource analysis, and weather reports; for the conduct of science and the development of new technologies; and for the national security of our country. Space is no longer an unknown, unreachable environment. It is simply a place to conduct useful activities. A place for men and women to live, work, and learn.

Continued U.S. leadership in space is but one reason why a Space Station should be built. A Space Station will add significantly to knowledge of our own planet and the universe we live in. A Space Station will stimulate technology resulting in "spin-offs" that improve the quality of life for people everywhere. A Space Station will create jobs and maintain our nation's skilled industrial base. A Space Station will improve our country's competitive stance at a time when more high technology products are being purchased overseas. And a Space Station will be a source of pride for all Americans and a visible symbol of our nation's ability to carry out complex scientific and engineering endeavors.

WHAT EXACTLY IS A SPACE STATION?

The Space Station, as envisioned by NASA, will be a permanent, multipurpose facility in orbit. It will serve as a laboratory to conduct basic research, an observatory to look down at the Earth or peer out into the sky, a garage to fix and service other spacecraft, a manufacturing plant to make exotic metal alloys, superpure pharmaceuticals or perfect crystals, an assembly plant to build structures too large to fit in the Shuttle's cargo bay, and a storage warehouse to keep spare parts or even entire replacement satellites.

The Space Station concept provides for both manned and unmanned elements. The manned facility, as well as an unmanned free-flying platform, will be placed in a low Earth orbit of about 300 miles at an inclination to the equator of 28.5 degrees. Two

or more platforms in high inclination or polar orbits will be launched and serviced by the Space Shuttle.

The initial Station will support a crew of six to eight people with crew rotation and resupply from the Space Shuttle at approximately three-month intervals. In addition to living quarters, the facility will provide utilities (electrical power, thermal control, attitude control and data processing), work space, and a docking hub to allow tending by the Space Shuttle. The modules will be able to support scientific research and technology development requiring crew interaction.

The unmanned platforms will be able to provide changeable payload accommodations for activities requiring minimum disturbance and protection from contamination. A maximum of common subsystems such as power, thermal, docking, and data will be used both on the Space Station and the platforms. The co-orbiting platform will be tended and serviced from the Space Station. Modules will be designed and prefabricated on Earth. These will then be transported to orbit in the Shuttle's bus-size cargo bay. There, they will be unloaded and assembled by astronauts wearing space suits and propelling themselves with jet-powered backpacks.

While orbiting at an altitude of about 250 miles, these crews will use cranes and other tools designed especially for work in space.

One module will be furnished as living quarters for from six to eight persons; another module (or modules) will be outfitted as a combination workshop and laboratory. Environmental conditions inside the modules, resembling the interior of a passenger airplane cabin, will enable crews to work in Earthlike shirt-sleeve surroundings.

Other attached modules will carry utilities such as power generating machinery and still others will provide storage space for supplies and equipment. The Station will be self-sustaining for several weeks or even months. It will be partly independent from ground control. Crew members will have considerable discretion in their use of the facilities and in scheduling and carrying out their work.

Attached outside the modules will be platforms called pallets for automated and remote-controlled experiments and observation instruments. Other instruments will be carried on unattached free-flying platforms in separate orbits nearby.

These unmanned portions of the Space Station complex will be important for experiments and observation requiring protection from the contamination and vibration which are inevitably present in an inhabited spacecraft. These platforms are also necessary for maintenance, adjustments, repairs and retrieval.

At intervals of several weeks, the Space Shuttle will arrive at the Station to deliver a replacement crew and new supplies. Some or all of the old crew members will then return to Earth in the Shuttle.

SCIENCE ACTIVITIES PLANNED

Among their numerous activities aboard the Station, crews will carry out basic research in medicine, astronomy, space physics and solar studies. They will conduct experiments in Earth sciences and in many other scientific disciplines. The crews will also work on technology experiments aimed at developing products and services useful for industrial customers and consumers.

Specially trained crew members will make Earth resources observations. Others will check out and launch automated spacecraft to higher orbits. Some crew members will provide in-orbit maintenance, repair and retrofit services for scientific and applications satellites.

One of the Space Station's crucial assignments will be to serve as a national laboratory. It is to be a center for the inception and development of the advanced technologies upon which our nation's economic and social well-being depends in an increasingly competitive and sophisticated world.

The intermittent visits of astronauts to Earth orbit will no longer suffice in the final years of this century, if our nation is to retain its preeminence in space. Sustaining America's competitive edge in technology, from which we derive our standard of living, requires continuing renewal and advancement. The Space Station will help us do this. It will become a key element in our nation's technological investment strategy as we approach the 21st century.

SPACE ADAPTATION

Medical research will play an important role in the early phase of the Space Station era. Through research the industrialization of the later Space Station years will be made practical. For the time being, however, early medical research must concern itself with the "potentially serious" physical changes of the crew members repeatedly exposed to long-term periods of microgravity in order to prevent the occurrence of environment-induced occupational disease.

An issue of concern is adaptation vs acclimatization. Adaptation may be defined as that adaptive characteristic to an environment exhibited by living organisms through many generations of residence in a particular environment. Acclimatization is the process living organisms, that are adapted to a unique environment, use to adapt during exposure to a new environment which enables them to survive.

Understanding human adaptation to the Space Station environment and the implementation of appropriate medical research are a high priority. Previous spaceflight experience indicates that microgravity can present some physiological changes to crewmembers in such areas as calcium homeostasis, cardiovascular adaptation, muscle atrophy, physical deconditioning, space motion sickness, drug pharmacodynamic changes, radiobiology, metabolic functions, environmental factors, red blood

cell alterations, fluid and electrolyte changes, immunological alterations, pulmonary function, oral health, and microbial contamination.

The state-of-the-art equipment on board the Human Research Facility (HRF) and the dedicated scientist-technicians will enable in-depth research which should produce statistically valid data on physiological adjustments of humans to microgravity. The goal of the research on board the HRF is to obtain a better definition of each problem and an understanding of the underlying mechanisms which will ultimately lead to prevention of the problems encountered by today's spaceflight participants.

CONCLUSION

A challenging new era is under consideration and on its way. With it, come new problems and questions to solve and answer. Nevertheless, positive thinking is required of all those who participate in or share part of the Space Station's responsibility. Hence, no longer is space an unknown, unreachable environment. It is simply a place for men and women to live, work, and learn.

BIBLIOGRAPHY

NASA FACTS--by John F. Kennedy Space Center.

SPACE STATION ARCHITECTURE--by Marc M. Cohen.

COMBINED MODULE STUDY--by P. Holman Smith.

SPACE STATION HABITABILITY MODULE--by P. A. Bahr.

SCIENCE LABORATORY MODULE OUTFITTING--by Thomas M. Olcott.

GOING TO WORK IN SPACE--by Robert A. Schmitz.

SPACE STATION CREW SAFETY ALTERNATIVES STUDY--by R. F. Raasch.

SPACE STATION LIFE SCIENCES--by Life Science Division.