Building for the Future

Rocco Petrone

Assistant Director for Program Management, Kennedy Space Center, NASA

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Thank you, Mr. Hagan:

It is an honor and a challenge for me to speak to this distinguished group representing the space community and to undertake an extremely difficult task - which is to attempt to substitute for Dr. Kurt Debus, Director of the John F. Kennedy Space Center, NASA.

Dr. Debus asked me to extend his sincere regrets. You may know that Mrs. Debus recently underwent major surgery in Nashville. While she is recuperating nicely, Dr. Debus could not speak to you at this time.

Let me add a hearty welcome from NASA to that of John Hagan, the Canaveral Council of Technical Societies, and General Davis. It is very appropriate, of course, that the First Space Congress has convened at the door of the nation's spaceport. We sincerely hope that the Space Congress will grow into a permanent asset for the Government and space-oriented industry.

In an undertaking as large as the space program, it is essential that channels of communication should be open and freely operating between Government and industry. We would never consider launching a spacecraft without adequate provision for communications to transmit commands to the vehicle or to transmit data back to Earth. Yet we often become so engrossed in management tasks that we forget the vital need to exchange information. When we fail to communicate, we fail to profit from the experience of others. Conferences such as this help to keep the channels open and provide opportunity to discuss not only where we are going in space, but why we are carrying on this tremendous effort, and how we are going to get there.

Mr. Hagan and his aides are to be commended for the excellent program they have arranged. I am sure that much good will come from your meetings. And I hope that many of us are still around to listen in on the proceedings of the 25th Space Congress - which might well concern itself with an analysis of data received from a manned base on one of our nearer planets - so that we can evaluate just how good the foundation was that we are building today.
The cornerstone of that foundation was laid in 1958 with the passage of the Space Act and the establishment of the National Aeronautics and Space Administration. You will recall that this came one year after the first Sputnik had shocked our country into an agonizing reappraisal. In retrospect, some of the critical examinations which followed went to grotesque extremes. But much good also came out of that soul-searching which forced us to take a close look at some aspects of our social structure that had been taken for granted. When we did look, we found some of them wanting.

History may find that Sputnik helped to guide the nation back to those fundamentals which made it great. Other civilizations waxed and waned because their people refused to accept sacrifices that are the inevitable price of progress. One could find many examples of people who attained high degrees of culture, only to start downhill when they refused to accept challenges of military, political, economic, or technical kinds. Less than six years ago, after months of debate and disclosure, the Administration and Congress committed the country to explore space for the advancement of knowledge to the benefit of all mankind. Thus the challenge was accepted. Our people willingly tightened their belts in accepting the sacrifices that would be necessary to assure the United States a position of pre-eminence in space — the only position which is in keeping with our heritage.

That was what President Kennedy meant when he told the Congress, in May 1961, that when the first astronauts travel to the Moon, it will not be they alone who make that awesome journey, it will be the entire nation. President Johnson put the task squarely when he said that "the fate of the free society is inalterably tied to what happens in outer space as humankind's ultimate dimension."

To those of us in Government, as well as to you of industry, our leaders have flung down the gauntlet to overcome many barriers - of heat, and radiation, and all the other obstacles which stand between us and the Universe. We are overcoming them, one by one, until today we admit no barrier, no obstacle, no limits — except those of the mind.

Great progress has been achieved since 1958. To summarize the rate of growth, I would like to quote Mr. James Webb, the Administrator of NASA, who recently told the Congress that:
"It is apparent that we have reached a critical midpoint in our effort to achieve space pre-eminence. We have moved from a circumstance in which the Soviet Union held clear superiority in space to one in which, as a result of the driving effort put forth in the past five years, we have achieved a degree of parity in our ability to penetrate and operate in the space environment. As a consequence, the nation is in a position to consider not merely what it is able to do in space, but also what it is wise to do in view of our greatly increased scientific and technical ability. We have, in short, moved from a period in which we did everything we could and regretted our inability to do more, to one in which we have a very large capability and are increasingly confronted with hard decisions in the selection of the programs which we will undertake."

As the first major objective, President Kennedy told the world in May, 1961 that Americans would travel to the Moon and back before 1970. President Johnson has reaffirmed that resolution.

As to the logic and motivation behind the program, Dr. Wernher von Braun of NASA listed four reasons in his recent address to the American Ordnance Association: first, man was born to explore and what man can do, he will do; second, Sputnik taught us that the world judges scientific and technological capabilities in terms of achievements in space; third, we can only assure future security and prosperity by developing a broad capability to operate in this new dimension; and finally, the benefits to mankind in terms of knowledge and technology will be truly rewarding; possibly, it might be said, as rewarding as those which followed the discovery and settlement of this continent.

Time will not permit a detailed examination of the many tasks undertaken by NASA in the context of the overall space program. This audience well understands the important assistance which the earlier development work of the Department of Defense contributed to the NASA missions. To put it simply, NASA, in essence, took modern weapons systems and converted them into scientific plowshares by utilizing the basic vehicles which were developed for defense to carry out manned and unmanned space missions.

Further, the on-going launch vehicle programs, such as the Saturn V, are utilizing the heavy tooling of the aerospace industry for weapons systems that are being phased out. Some of the same presses and tooling employed for the B-52 are helping to shape the metal for the 7.5 million pound booster. To these available tools, it has been also necessary to add newly developed tools and techniques, to meet the greater technological demands of this larger booster development.
We have used that technology developed for the weapons systems as a springboard to advance the state of the art. The technology now being developed under the NASA aegis can, if required for the defense of the country, be converted back into the swords of tomorrow. So there has been, and will always continue to be, a significant interplay and interaction between the technology utilized for peaceful exploration of space and that required for purposes of defense.

Two-thirds of the current NASA effort is concentrated in the development of manned space flight capability, namely the Gemini and Apollo programs. These programs now bear the initial cost of advancing the broad spectrum of space flight capability, that is the development of the large launch vehicles, manufacturing, assembly, checkout and launch facilities and the management framework which steers these programs. These capabilities, once developed will be available to the nation to carry-on new programs many of which are now in the feasibility study phase. However, the agency is also pressing steadily forward with programs in space science and applications, advanced research and technology, and the use of technology generated by space research in the economy.

Most of my remarks this morning will relate to manned space flight, but let me quickly review some of the other facets of the NASA effort.

In space science and applications, man is increasing his understanding of the Earth environment, the space surrounding it, the solar system, and the universe. Unmanned satellites are the essential instruments of this basic investigation which will help to define and measure the flight environment for manned craft.

This phase of the program has brought substantial dividends in a very short time. Tiros, for example, while it has limitations in scope of coverage, demonstrated convincingly the potential for weather prediction beyond anything yet available to this science. Nimbus is being developed to provide the first, true operational weather observation system. In due course it will fulfill the promise of its forerunner.

The communications satellites paved the way for an efficient space communications network. This program is unique because it was the first in which the commercial possibilities were immediately recognized. The Congress has licensed the corporation which will operate the network, employing the techniques and the technology which came out of Relay and Syncom.
In the launch vehicle area, the Goddard Space Flight Center has established a formidable record by supervising that famous string of 22 successful launches of the Thor Delta. This gives an indication of the maturity that the space program has achieved. The Lewis Research Center added another remarkable contribution last November with the first successful flight of Centaur, the liquid-hydrogen powered vehicle designed to up-grade our payload capability for lunar and other space probes.

Another major facet of NASA interest is that of advanced research and technology to learn how to do things which have never been done. Here exploratory work is continuing in such key areas as propulsion, spacecraft technology, electronics, nuclear systems, and human engineering. From this area of endeavor will come the knowledge we need to develop the pro­grams of the future.

In support of the space program, NASA has joined with the Department of Defense to construct and operate the worldwide tracking and data acquisition systems. This is a cooperative enterprise out of which the country has acquired a national asset, and at much less cost than if each had gone it alone. These tracking and data acquisition systems are vital to all space flight programs - those now underway and those to follow.

Also, NASA has undertaken an aggressive effort to find and test effective means to accelerate the use of new technology in the civilian economy. Only a few months ago, patent agreements were relaxed to permit industry to apply new developments in such fields as energy use, advanced electronics, new materials, the life sciences, and highly advanced engineering systems.

Turning now to manned space flight, which is supported by about 60 percent of the space budget, the objectives are to understand the environment and establish man's capability to operate in that environment, to explore space, to develop the national capability for manned space flight and, in doing all of these things, to achieve leadership for the United States, in space flight capability.

The unqualified success of Project Mercury, both in the early suborbital and the later series of orbital flights, provided a firm foundation for the much more complex programs on which NASA has embarked.

Skeptics who had doubts concerning Mercury might explain what happened as did one of Admiral Peary's Eskimo guides after the discovery of the North Pole. "The devil is asleep," he remarked, "or having trouble with his wife. Otherwise, we should never have come back so easily."
Actually, Mercury’s success can be attributed to planning, the hard work of thousands of people—civilian and military—and meticulous attention to detail.

Gemini, as might have been expected, demands far more in terms of new interfaces, new members of the manned space flight team, a much bigger base.

In turn, Apollo has required further expansion and broadening of the support structure.

Mercury confirmed that a trained astronaut can function effectively in space for relatively short time periods. As to the why of man in the loop, I believe the debate has long since been resolved for the fundamental reason that only man can react to the unknown and it is the unknown which we must expect. We haven’t yet learned how to program machines for what we don’t know.

The successful flight test of the first boilerplate Gemini capsule was an important milestone in this program which bridges the gap between Mercury and Apollo. Inde time, NASA will gain invaluable experience from missions involving two astronauts over time periods up to two weeks. The techniques of rendezvous and docking with the Agena target vehicle in near earth orbit will be invaluable to Apollo and subsequent manned space flight missions.

NASA is gratified with the decision of the Department of Defense to utilize the Gemini program in order to measure the potential military significance of manned spacecraft with maneuverable capability.

In Apollo, NASA will acquire a three-man spacecraft capable not only of extended flight, or rendezvous and docking in near-earth orbit, but also of operating out to a distance of one quarter million miles from Earth.

As Dr. George Mueller, Associate Administrator for Manned Space Flight said recently, "Our flight to the Moon can be compared to Lindbergh’s flight to Paris. His purpose was not to reach Paris, but to develop and demonstrate the capability, equipment, and know-how for trans-Atlantic flight." Had Lindbergh only desired to tour Paris, he would have taken a boat.
So the Moon is not the end. Rather it was a logical target, a beacon on which to focus the manned space flight program at this point in time. Fully 90 percent of the investment in the Apollo program would have been necessary to develop the capability even if there were no Moon. We would certainly have trained the people, created the industrial base, developed such powerful launch vehicles as Saturn, and advanced spacecraft, constructed the necessary facilities, and obtained the experience in other operations. Apollo provided a focus for all of these related efforts.

Mr. Webb summed it up when he said, "Much of what we need for pre-eminence in space will be acquired on the way to the Moon."

The most important factor in the total capability required for Apollo is people. Nearly 250,000 people are at work now in the program. When it peaks next year, the number will increase to 300,000. Only about six percent of them are Government employees. The bulk are on the payrolls of industry. However, many are also laboring in research institutes, and in the laboratories of many colleges and universities coast to coast.

Of that impressive reservoir of trained manpower, about 45,000 are scientists and engineers. They represent something like 2.8 percent of all of the scientists and engineers gainfully employed in this country. While that is a substantial number, it is obvious that the national supply is not being strained. In fact, the opposite is true because industry has additional trained manpower if more should be needed.

A second factor in the national capability harnessed for Apollo is the industrial base. As you well know, this team consists not only of prime contractors, but also of several tiers of subcontractors and suppliers in every State, some of them quite distant from the regions in which the aerospace industry is concentrated.

It has taken several years to build an industrial team of the size and competence required for the program. That is understandable when you evaluate its true magnitude, for it is bigger and far more complex than any other program ever undertaken in peacetime. Now that such a team has been welded together, it is available to serve the nation in future space undertakings.
A third requisite in manned space flight was the increase of launch vehicle power. For five years we trailed the Soviets in this area. Consequently they were in a position to accomplish many "firsts" in space flight. With the advent of the Saturn, NASA's first heavy launch vehicle, we are beginning to catch up. You will recall that the Saturn I launched January 29th, employing a hydrogen powered second stage, orbited a mass a thousand times heavier than the first U. S. satellite.

The Saturn I can orbit a payload of 11 tons, or about twice the payload capability of the Soviet Vostok. The more advanced Saturn IB will increase the capability to some 16 to 17 tons of payload in orbit. With a Centaur third stage, the Saturn IB could accelerate about six tons to escape velocity.

A really major advance, however, will be provided by the Saturn V which will be capable of launching 120 tons into earth-orbit or of injecting a spacecraft assembly of 45 tons into lunar trajectory. This would be considerably more than the largest payload which the Soviets have thus far launched.

I believe it is worth noting that the Saturn vehicles will be available to fly other missions after their initial development for the lunar exploration program.

The Apollo spacecraft will carry technology much beyond its predecessors in Mercury and Gemini. The command module can reenter the atmosphere at a velocity 40 percent greater than orbital flight. The crew will be shielded against radiation in the command module and can function in a shirt-sleeve environment during much of the flight. The service module carries a high-thrust rocket propulsion system and sufficient fuel to assure the astronauts substantial capability to maneuver in earth orbit and to select the reentry corridor.

The companion spacecraft, the lunar excursion module, represents another "first" because it is the first U. S. manned craft designed wholly for operation outside the earth's atmosphere.

If we measure the resources of the Apollo program in terms of the long-range future, perhaps the most important asset the nation will acquire is represented by the facilities being provided for design and development, manufacture, assembly, testing, checkout, launch, and flight control.
Perhaps the most impressive of these facilities is now being erected at the John F. Kennedy Space Center, NASA on nearby Merritt Island. Complex 39, as it is known, will provide the nation with a flexible capability for launch, which we simply have not had in earlier research and development programs. We considered it mandatory to successful space operations.

In concert with these physical attributes of the total efforts, the demands of the Apollo program are pushing the art of management of large-scale research and development operations into new dimensions.

You can understand, I am sure, that the overall capability — people, industry, research institutes, launch vehicles, spacecraft, facilities, operational experience and management — will provide the nation with space power, including new knowledge and techniques, that has enormous potential.

With a view to the future, advanced program studies are now being carried forward, to provide the base of knowledge upon which decisions may be made for future national space programs. These advanced studies in the manned space flight program are concentrating on such possibilities as earth-orbital platforms, manned inter-planetary flights and manned lunar bases.

These studies will provide the leaders of the nation with the data upon which to base a judgment as to the timing and direction of our next large step into space.

Right now, we must get on with the task at hand. We are rapidly approaching the period of maximum effort in the Apollo program. We are filling the pipeline. NASA Headquarters and its Centers are working in harmony with the industrial team providing the research and development base. We are collaborating with the Department of Defense and all other agencies of Government having an interest in the program.

Production lines have been established and must be kept moving.

Facilities are well along in construction and must be pushed to completion in phase with the hardware development.

We have successfully completed our initial steps into outer space.

Like the explorers of old, we cannot foretell all the consequences of our voyages, but we are confident that mankind will profit from the greater understanding borne out of the new knowledge and technology derived from the space program.