Korean Space Activities and Its Future Direction

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Honorable guest, ladies and gentlemen, it is an honor and a great pleasure for me to take this opportunity to discuss about Korean space activities and its future direction. I would like to review briefly present status of international space activities and look out 21−st century space programs of the advanced countries before start to discuss Korean activities.

Ⅰ. WHAT HAS BEEN DONE

For the first two decades of the Space Age, space exploration and utilization were conducted almost entirely by the United States and the Soviet Union. Space power is rapidly proliferating now as more and more nations achieve significant space capabilities ; China, India, Japan and the European

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Space Agency have the ability to launch satellites.

Several European countries, especially France and Germany, have developed substantial aerospace industries to build launch vehicles and satellites. Canada, although it has no national launch capability, has a strong aerospace industry that has built communications satellites and the robot arm for the space shuttle. India has its own small launch vehicle and is developing its own remote sensing and communication satellites and more capable launch vehicles. Brazil is developing the capability to build and launch satellites in a few years. Indonesia was the first of the less developed countries to establish its own domestic satellite communication system.

The former Soviet Union placed first satellite, the first animal, the first man, and the first woman in space ; launched the first space station ; returned the first pictures from the far side of the Moon and the first pictures for the surface of another planet Venus. They are operating modular station MIR for many years. Clearly, the Russian intend to expand their presence in low earth orbit and then move out with piloted missions to Mars and possibly the Moon. Two new rockets and their own version of a space shuttle are reported to be in development.

On the other hand, we find the relationship between the U.S.A and Russia, the two major space countries, has drastically changed with the end of the cold war in the international society. Thus, the focus is shifting from a period of competition to a period of harmony.

Formed in 1975, the European Space Agency(ESA) is a group of 14 European countries ; Belgium, Denmark, France, Germany, Ireland, Italy, the Netherlands, Spain, Sweden, Switzerland, Austria, Norway, Finland, and the United Kingdom. All countries contribute to the organization's general operating budget which supports basic space activities. Special projects, such as the development of the Ariane launch vehicle, were selected separately and no country is forced to participate. ESA's Ariane competes with the U.S. space shuttle for launching satellites.

A little-known fact outside space community is that the Peoples Republic of China has been launching satellites since 1970. In 1984, China not only introduced a launch vehicle whose third stage uses high efficiency cryogenic fuels(liquid oxygen and liquid hydrogen), but also placed a communication satellite in geostationary orbit. These two feats were worthy of a major space power(the Russians, for example, still do not have a launch vehicle that uses liquid hydrogen/liquid oxygen). The rocket, called the Long March 3, is now being marketed internationally by the Chinese, along with the less capable Long March 2.

The Japanese space program was founded in cooperation with the United States. Their N launch vehicle was manufactured from a U.S. designed Delta vehicle and U.S. industry built most of the satellites launched by the Japanese for meteorology and communications. Japan has been building its own launch vehicle designated the H, which will use the higher efficiency liquid hydrogen/liquid oxygen fuels.

The circumstances of space development in Japan has drastically changed in these past few years. The general common understanding is that they are facing a period of transformation into the space advanced country. For example, in February 1994, they succeeded in launching the first H-II launch vehicle that was developed with their own. In August 1994, they succeeded in launching an engineering test satellite 2 ton class KIKU-6. Though the launching process was successful, the satellite unfortunately did not successfully transfered into the geostationary orbit due to the apogee engine malfunction. However, they succeeded in launching a geostationary satellite last march.

The Japanese Space Activities Commission established special committee on Long-Term Vision to forecast the future 10 to 15 years space development program in Japan, on a 30-years outlook. And, the long-term vision was announced officially in July 1994, under the title of "Toward Creation

of Space Age in the New Century."

This Japanese long-term vision includes the following five points as the purpose of space development with consideration to the first quarter of the 21-st century.

The first point indicates that studies on potential of space expands the intellectual frontier of mankind and contributes to creating a new culture.

Point two, is that space development contributes to expand activity ranges and secures the existence for mankind.

Point three, is that development of innovative space technology contributes to creating future new technologies and industries.

Point four, is that mutual understanding and respect deepened on a global view contributes to stability and development of a global society.

Point five, is that space development contributes to development of human resources of the next generation that will support the development of future society of mankind.

II. OUTLOOK TOWARD 21-ST CENTURY

It is as challenging for us today to envision the advanced world of 2035 (next forty years) as it was to foresee today's world back in 1955 (before the first man made satellite). The program which the space advanced countries propose sets the stage for exciting achievements in pioneering the space frontier. A few important challenging technological milestones would mark this progress :

○ Initial operation of a permanent Space Station by the year 2002 ;

- The space station project once conducted by the U.S.A., Europe, Canada and Japan is restructured as a 5-partner's joint project including Russia. It is expected to be in Initial operation stage by the year 2002.

○ Initial operation of dramatically lower cost transport vehicles to and from low earth orbit for cargo and passengers ;

- The U.S. shuttle fleet will become obsolescent by the turn of the century. Reliable, economical launch vehicles will be needed to provide flexible, routine access to orbit for cargo and passengers at reduced costs. A new vehicle be put into operation by the year 2000 with a goal of achieving operation costs of $200 per pound delivered into orbit. At present Japan is actively committeed in research and development on transportation between space and earth using unmanned winged transfer - and - return vehicles HOPE that can transport goods to and from the space station.

○ Return to the Moon ;

- Only 24 individuals have traveled as far from Earth as our nearest neighbor in space, and only 12 have landed upon it. The total time spent by humans on the lunar surface was less than two weeks, all of it in the Apollo years from 1969 to 1972. In those brief journeys a remarkable amount was learned about the Moon ; more than 800 pounds of lunar soil and rock were returned to be analyzed on Earth. Now in the 21st century, Men return to the Moon, not only for brief expeditions, but for longer, systematic explorations ; eventually, we should come to stay. The lunar surface will be put to good use when we venture farther into space.

○ Human exploration and prospecting on asteroids and Mars by the year 2035 ;

－A small number of Earth－crossing asteroids have orbit so nearly match Earth's that they can be reached more easily, in energy terms, than the lunar surface. Others are of interest for enterprise and settlement because they appear to contain the life－giving elements carbon, nitrogen, and hydrogen.

After the accessible asteroids, the next easiest objects to reach in our Solar System are our neighboring planets Venus and Mars. Pioneer, Mariner and Soviet Venera spacecraft confirmed that Venus has a poisonous atmosphere, a crushing pressure at the surface, and a temperature hot enough to melt lead. It is no place for humans. But Mars, our other nearest neighbor, is far more hospitable. Mars turns out to be rich in surprises, mysteries, and promise. However, the distance from Earth to Mars, averaging about 1,000 times as far as to our Moon, is great enough that we are more likely to visit the planet for exploration than for enterprise.

Ⅲ. BENEFITS FROM FUTURE SPACE ACTIVITIES

The continuing space program for 21st－century will return tangible benefits in many forms.

○ Advances in science and technology of critical importance to the nation's future economic strength and national security ;

－The space program will motivate people, provide standards of excellence, and stimulate many fields of science and technology, including those that we believe will be most critical to the economic growth of 21st century. Specific examples include artificial intelligence, robo-

tics, tele-operation, process automation, hypersonic flight, low-cost global and orbital transport, optical communication and data processing systems, ultra high-strength and high-temperature materials, super computers, wireless power transmission, pollution-free vehicles, closed-ecology biosphereoperation and myriad others.

○ Provide direct economic returns from new space-based enterprises that capitalize upon broad, low cost access to space ;

- During the next 10 years, the Space Station may spark new industries by serving as a space laboratory for academic and industrial researchers. New processes of economic significance can be expected from applied materials and processes research in microgravity. Other new economic opportunities may come through laboratory environments isolated from Earth's biosphere, through the orbital global perspective for communications, navigation and observation of Earth, and through increased public access to space. Obtaining a return from new processes will require private investment in orbiting industrial parks established to provide common services to entrepreneurial companies carrying out independent operations in orbit.

○ Open new worlds on the space frontiers, with vast resources that can free humanity's aspirations from the limitations of our small planet of birth ;

- The immediate benefits from advances in science and technology and from new economic enterprises in space are sufficient to justify future space activities. However, we believe that the longer-term benefits from the settling of new worlds and the economic development of the inner Solar System will prove even more rewarding to humanity. These returns are difficult to quantify. But the contributions to humanity from Columbus' New World are surely far beyond its material

returns, we believe that in removing terrestrial limits to human aspirations, will provide of incalculable value to planet Earth and to the future of our species.

Ⅳ. SPACE ACTIVITIES OF KOREA

During the late seventies and eighties, we used space technology on a developmental research basis particularly in the inventory of natural resources, food production, land use mapping, coastal zone management and geological mapping.

Although there have been an increase in interest to acquire and develop space technology in Korea, there is still much to be done. The development of infrastructure, equipment and trained and skilled manpower has been slow thus hindering widespread adoption of the technology. A general feeling is that there is enough awareness on the importance or usefulness of the technology for socio-economic development among the professionals. However, the same level of awareness has not reached the policy makers and the politicians to warrant this country to embark on a serious program to utilize the powerful tool of space technologies in our national development strategies.

However, this circumstances start to change slowly during the early ninties.

KAIST(Korea Advanced Institute of Science and Technology) Satellite Research Center(SRC) initiated a small experimental scientific satellite program for the purpose of education and training of graduate students.

Woo Ri Byul-1 was built with the technical assistance of University of Surrey, U.K., and was launched into the low earth orbit by the Ariane

launch vehicle in a piggy back ride in August, 1992.

Subsequently, Woo Ri Byul-2 was launched into an orbit with inclination angle of 99 degree and at an altitude of 820 km sun-synchronous circular orbit in September, 1993. KAIST was responsible for the development of satellites electronic system as well as the management of the total system. Sam Sung Electronics Co. and Sam Sung Aerospace Co. were responsible for the development of CCD camera and the bus structure, respectively. Korean Aerospace Research Institute(KARI) participated in the environmental test of the system.

Through the Woo Ri Byul 1, 2 program, KAIST SRC has accumulated experiences in designing small satellite and ground tracking operations. Scientific activities such as voice and image data communicationn, picture taking of the Earth's surface and measurement of primary cosmic rays have been carried out.

Woo Ri Byul-3 is scheduled to be launched in November, 1996. SRC is developing 3-axis attitude control system, high-speed image data transmission system, solar panel deploying technique, data collection system for ocean research, cosmic ray detector and CCD camera with 20 m resolution.

To meet the increased demand of domestic and international communication and broadcast, Korea Telecommunication Corporation is developing "KOREASAT" communication satellite which is scheduled to be launched into geostationary orbit in July 18, 1995 at Cape Canaveral.
Although it's not the world first communication satellite, once KOREASAT reaches the operational status sometime this year, the impact it brings to Korean society will be tremendous. Communication is not only a basic human need itself, but it contributes to meeting all other needs. Economic and social development generally imply increased mobility of populations, and communication system can help people maintain important relation-

ships. Trade and Commerce, whether national or international, depend on communication. Emergency communication in disaster situations, for example during last Kobei earthquake, is indispensible to prevent or to reduce suffering and to bring in any help.
Communication is the most highly developed of space technologies. In these sense, KOREASAT will mark an epoch and generate new momentum in the future Korean Space activities.

KARI is launching a new scientific satellite program, KOMSAT, this year. KOMSAT is a low earth orbit satellite with an altitude of 800 km and weighs 500 Kg. KOMSAT will be developed jointly with TRW, an U.S. aerospace co., to maximize related technology transfer. Many Korean Universities and Aerospace companies join the program for design, manufacturing and testing of the various subsystems. KOMSAT is scheduled to be launched in 1999. We expect the Korean Aerospace industry's space technology capabilities will make a quantum jump through this program.

KARI is also actively involved in the development of scientific sounding rocket. We have launched single stage sounding rocket successfully twice in 1993. A new 2-stage sounding rocket which has a capability of carrying 200 kg payload to a maximum altitude of 150 km is underdevelopment. Scientific investigation of the Earth's lower ionosphere, measurement of ozone concentration over the Korean peninsula and observation of celestial bodies with X-ray will be made in 1997.

V. CONCLUSION

Certainly, Korean space community is making a small but important steps forward in this decade. However, at the threshold of the 21st space century, it would be more than appropriate for Korean Space community to reconsider the national activities in terms of what should be done, how it could be done and how to get the necessary fund.

When we look at the future of this technology, we discover that all of us are consumers of this technology. In other words, we cannot live any single day without using space technologies in the future. Then, the question that we are going to ask is, we are going to be just a community of consumers on one side or we are going to be a community of producers as well as consumers on the other side. To be a producer of space technology does not necessarily mean to be a forerunner in the space technology. It is well known fact that any single nation cannot assume whole responsibilities of developing new space technologies. 21st century human achievements in the space technology can only be made through international cooperation due to the economical and political reasons.

Therefore, it would be very important for us, as a developing country, to adopt the space technology on the wider basis to enhance the capability of the people at the national level. This will make us more receptive to science and technology so that advanced technologies could be transferred into our community efficiently.

A country can adopt space technology either on adhoc basis—with each agency deciding whether existing space technology is cost—effective for meeting its requirements—or by establishing a space program to develop technology to meet national needs. With the exception of a few countries which have been involved in the development of space technology since the beginning of the space age, most countries have initially adopted space technology on an adhoc basis, using existing satellite systems for international telecommunications, for meteorology or for remote sensing. Some of these countries have subsequently established space programmes to develop or adopt new technology to their needs.

In my personal point of view, it is time for us to establish a space programme which is based on an assessment of our national development priorities, our technical capabilities and our financial resources. A long term

vision for coherent and sustainable development looking out 21st century is most desirable. I would like to propose to establish an Inter-Ministry cabinet level "KOREAN SPACE AGENCY" to study and execute KOREAN SPACE PROGRAM of the 21st century.