Development and Utilization of Space Resources

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The conflict between the soaring growth of population and the intensifying shortage of resources on the earth is one of the principal contradictions of our time. This paper, based on the relevant information acquired by the space nations of the time. tries to prove that brilliant prospects are before man to exploit space resources and bulid up the space economy, which will be a great cause benefiting the human race and their descendants.

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The boundless cosmic (outer) space with infinitely rich and precious resources seems to be the new space for mankind to survive and develop in the 21st century and further ages.

The major resources existing in the outer space are described as follows.

1. Space material resources. They exist primarily on the planets and moons in the solar system and the Galaxy as well, including mineral resources, land resources, water (ice), etc. Take the moon as an example. It is the nearest celestial body to the earth in the solar system, endowed with plentiful material resources. The rocks on the moon contains quite a quantity of oxygen, hence no need to carry large quantities of liquid oxygen from the earth when man starts out from the moon to launch large scale explorations in the space. The sand and soil on the moon contain considerable He3, an excellent fuel for nuclear fusion. There are also large amounts of ores containing metals such as iron, nickel and cobalt on the moon, whose igneous rocks are a fine raw material from which aluminum, silicon and oxygen can be extracted. 95 percent of the material for building a space metal smeltery on the moon would be available from the moon itself, hence the cost of space transportation would be greatly reduced, which would therefore confirm the feasibility to build space towns on the moon. Many a planetoid in the asteroid zone contains very precious mineral reserves such as the asteroid 1986 DA holding a reserve of platinum worth £700 billion and gold worth £70 billion.

Space energy is also part of the space material resources, for instance, the luminous energy, which are an inexhaustible source of energy as well as a source at low costs. As known by determination, the luminous energy of the sun sent to the surface of the earth per second amounts to 8 billion kw, an equivalent volume to tens of thousand of times the total generating power output of the whole planet. Thus, it has become an important subject for scientists round the world to work on as how to exploit this most tremendous resource.

the space where man would be able to make fortunes. Presently, the space nations are paying great attention to probing into of how to use the environment of spatial microgravity, high vacuum, deep cold and high purity as to produce some particular substances and materials. It is hopeful that some valuable semi-conduct materials and medicines could be created when processed in the outer space. Astronomic scientists believe that now is the time when spatial pharmacy is coming into being and medical scientists hold that spatial pharmacy will contribute to man's conquering diseases and enhancing human health. It is predictable by numerous experiments that the exploitation of space microgravity may cause a revolution in the fields of material industry and biology, a revolution that would add something new to the industrialization and commercialization of space resources and help quicken the pace of growing space economy.

3. Space tourism resource. As a matter of fact, tourism today is becoming part of the citizen's cultural consumption in many countries. It is expected that the development of astronomic technology will bring forth conditions for the well-to-do individuals and families to travel around the outer space. Those big tourism agencies and building companies in the United States, Japan and other major developed countries have already fixed their eyes on the space. Tourism and exploration companies will arrange space flight round the earth for their tourists. Sumitomo in Tokyo, the biggest building company in the world is designing a hotel travelling in the orbit as far as 270 miles away from the earth, hence it is called "Space Hotel". In a word, the boundless and mysterious space is a most attractive tourism resource to be exploited.

It is man's great mission of historic significance to start exploiting the resources in the space in the coming century. Several tens of countries in the world, big or small, rich or not rich, have involved themselves in the frequent activities of space exploration and exploitation at high cost. The ambitions of these countries to explore the space, apart from their military consideration, are derived from the

tradiction between the overgrowth of the global population and the growing shortage of resources on the earth. As an inexhaustible source of man's consumption, the space will become a new world for man to live in and develop for himself. The "population explosion" has lasted for more than half a century. The number of world population was respectively two billion in 1930, three billion in 1960 and four billion in 1975, and now it has increased to 5.7 billion. According to the forecast by the US scientists, the number of world population, if increasing at such a rate, will amount to millions of hundred millions, really an astronomic figure! By that time, the entire land on the earth, even mountains, deserts and glaciers, would be all inhabited by man, with a result of 0.3 square meter of occupied area per capita, leaving no room for any activity.

Larger quantities of resources will inevitably be consumed as populations expand drastically. China, for instance, with a population of near 1.3 billion, consumes per day 750,000 tons of grain, near 60,000 tons of pork, 10,000 odd tons of edible oil, 220 million packs of cigarettes, 36,000 tons of wine and liquor, 460,00 tons of coal and 420 tons of kerosene. In addition, 34 million odd meters of cloth, 200 million odd meters of silk and satins, 1.3 million pairs of leather shoes and many other lines of goods not in the list are sold per day. Americans enjoy a still higher standard of living. An average American who lives a life of eighty will have a lifelong consumption of 200 million liters of water, 20 million liters of gasoline, 10,000 steels and wood from 1,000 big trees.

The resources on the earth, however, are found shorter and shorter. The condition of staple food supply, due to the continuous shrink of cultivated land, is from bad to worse. 450 million people throughout the world, women and children as the majority, are suffering from lack of food. Presently, 28 people are starving to death per minute and hundreds of millions of people are suffering from malnutrition on this planet.

Today man is confronted with an inevitable outcome, the shortage of mineral resources and energy, and some other resources will

Welt, the time limits of mineral reserves available are as follows: oil for 48 years, zinc for 32 years, nickel for 42 years; lead for 50 years, iron for 61 years, aluminum for 79 years, manganese for 63 years, copper for 49 years and natural gas for 69 years.

Unknown though the reliability of the above information is, these figures do give us a warning that the world consumption volume of minerals will inevitably have a sustained increase so long as the population and economy keeps expanding. The crisis of mineral resources is a real thing that does occur to us rather than a matter of figures. It is a subject of vital importance before the human race that how to handle the contradiction between the rapid growth of population and the intensifying shortage of resources. It is a critical problem that requires economists and scholars of futures studies to give a resolution.

This author holds as mentioned above that an important avenue to solve this problem is to get down to exploiting and utilizing the resources in the space and building up space economy, which is referred to as the production activities, economic management and relevant services carried on in the space.

Space economy has several characteristics as follows:

1. The term of space economy is defined as the production activities carried on in the outer space far off the earth, hence the range of space economic activities would be boundlessly vast.

2. As space economy would be the application of the most advanced science, technology and knowledge of the time, each of the economic activities might result in a miracle bringing about a big leap forward when the course from test to formal practive was fulfilled.

3. Space economy, from a long-term point of view, would be an economy of high efficiency, whose significance and value would be incomparable to any conventional economy.

4. Space economy would be an economy with most brilliant prospects, because resources in the space are inexhaustibly rich. The peculiarity of space environment is beyond compare with that of the

significance to the satisfaction with man's demand.

It is the key to the development of space economy as how to use the luminous energy for building space energy industry, which is an important means of relieving the energy crisis on Earth. Scientists make a proposal that the moon be made a gigantic power station for the earth by converting the solar energy collected from the surface of the moon into electric energy to be sent to the earth while partially supplied to the space production. Some scientists from the US and Japan even assume that solar energy can be used for generating power in the outer space.

With the particular space environment of high vacuum and microgravity, space manufacturing industry would be built, which would be able to manufacture alloys and compound materials with high purity, high hardness and high intensity. Today, it has become an important sphere in which many countries have entered into rivalry with each other over competitive edges. As a result, governments and enterprises of different nations have set out to undertake risk investments.

With the development of space technology and man's frequent probes into the space, space mining would certainly be a promising industry as there are great amounts of mineral reserves on the countless planets and satellites.

Space pharmacy bears advantages beyond compare. Medical specialists and pharmaceutical companies have discovered that space pharmacy is with the advantages of high vacuum (clean and germ-free), zero gravity (free from sedimentation caused by gravity) and so on, so that many a super medicine beyond imagination on Earth can be produced over there.

Space service is also an industry with enormous benefit. It is defined as a service provided to clients by means of spacecraft and a variety of facilities in the particular environment of space, such as the service provided for scientific research, industry, agriculture and military affairs. It was proved by test that seeds of crops, when sent to the space by the space vehicle (a kind of service), can grow into

ronment. Distance education can be developed extensively and bring about high social efficiency by means of satellite service. Television programs are transmitted through geostationary satellites so that people all over the world can know what is happening in all corners of the planet everyday and enjoy every performance they like. And weather forecast and resource prospecting through satellites can also bring forth extensive economic benefits and social efficiency.

Overall, the exploitation of space resources and the development of space economy are a great cause unprecedented in human history, a cause benefiting the whole human race and their descendents.

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