Establishing a Moon Base and Exploring the Universe

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The author comments on a recent article by Klaus P. Heiss which advocated the establishment of a human colony on the moon both for tapping the wealth of the moon and as a base for manned space exploration and possible colonization at some future date. But while he finds the idea of a moon base to be plausible he expresses skepticism of human ability to ever establish colonies elsewhere in the universe.

Key Words: Space exploration; Manned moon base; Solar power; Extra-terrestrial life.

In his article "Tapping the Wealth of the Moon," (*JSPES,* Spring 2004, Vol. 29, No. 1, pages 3-64) Klaus P. Heiss makes an enthusiastic pledge for enhanced space exploration and especially for landings and work on the moon. The relatively short distance of the moon from the earth, its low gravity (1/6 of earth), the enhanced solar radiation (no atmosphere) and richness in ^{3}He (Helium 3) in the soil, are good reasons for regarding Heiss's proposals with favour. Also, the famous SPS (solar power satellite) could be serviced from a Moon-base. As a site for an inter-galactic observation station, the moon would serve as a starting point for a built-up of the SPS[2] as well as an observation station around the moon.[3]

Heiss describes with enthusiasm how the moon, as a firm and near-earth platform, can be used for extended, astronomic and astrophysics data acquisition. Without a dense atmosphere, the far side of this natural earth-satellite is the ideal place for intergalactic space observation through the entire frequency spectrum and with much more elaborate and extended technical means than is possible on small earth bound satellites like the Hubble-spectroscope.

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[2] Glaser: P.E.. The potential of satellite solar power. Proceed.IEEE,65(8) 1162, 1977

[3] H.F.Mataré and P.Faber: "Renewable Energies";VDI-Springer Verlag 1993, p.101

Another obvious advantage of a Moon basis is the abundance of energy, either in the form of solar radiation or from the use of the ample supply of Regolith, which is the superficial, stony surface layer that has accumulated Helium 3 over eons of time.

It has been pointed out that also the 1.3 kW/m^2 of solar energy on the moon is more than a thousand times the value on the earth-surface beneath the earth's dense atmosphere.

In using the supply of ^3He for fusion, one could imagine that the Moon would serve as an ideal platform for fusion reactors. The advantage of fusion with ^3He, Heiss points out, lies in the fact that the by-product is not volatile Tritium but Deuterium. It is to be mentioned here though, that the ignition- or threshold-temperature is about twice as high in the first case: 100 keV as compared to 50 keV in the D + D reaction.[4]

Heiss points out correctly that a number of important sensing observations for stellar radiation from Gamma-rays to the infrared could best be situated on the Moon surface and operate more safely than in orbiting satellite spectroscope laboratories.

It is also true that we may expect to witness a further build-up of earth observatories on the Moon to replace part of the fragile satellite relays, be it for agricultural, atmospheric, magnetic measurements or for information, television or industrial communications. In particular, the operation of an SPS in geostationary orbit could bring energy to the remotest areas of the globe and fill a particular need in the Third World countries, where industrialization and agriculture depend on available energy; this especially with modern compound crystal solar cells with over 30% efficiency.[5]

But with all the optimism for a power satellite, practical and difficult questions about the best way to transfer this energy to the earth must be answered. There were conflicting views about the system to convert solar radiation to microwave radiation and to use a dipole antenna to beam the microwaves to earth, where a rectifying antenna (rectantenna) on

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[4] H.F.Mataré: „Energy, Facts and Future", CRC-Press, Florida, 1989 p.96

[5] A.R.Martin; "Satellite Power Systems. Promise and Perspective." SPS 91; Paris 1991 p.65 and Mataré p.411.

the ground would transfer the energy to lower frequency. Here the difficult question arises: how much of a field strength can be allowed to pass through the atmosphere? There were heated debates about the dangerous effects of microwaves on humans when a microwave uplink facility was built in Rockaway N.J. in 1980 . In this case the intensity was in the 0.005 mWatt/cm^2 range! But a reasonably dimensioned rectantenna should at least receive one mWatt / cm^2.[6] Here the danger for airplanes or birds getting into the power beam is obvious. That is the reason why, in discussions about the best location for such rectantennas (on mountainous areas) we could not agree on any specific area in the whole USA.

But Human Space Exploration is a Different Matter

Optimism is necessary for any groundbreaking, new technology, and one must share the optimism of Heiss for a Moon basis, but Heiss´s optimism with respect to human space exploration far beyond the Moon and into interstellar space to other planets, is another matter entirely. Heiss thinks, it should be the goal of humanity to outgrow this planet and to form new colonies on other planets and to declare "independence" from earth (a new type of "declaration of independence"). This is certainly not as easy as it sounds. A goal like this ignores a few basic facts. This position forgets the whole complex history of a biologically benign planet. Within the billions of years of existence of a planet, the right amount of solar radiation, an atmosphere, oxygen, the possibility of organic life etc. exists, if at all, for a duration of just a few million years during the lifetime of billions of years of a planet. This is comparable to the duration of a few minutes in the lifetime of a human of 80 years of age.

The search for a planet suitable for human colonization in the "neighbourhood," i.e., within the Milky Way, is not just a question of finding other suns with planets. The problem is the same, or even more difficult, than what is called: "Project SETI" (Search for Extraterrestrial Intelligence). In discussing a book by Stephen Webb on this subject[7], Jill

[6] G.R.Woodcock: Economics of Lunar resources for Solar Power satellites." SPS-91;Paris 1991 P.194

[7] Stephen Webb: "If the Universe is Teeming with Aliens Where is Everybody?"

Tarter[8] concludes that the search has not covered sufficient sky for a conclusion, yes or no to the Fermi question: "If the Universe is teeming with Aliens, where is everybody?" Since Giordano Bruno was burnt at the stakes by the Catholic Church around 1600 because he maintained that there were other inhabited planets, the consensus is that, indeed, there must be other planets with biological developments similar to that on earth. So, goes the logic, there must be humans who communicate (d) by radio waves which must reach us here. The SETI project has been running for ten years without success so far. A newer report[9] states that a search for "near earth" star systems only 150 Light Years distant with the Arecibo antennas in Puerto Rico found no intelligent signals. Here powers of 10,000 Watts may be sufficient to cover the distance. Can one conclude from generally known data that the "Teeming" is quite possible but that a communication in any way is impossible? The answer is "yes". A few considerations may illuminate this conclusion:

There is a general way to estimate for the number of near earth planets. Let us start with the total number of galaxies as derived within the Hubble length:

$n^*(c/Ho)^3 = 3 \times 10^8$ galaxies (Peebles)

$Ho = 55$ km/s/Mps; 1 Mps $= 3.3 \times 10^6$ LY ; LY (light year);. $c = 3 \times 10^5$ km/sec

Each galaxy has of the order of 10^9 stars. Thus, all galaxies together have 3×10^{17} stars and among them, let us assume 10 planets/star, a figure derived from our own solar system. This results in a rough figure of 3×10^{18} planets. From this figure it is logical to assume 1 per mil or 10^{15} planets to have conditions, sufficient for development of life, like: solar radiation to keep the average surface temperature in the range –10 to + 40 C and an oxygen carrying atmosphere as well as water. This sets stringent conditions also for the mass of the planet and its ability to attract/keep a gaseous, oxygen-carrying atmosphere. The average

Copernicus-Springer Verlag: 2002.

[8] Jill Tarter: "Ongoing Debate over Cosmic Neighbors," SCIENCE, 3.Jan.2003,p.46

[9] Richard A.Kerr: "No Din of Alien Chatter in our Neighborhood"; SCIENCE Vol 303, 2/20; 2004. page 1133

distance from earth of this specific type of planet must be assumed to lie in the range of 10^7 to 10^9 light years. One must consider this as an optimistic assumption. Thus, any communication delay between an inhabited planet and earth is of the order of 10 million to 1 billion years. If there is a planet with organic life, it has a lifetime of some 10^9 years. As on earth, there are certainly several "short" organic developments e.g. from fossil eukariotes to reptiles and mammals etc., each some 10^7 years of duration. The duration of the existence of a developed human being is only 1/1000 of the time of possible, organic life on such a planet.

With the long telecommunication delay, signals from a distant planet could reach planet earth only long after life on that planet had ceased. During their active period, such inhabitants would have to have created strong radio sources to announce their existence, much stronger than needed for inter-planet communications. These distances actually require radiation power as emerging from synchrotron radiation sources, in the 1000 MeV range. But human equipment works in the 1 to 10 electron-Volt range, in any case not over 10^{-6} of the power from star collisions. Human signal transmission has so far covered distances from earth to Saturn, a minuscule distance, compared to the distances to be covered in this case. Sensitivities of the best centimetre microwave receivers are in the range of 10^6 to 10^7 kT (k = Boltzmann constant; T = abs. temperature) or 10^{-9} to 10^{-10} Watts.[10] One has to assume that the power of the microwave signal decreases with the distance cube as a consequence of dark matter absorption. To result in a measurable signal after covering distances of say only 1000 LY or 10^{16} km, the signal strength must be in the range of the power of star events i.e. over 10^{20} Watts, well above any earth-like equipment ever known. In addition, the probability that there is coincidence of human capability on two planets is practically nil, as synchronization of both short periods of human-like existence during the planets lifetimes is only 1/1000 or less of the possible interval of the planet´s lifetime of some 10^9 years. Also, travel near light speed would still take a billion years, much too long for any organic structure to survive.

[10] H.F.Mataré: "Receiver Problems in the UHF-Range", Oldenbourg, Munich 1951

Conclusion

There are possibly a billion planets similar to earth in the "near" universe and surely, thousands with organic life and also human-like organisms (Giordano Bruno´s Proposition was certainly correct) but their average distance, even in the near universe, make it impossible to connect to anyone of the inhabitants of these planets, especially as the life span of a developed human is only a short portion of the overall existence of life on such planets. The probability of a coincidence of this short period on two planets, make communication even more remote, not to mention the enormous signal power needed to cover such distances. Even more remote is a voyage of humans and all their biological conditions over thousands of light years! Instead, humanity has to organize this planet pragmatically, avoid overpopulation and improve on the quality of life.

Country Creativity and IQ

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The author presents evidence of the link between intelligence, freedom, creativity, and the prosperity of nations, and emphasizes the need for this information to be taken into consideration when formulating public policy.

Key Words: Intelligence; Freedom; Creativity; Economic growth; Developing nations.

Creativity and innovation are the backbone of economic growth. Schumpeter lauded the entrepreneur's primary role for economic growth and development. Most principles of economics textbooks, in addition to capital, labor, and land, typically single out entrepreneurial ability as a factor of production. Recently, Richard Florida, in his book, *The Rise of the Creative Class* (2002), argues that the key to prosperity of any locality is its ability to attract creative people.

It would seem to be an irrefutable proposition that a minimum level of intelligence is a necessary condition for creativity. Great advances that have benefited mankind have invariably come from the activities and undertakings of gifted people. It is surely an intuitively appealing proposition that greater mental capability, given the opportunity, given the freedom to express itself, leads to greater economic creativity. If this is the case, then differences in IQ scores across countries will be a source of differences in economic creativity between countries.

This paper looks at the relationship between creativity and intelligence across nations using recently available data on average IQ scores across the world. Specifically, the paper uses cross country regression analysis to look at the relationship between country creativity and country IQ, and between country creativity, country IQ and country freedom. The paper is divided into four sections. The first section puts forth the case as to why intelligence is important for creativity. The

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