WIRELESS POWER TRANSMISSION AND THE EFFECT OF ITS DEVELOPMENT ON PLANETARY EXPLORATION. N. Soper, ISU, e-mail; nsoper@interchange.ubc.ca, nik_soper@hotmail.com.

The technology currently exists to transmit power remotely from one site to another without the use of cables. In the 1970's NASA began a feasibility study of the idea to generate power in space via solar energy and transmit it back to earth [1]. The concept requires in orbit solar panels to be used as a power source, absorb solar energy which can be converted to laser and microwave beams of energy. These are then transmitted to a receiving antenna on earth which will generate DC power for a cable transmission or further wireless transmission. This paper will consider the future of space exploration in the event that this technology is developed and implemented.

The absence of certain limiting factors will enable the industry to develop this wireless power transmission (WPT) for advancement of current proposed projects and programmes. These limitations include; development of the technology to be used from orbiting satellites and transmitted to an antenna on earth or some other body, increasing efficiency, and providing a system architecture for the technology. Limitations also include the cost of the R&D and implementation, policy and political issues of international cooperation, the difficulty in penetrating the largest market in the world (the electricity power demand) and the health and safety issue of such beams of energy being transmitted. All these factors relate to transmission to or from earth, however the scope of this paper is to consider the implications this will have on exploration.

In the future, planetary exploration is likely to include the colonisation of the Moon and Mars. A community at either destination will require power to set up and run their 'base stations', transport themselves around the body, and to live in-situe. It has been suggested that in-situe resources will be exploited to generate the power we will need to function, and to further explore. If satellites could transmit power to the base station, a greater amount of solar power could be harnessed from ordit, with repect to that harnessed from solar panels on the surface of a planet. The efficiency of this technology, in previous experimentation and trials, is as high as 82% in converting microwave beams into DC power at the receiving end [2]. This would provide a remote source of power, which can be received by any vehicle or structure at any position on the surface.

WPT would also have other applications in the space industry including powering of the ISS, small experimental probes, and more importantly sending power back to earth to solve the energy crisis we are entering, with regards to limited supplies of fossil fuels and limited uptake of renewable sources.

Development of Space Solar Power to incorporate WPT will enable power to be transmitted and stored at set sites through the day so the supply of energy to the user is continuous. This is not just a concept to be developed for a colonizing community, but for the power of rovers and short human planetary missions. Lasers can penetrate a dense atmosphere, and so can be a source of use on Venus as well as Mars.

Receiver maintenance may still be a problem as it is now with conventional solar powered rovers, which inhibits its performance and is a key limiting factor to the life of the robot/receiver.

This WPT technology gives us the chance to settle on another planet or body and use the inexhaustible and reusable energy of solar power, transmitted from orbiting satellite to the surface, to be stored and used at will, to develop, manufacture systems and structures, to travel and explore, to carry out daily functions and maybe in the future to continuously power the enclosed life supporting environment we create, through the implementation of a constellation of 'powersats'.

The development of this technology is also symbolic of our advancement as a culture, to harness and use clean and safe resources rather than exploit finite resources and destroy our environment in doing so.

References:

[1] Leonard. D. (2001) *Space.com*
[2] Glaser P.E. (1993) *J. Prac. App. Space.*