Laser Power Beaming Market
Fact Sheet

I. What is Laser Power Beaming?

Laser power beaming is the wireless transfer of energy (heat or electricity) from one location to another, using laser light. Power can be transmitted through air or space, or through optical fibers, as communications signals are sent today.

II. What are the uses for Laser Power Beaming?

Although still largely in the R&D stages, laser power beaming has many potential uses in the real world. These include powering vehicles, replacing electric power wiring and transmission lines in difficult places, and even launching rockets into orbit.

IV. Market size and applications

Because commercial applications of laser power beaming are in the development stages and have not yet reached the market, it is still too early to predict the overall market size. However, by looking at some of the top industries expected to utilize laser power beaming, one can get an idea of its market potential. Among the top potential commercial applications for laser power beaming and their current market size are:

- Unmanned aerial vehicles (UAVs). Laser power beaming opens up new market opportunities for unmanned aerial vehicles, which currently represent one of the largest growth sectors in the aerospace and defense industries. Spending on UAVs is expected to grow worldwide from its current $3.4 billion annually to $7.3 billion annually in the next 10 years. Because laser power beaming enables aircraft to be refueled in flight, it is especially viable for high-altitude, long endurance unmanned aerial vehicles and other types of aircraft that need to power over a long period of time, and even potentially replace satellites in certain instances, such as be placed in orbit over cities, coastlines and other sites.

- Space systems: Laser power beaming is an enabling technology for many space missions, and an alternative or supplement to direct solar power for others. The value of satellites launched is in excess of $10 billion annually; power subsystem represent 5-15% of typical satellite costs.

- Solar energy from space. As energy prices, the development of alternative energy, such as solar power, is on the rise. In fact, since 2004, the total market value of all publicly-traded solar companies have increased 7,000 percent worldwide, from $1 billion to $71 billion. With power beaming, satellites in space can collect solar energy and beam it down to the earth via wireless transmission, as well as to locations in space. In addition to being a renewable energy source, laser power beaming offers the potential to transmit electricity to remote locations on the planet, where the laying of power lines is either not feasible or too expensive.

And in a more down-to-earth context:

- Wireless powering and charging of portable devices. Small-scale smart power beaming systems could eliminate the tangle of cords and chargers that today accompany portable computers and other electronic devices – even cell phones. Spending on laptop computers and accessories alone currently exceeds $69.5 billion annually.

VI. History of Laser Power Beaming

Although laser power beaming is a promising technology for the 21st century, the concept is not new. In fact, rudimentary tests demonstrating the transmission of electrical energy without wires were conducted

approximately 100 years ago by Nikola Tesla, a Serbian scientist whose patents and theoretical work form the basis of the modern alternating current electrical systems and the modern AC motor.
However, the first person to integrate all the elements of power beaming into workable system was William C. Brown, an American electrical engineer who helped to invent the crossed field amplifier in the 1950s. One of the pioneers of microwave energy for wireless power transmission, Brown published the first paper in on the topic in 1961 and later demonstrated the technology a microwave model helicopeter powered by wireless microwave beam. Brown conducted additional developments in the field from 1969 to 1994 while affiliated with Ratheon. Among his acheivedments there include beaming 30 kilowatts of every over a distance of one mile at 84 percent efficiency.

In 1968 American scientist Peter Glaser proposed using wireless power beaming to transmit solar power from space to Earth. Satellites with solar panels would be placed in space, and power would be beamed to the earth using microwaves, which would then be converted to electricity and transferred to power grids. Throughout the 1970s, the idea was studied by NASA and the Department of Energy, which concluded at that time that the cost to do so was prohibitive.

In the ensuing years and as technology developed, the concept had been looked at frequently, with both microwaves and lasers proposed as the energy transmitters. In the 1980s, researchers began looking at the technology both for space-to-space energy transmission as well as for space propulsion. However, in the 1980s, a multinational group of researchers conducted tests using microwaves to power model aircraft, although the energy loss as the beam spread over long distances would be impractical for large applications.

While researchers continued various experiments using laser power beaming, such as demonstrating the feasibility of the technology for powering unmanned aircraft, until recently the power and cost of laser diodes – necessary for power beaming – have been a key barrier to the practical application of the technology. However, with recent advances in technology, laser diodes are becoming powerful, efficient, and inexpensive enough to make the commercial development of the technology feasible. In fact, in 2007, the Pentagon released a study recommending the development of space-based power systems using laser power beaming as the energy source. In the study, the Pentagon found that if placed correctly space power systems could provide enough solar energy in a single year equal to all known oil reserves on Earth, provide power for global U.S. military operations and deliver energy to disaster areas and developing nations. In addition to the U.S., other nations studying the idea are Russia, China, the European Union, India, and Japan, which is working toward testing a small-scale demonstration in the near future.

VII. Current players

At present, there are a limited number of companies conducting research on laser power beaming. These fall into two categories: major aerospace companies such as Boeing, which are exploring the technology for powering UAVs and other large applications, and smaller privately held companies developing applications for specific, select applications. JDSU (a major laser and photonics manufacturer) offers power-over-optical fiber systems commercially, but only for specialized very low power applications.

VIII. LaserMotive and its role in the Laser Power Beaming market

LaserMotive is the first privately held company devoted exclusively to the commercial development of laser power beaming.

IX. Future directions

What can we expect to see in the future regarding laser power beaming? Certainly, as the technology evolves, costs for high power lasers are expected to continue to decrease, making the possibility of high power laser power beaming applications an increasing reality. Research will continue in the development of the technology for commercial use in several key areas, including unmanned aircraft and wireless electricity. Whatever direction the market goes, LaserMotive plans to be a key player.

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