



## **LaserMotive Corporate Background**

Imagine an unmanned aircraft that can fly indefinitely without refueling. Imagine a rocket launched into space, with most of its costly engine staying on the ground. Imagine solar energy collected in space and beamed wirelessly to where it is needed, in space or on Earth.

These are just some of the possibilities with the emerging technology of laser power beaming. If Seattle-based LaserMotive, one of the up and coming leaders in this market, has its way, these scenarios will become reality in the not-too-distant future.

### **About LaserMotive**

Who is LaserMotive? Headquartered in Kent, Washington, LaserMotive is an independent research and development company specializing in laser power beaming, a promising segment of the technology sector in the 21<sup>st</sup> century. Located in the ever-expanding technology corridor of greater Puget Sound, home to such industry notables as Microsoft and The Boeing Company, LaserMotive's focus is on the development of the technology for both short- and long-term commercial applications. These applications range from wireless power to launching rockets, starting with the NASA Centennial Challenge for Power Beaming, a competition designed to promote technologies that promise to expand the space program. With a \$2 million purse prize at stake, LaserMotive believes that winning the Challenge can help provide seed money the company can use to springboard the development of commercial applications of laser power beaming.

### **Company Vision**

The company's vision is straightforward: to be the leading company in the development of laser power beaming technology and the first to bring it to commercial reality. To bring this vision into reality, the company has developed a four-phased business plan.

- *Phase One* is the successful development of the winning entry for the NASA Centennial Challenge for Power Beaming. Also known as part of the Space Elevator Games, the Power Beaming Challenge focuses on laser power beaming as a technology to help expand the space program and has a top purse prize of \$2 million for the team or teams who meet or exceed NASA's requirements.
- *Phase Two.* After successfully completing the Power Beaming Challenge, LaserMotive plans to use the funds as seed money for its next step in its growth, which is the development of technology and system prototypes for high-value, moderate-scale applications, particularly in aerospace and other high-margin industries.

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- *Phase Three* is the production and marketing of operational laser power beaming systems, for a range of industrial uses such as remote powering of vehicles.
- *Phase Four* will be widespread application of laser power beaming technology: in large-scale applications such as power satellites and rocket launch, and in small-scale but high-volume applications such as powering mobile electronics.

### **About the Laser Power Beaming Market**

What exactly is laser power beaming? Simply defined, it is the wireless transmission of energy from one location to another using laser light. Power is generated at a central location and then distributed remotely using laser beams.

Although it is still in the R&D stages, the development of laser power beaming for commercial applications has the potential to revolutionize industry, primarily because it enables transmission of power when laying power cables is not feasible. Some examples of potential uses of laser power beaming include the wireless transfer of electricity, either ground to ground, ground to air or air to air, powering of aerial vehicles and airships, both low and high altitude, and launching space systems.

### **The Space Elevator and Laser Power Beaming**

While it is perhaps decades away before it is constructed, it is important to make mention of the Space Elevator and laser power beaming, as laser power beaming is expected to play a key role in its eventual development. A revolutionary way to send cargo and people into space, the Space Elevator as proposed in its current concepts is expected to consist of a carbon nanotube composite ribbon eventually stretching some 62,000 miles from earth to space, anchored to an offshore sea platform near the equator in the Pacific Ocean, and to a small man-made counterweight in space. Mechanical lifters are expected to move up and down the ribbon, carrying such items as people, satellites and solar power systems into space. Laser power beaming will provide a way to power the vehicles up and down the space elevator.

### **Company History**

LaserMotive was founded in late 2006 by Jordin Kare and Tom Nugent, both physicists with a long interest and backgrounds in the space industry and with a shared passion in laser power beaming and its potential applications. Together, they outlined an initial system design for winning the NASA Power Beaming Centennial Challenge.

With their design outlined, they began to grow the team as the company worked to turn the design into reality. It was during this time that LaserMotive was able to obtain the attention of The Boeing Company, the first of the company's industry partners. Boeing provided both financial and technical resources to the company, including loaning its facilities for testing its first prototype vehicle powered by high-energy laser

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power beaming. So successful was the company in its efforts that it attracted the attention of the BBC, which visited the company in May 2007 and profiled its efforts. During this time, LaserMotive continued to add industry partners and sponsors, including the support of Andrews Space.

The company entered its design in the 2007 Power Beaming Challenge. Although its entry was described as "one of the favorites" by the Spaceward Foundation, their entry was disqualified due to some issues in getting their functional system to match the requirements set by NASA in time.

In early 2008, LaserMotive acquired facilities in Kent, Washington, where the company is now located.

### Markets served

As already mentioned, LaserMotive's initial focus is on developing a successful entry for the Power Beaming Challenge in the NASA-sponsored Space Elevator Games. However, the company's focus and markets served go far beyond this. These include:

- **Short term markets.** Short term, the company is focusing on the development of markets in a range of industries. Among the applications in this category are:
  - Powering unmanned aerial vehicles
  - Assisting solar powered aircraft
  - Powering small aircraft from larger aircraft. This can include powering drones that accompany fighter aircraft
  - Wireless power, such as power over optical fibers
- **Long-term applications.** In addition, the company is focusing on longer-range markets; i.e., applications that may take up to 20 years to fully bring to commercial development. These include:
  - Power satellites and spacecraft from the ground, or from dedicated "power station" satellites
  - Launch rockets from the Earth into orbit
  - Demonstrate beaming energy from space down to Earth

### Industry partners

A key component of LaserMotive's corporate strategy is its industry partner program that teams LaserMotive with some of the leading companies in the aerospace and laser markets. The program is designed to expand the company's capabilities by leveraging the knowledge and services of key leaders in critical market segments important to the technology

Among LaserMotive's current and past partners are:

- The Boeing Company

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- DILAS High Power Laser Diodes
- Andrews Space
- A123 Systems Advanced Lithium-Ion Batteries
- CoolEarth Software
- TwinTec

### Competitors

LaserMotive fills a unique position in the laser power beaming market, being the first privately held company to focus exclusively on the commercial development of laser power beaming for large applications. Its key competitors fall into two categories:

- Major aerospace companies. These typically are focusing on longer term applications for use in aerospace only, such as powering rockets and launching rockets or satellites into space.
- Handful of smaller companies. Here, the focus typically is on smaller scale applications, such as power over fiber optic.

LaserMotive is the first privately held company to focus on both near and long term large-scale applications.

### Management Team

LaserMotive's management team includes some of the leading experts in their respective fields. Collectively, the management team has more than 300 years of experience in their industries.

Its management team includes:

**Dr. Jordin Kare, co-founder.** As co-founder of LaserMotive, Dr. Kare is a leading physicist, aerospace engineer and one of the industry's top experts on of laser propulsion; aka high-energy laser power beaming. A recipient of a NASA Institute for Advanced Concepts (NIAC) grant to study a near-term form of laser launch using arrays of relatively low powered lasers, Dr. Kare has been involved in the development of laser and space technology for more than 20 years. He was the project leader for Mockingbird, a conceptual design for an extremely small reusable launch vehicle, developer of the Sailbeam interstellar propulsion concept, and involved in the Clementine lunar mapping mission. Prior to founding LaserMotive, Dr. Kare was a leading researcher on the topic for many years at Lawrence Livermore National Laboratories (LLNL). While at LLNL, he organized the 1986 Workshop on Laser Propulsion at LLNL and led a development program for ground to orbit laser launch supported by SDIO.

Dr. Kare holds dual B.S. degrees, in Electrical Engineering and Physics, from the Massachusetts Institute of Technology, and a Ph.D. in Astrophysics from the University of California, Berkeley.

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**Tom Nugent, co-founder.** Prior to co-founding LaserMotive with Dr. Kare, Nugent served as Research Director for LiftPort Inc. – the space elevator companies, and one of the pioneers in the development of the modern space elevator concept. While at LiftPort, Nugent led the research team that outlined a realistic path to space elevator development, as well as working on a variety of milestone tests of robotic lifters. Nugent’s other space development work includes liquid-fueled rocket engine development through the MIT Rocket Team, and advanced fusion propulsion research at the Jet Propulsion Laboratory.

Nugent holds a B.S. in Physics from University of Illinois at Urbana-Champaign, and M.S. in Materials Science and Engineering from Massachusetts Institute of Technology.

Other company principals include:

- Carsten Erickson, owner of Coolearth Software, a provider of supply chain execution & warehouse management software
- Steve Burrows, co-founder of TwinTec, Inc., a provider of multi-tube solutions
- Steve Beland, systems engineer with 22 years experience working the integration of complex commercial airplane systems
- Dave Bashford, currently an engineer at Philips Oral Healthcare who also helped design & perfect Coinstar "Coins-to-Cash" machines
- David Shoemaker, software engineer at Microsoft and former robotics engineer at the LiftPort Group.

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