

## How to Start a Small High Tech Business in Troutdale, Oregon?

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### Abstract

Blue Road Research has grown from a one-person company in 1993 to fourteen employees during the summer of 2002. This paper describes the core philosophy of the company and outlines its growth and plans for the future.

### Starting a High Tech Business in Troutdale, Oregon

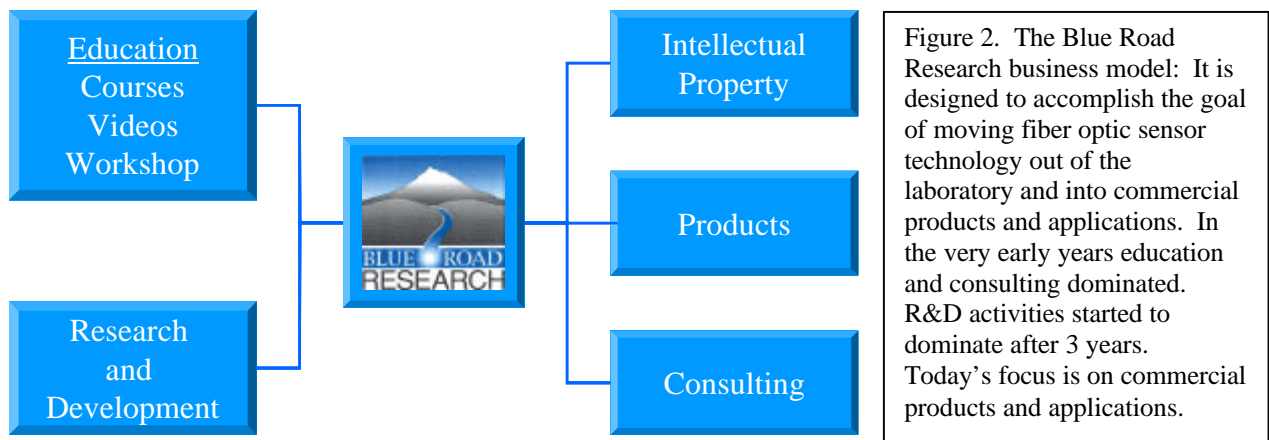
The motivation for creating Blue Road Research arose primarily from my wife's parents having health problems and her wanting to move back to the Northwest. Further complicating things were her parents wanting to sell the home she grew up in that was in an unincorporated area of Oregon with a Troutdale address. Looking at the area around Troutdale it became readily apparent that the only way to continue working on fiber optic sensors and live in Troutdale would be to create my own company.

Since my wife wanted to live in the house she grew up in that pretty much defined the site. By selling our house in Southern California where housing was relatively expensive I determined that we could build a building to house the business and remodel and fix up the Troutdale house, which was in relatively poor condition. Fortunately the site, Figure 1, had 2.9 acres of land so room to expand was not an issue.

The next step was to build a business model that would allow an adequate income to live on and eventually result in a self-sustaining company. There was also the issue of choosing a name for the company and putting the legal papers in place. These efforts took place concurrently over several months prior to my leaving McDonnell Douglas in August 1993. Perhaps more than any other question associated with the business that I have had over the past 8 years is how did the name "Blue Road Research" arise. The process started with my outlining perhaps a dozen potential names, "Blue" was chosen because it is my favorite color, "Road" has to do with the "Wizard of Oz", my favorite series of books when very young, and the "yellow brick road" that leads off to ??? Basically I felt I was setting out on a road that I hoped would lead to something great but it was definitely filled with ??? Finally "Research" was added because that is what I wanted to continue to do, although the mission I defined for the company was to move fiber optic sensor technology from "concept" to the field. My intent from the very beginning was to facilitate the transfer of fiber optic sensors to fielded commercial applications.



To accomplish this mission the model shown in Figure 2 was developed. It also was designed so that there would be sufficient income to allow a stable financial condition to be achieved before our savings ran out. From the customers point of view this model is intended serve the end user first by allowing a general introduction to the field of fiber optic sensors. The intent here is to create customers that are as knowledgeable as possible and to introduce a new technology. By offering courses at reasonable rates an easy entry point for potential customers was created. The very first courses offered by Blue Road Research also offered laboratories to shows customers how to build and use fiber sensors and associated technology. Blue Road Research has offered these courses continually since it's founding in 1993 and continues to improve on the course. To complement the course the Pacific Northwest Fiber Optic Sensor Workshop was created to promote the technology in the Northwest. The second part of the business model involved offering consulting services to customers who needed more than a general introduction to the field. During the very early years of Blue Road Research the majority of the revenue generated by the company derived from these two activities. By the end of the second year a significant portion of Blue Road Research revenue was generated by Research and Development contracts from commercial and government sources. Initially commercial contracts were dominant but by the end of 1996 Blue Road Research won its first Phase II SBIR and since that time government contracts have played the major role in funding Blue Road Research growth. Since its inception it was recognized that in order to have a viable product base intellectual property would be essential. Through negotiating with McDonnell Douglas 18 patents were licensed and sublicensing rights obtained on patents generated by Eric Udd while at McDonnell Douglas. Seven other patents associated with fiber optic gyros and secure fiber optic communication were not licensed since other companies already had or were in the process of negotiating licenses. In addition patent filing were made on a continuous basis to strengthen and expand the overall patent base.



After surveying all fiber optic sensor technology and reviewing the patent base it was determined that fiber sensors based on fiber gratings and the Sagnac interferometer would be the initial principal target product areas for Blue Road Research. While there have been time periods when research work on the Sagnac interferometer was a major part of Blue Road Research funding products based on fiber grating sensors and their application gradually become the dominant focus of the company. This in turn resulted in the generation of products such as dual and three axis fiber grating strain sensors, educational and industrial kits and fiber grating demodulators for high speed and sensitivity.

By the 1996/1997 time frame Blue Road Research approached a break-even condition and by 1998 the product side of the business had started to become significant. Figure 3 shows the financial history of Blue Road Research from 1994 to 1998 as the company moved to a stable financial condition and the distribution of revenue sources in 1998 as efforts to implement the business model became increasingly successful.

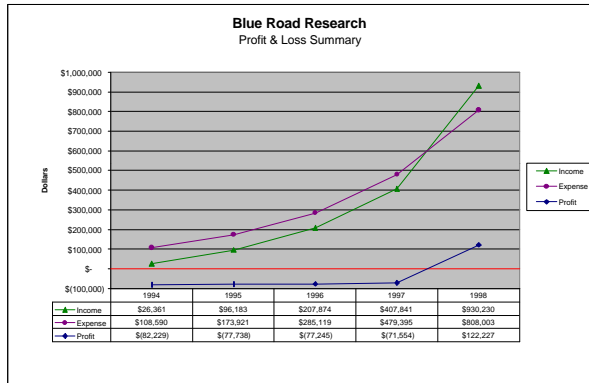
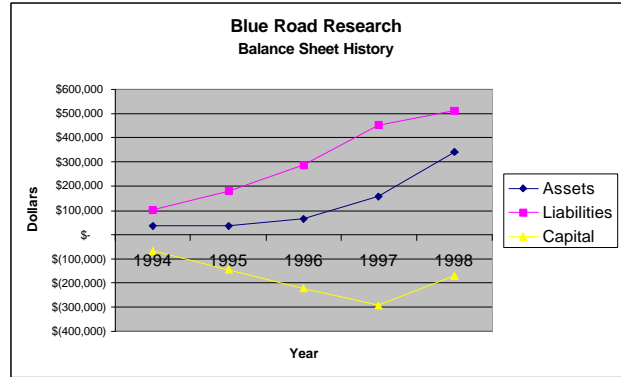
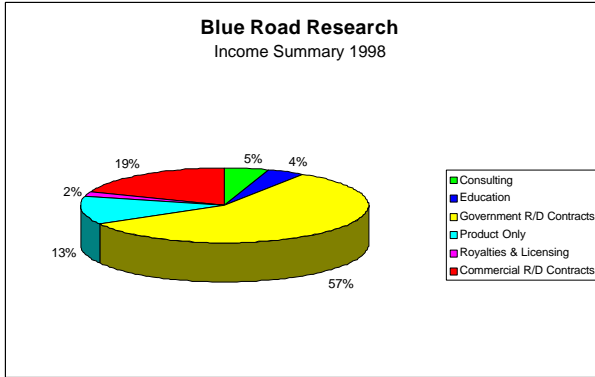


Figure 3. By 1998 product sales were beginning to become a significant segment of Blue Road Research business. By mid 1997 the company reached the break-even point and ceased to require additional investment to sustain operations. The performance of the company continued to improve in 1999 and 2000, eventually resulting in the acquisition of Blue Road Research by Standard MEMS in January 2000.

In 1999 and more aggressively in 2000 Blue Road Research was approached by larger companies interested in acquiring the company. At this point the question became that of trying to determine what the best next step would be. Standard MEMS seemed to offer the best prospects in terms of growing the company to the next level in terms of technology and expertise in raising capital. As a result effective January 2000 Blue Road Research became a wholly owned subsidiary of Standard MEMS.

### The Next Steps

Blue Road Research over time has focused on five principal market areas: aerospace, civil structures, oil and gas, naval applications, composite materials and environmental sensing. There have also been some activities in the communication and biomedical field. Fiber grating products that are offered include single, dual and three-axis fiber grating strain sensors; fiber grating strain sensors packaged for civil structure applications, high speed demodulation systems for fiber gratings operating with speeds of 10 kHz to 2 MHz and custom and standard kits to support testing with fiber gratings. Major new products that are being field-tested include a high performance fiber grating pressure sensor being developed for NAVSEA in collaboration with Schlumberger and fiber grating moisture sensors that are being field tested at Sandia Albuquerque. Blue Road Research intends to offer both the pressure and moisture sensing systems commercially in 2002.

Blue Road Research is cooperating with a number of companies and organizations on projects that have system level potential on aircraft and spacecraft, naval applications, civil structures and environmental sensing. In the civil structure area Blue Road Research has installed fiber grating sensors into the Horsetail Falls Bridge in 1998, the Sylvan Bridge in 1999 and the I 84 freeway in 2001. The Horsetail Falls bridge has been the subject of extensive static testing to verify the performance of a composite overlay method to strengthen the bridge using 28 embedded long gage length fiber grating strain sensors in the concrete beams and the composite overlay. This bridge was also used to demonstrate the ability to measure the speed and weight of traffic on the bridge as well as the presence of joggers. The Sylvan bridge which is scheduled to be replaced in 3 to 5 years is acting as a test bed for fiber grating strain sensors. An NSF Phase II proposal is pending that would allow Blue Road Research and UCSD to develop a system to

monitor seismic damage to bridges and buildings in real time. This effort would be supported by the Oregon Department of Transportation and Cal Trans. Recently Blue Road Research with support from the Oregon Department of Transportation installed fiber grating sensors into the I 84 freeway. These sensors have been used since August 2001 for vehicle classification studies. Figure 4 shows an overview of some of these efforts.

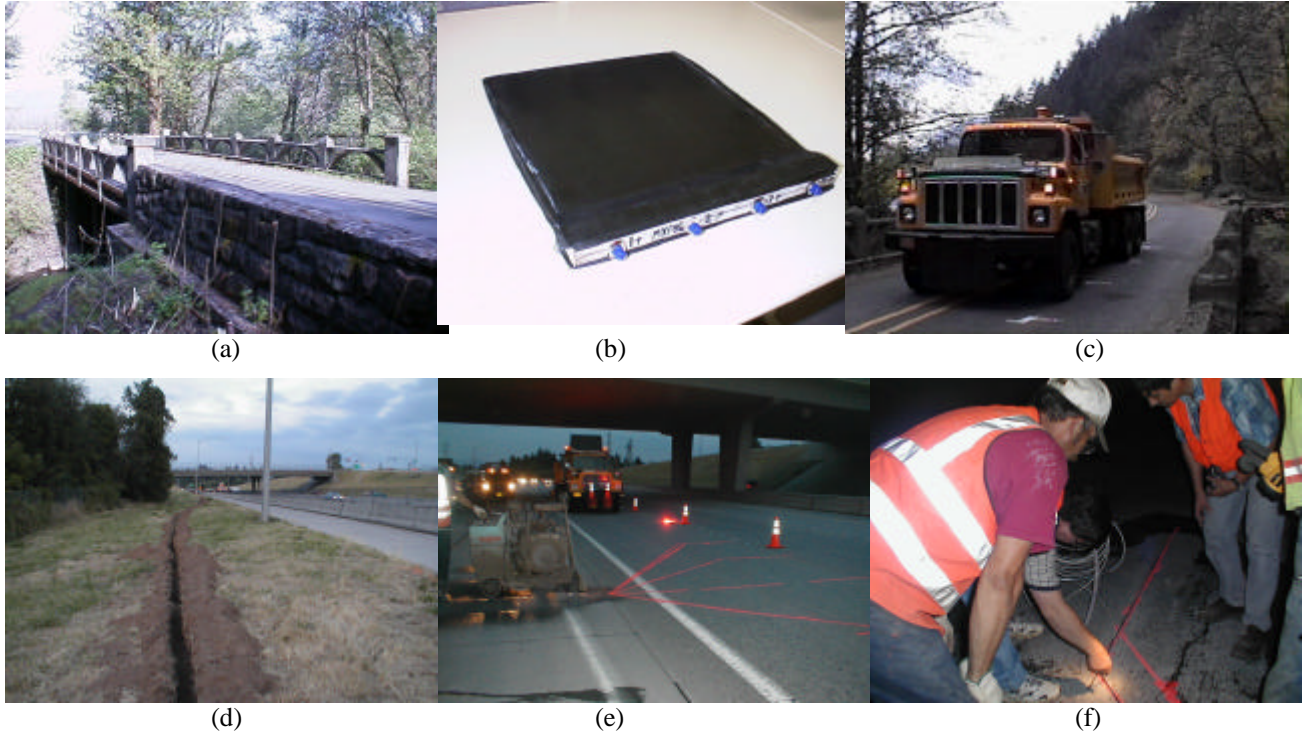


Figure 4. Examples of civil structure system applications: (a) Horsetail Falls Bridge, (b) bridge bearing using multi-axis fiber grating sensors, (c) static and dynamic bridge load tests, (d) fiber communication cable installation to fiber grating sensors on I 84 freeway, (e) cutting grooves into I 84 freeway, and (f) installation of the fiber grating sensors for vehicle classification.

Several field tests are scheduled for the fourth quarter of 01 and first quarter of 02 for measurement of multi-axis strain in adhesive joints, moisture sensing on soil capped hazardous waste areas, an underwater field trial of the Blue Road Research fiber grating pressure sensor, and additional civil structure testing on the Sylvan bridge and I 84 freeway. Other tests are scheduled with government and commercial organizations on fiber grating sensor projects on which Blue Road Research is cooperating.

### Summary

Blue Road Research has grown by developing and successfully applying its business model of offering customers end to end support in moving fiber optic sensor technology to products and the field. Its growing product line and customer base with support from its parent company Standard MEMS will allow it to fulfill its mission of converting the dream of moving fiber optic sensor technology to real world system a reality.

### Acknowledgement

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