

Rubicon Technology: a high tech start-up successfully practices strategic focus

John Sterling

John Sterling is a partner and co-founder of Sterling Strategies, which is located in Chicago, Illinois and specializes in strategic planning and management (J Sterling@stelingstrat.com).

Rubicon Technology is a materials science company focused primarily on the manufacture and marketing of high quality single crystals. Some of the major applications for its products include high brightness LEDs (light emitting diodes), integrated circuits for cellular telephones and high end computers, and semiconductor manufacturing equipment. The company possesses unique and advantageous crystal growing technology.

Rubicon was founded in 1995 as a distributor of Russian and Ukrainian grown material and began manufacturing its own crystals in the United States in 2000. Like many high technology start-ups, Rubicon faced a number of fundamental strategic choices about how to capitalize on the underlying technical advantages it possesses.

- What products should the company manufacture and for which markets?
- Within each chosen market, what marketing mix will deliver the highest perceived value to customers, the most sustainable competitive advantages, and the best returns to shareholders?
- How far up and/or down the value chain should the company integrate its manufacturing capabilities (i.e., what is core to its operations and what is peripheral)?
- What kinds of strategic alliances should the company develop, with whom, and what should its strategy be in each case?

Before examining how Rubicon resolved each of these fundamental strategic questions, a brief background on the firm and its technology will be helpful.

Background

Rubicon Technology manufactures high purity single crystals for use primarily in high technology applications. Single crystals are grown from molten raw materials in precisely controlled furnaces.

Rubicon's crystal growing technology – Kyropoulos – can be applied to the growth of a wide variety of single crystals (such as sapphire, ruby, lithium niobate, Langasite, and other high density crystals). The technology has significant advantages over competing crystal growth methods including:

- Higher quality materials (fewer defects, less diffraction);
- Larger diameter crystals (opening more markets today and in the future);
- Faster growth cycle (with implications for turnaround times and cycle time management);
- Higher yields in finished materials;
- Lower cost per gram and per square centimeter as finished substrate wafers.

However, having better technology does not guarantee market success – as countless high tech start-ups have demonstrated over the years. So, how can Rubicon translate its technological advantages into strategy that wins in the competitive market, lends itself to operational success, and delivers measurable value to customers?

Choosing a product focus

The first challenge facing Rubicon was a basic one. With a technology that can be used to grow a wide variety of single crystals, what product or products should the company manufacture? Among the most immediate options available to Rubicon were sapphire crystals (with a variety of down stream applications), rubies (primarily used in laser applications), lithium niobate (used in wireless telephones and in fiber optic hardware), and Langasite (used in various wireless technologies including cellular phones).

Rubicon approached this first challenge by addressing a handful of straightforward and logical questions.

- What do we have experience producing (i.e., do we have a core capability relative to any particular crystal products)?
- Which products have the largest current (i.e., proven) market applications?
- Which products have the greatest upside growth potential?
- Which product markets appear to be most accessible to new participants?

Answering these questions required a modest level of reliable market intelligence and a major dose of internal assessment. Like many high tech companies starting operations, Rubicon faced the inherent temptation to assess itself as highly capable of producing many types of crystals.

The team needed to move beyond the ego satisfying assessment that “*we can do it all*” (i.e., it could grow crystals to serve all the promising markets) and agree on what it could do best. An unvarnished self-assessment narrowed the range of possible products from literally dozens of crystals to a primary focus – sapphire.

Initial market research suggested sapphire had one of the largest proven end markets (estimated to be in excess of \$200 million in 2000). In addition, sapphire markets were likely to be accessible to a new producer due to chronic product shortages and long lead times. A number of factors contributed to this product shortage including limitations of competing crystal growing technologies (resulting in longer cycle times), a need for scarce and exotic refractory materials in order to expand capacity in competing technologies, and rapid demand growth from blue LED manufacturers. However, the market projected to have the greatest upside growth potential was lithium niobate not sapphire. Lithium niobate demand was projected to grow at a compound annual rate of over 500%, versus roughly 130% annually for sapphire. Thus, the company did have to make difficult decisions out of the box.

Ultimately, a decision to chose sapphire as the initial product focus was based on three interrelated considerations. First, raw materials for production of sapphire were more readily available (and in fact could be produced directly by Rubicon if severe shortages later emerged). The Rubicon technical and manufacturing

teams had greater experience with the production of sapphire crystals. And, existing market contacts ensured an outlet for initial production of sapphire.

In other words, operational and technical experience and market accessibility trumped other market considerations. The decision was reinforced by the breadth of potential applications for the product in proven end markets (e.g., blue LED and laser diode substrates, semiconductor manufacturing equipment, aerospace, lasers, etc.) – ultimately more attractive than the dramatic upside potential in a still developing product markets (namely, fiber optic hardware applications for lithium niobate).

Having chosen a product focus, Rubicon faced the further challenge of selecting core target markets for the company's sapphire. Rubicon's technology can produce larger crystals than most of its rivals', giving the company an advantage in military and aerospace markets. Conversely, the company had no technical advantages for crystal processing (e.g., slicing, polishing, and finishing). This seemed crucial since the most chronically undersupplied market application – substrates for blue LEDs and blue laser diodes (LDs) – required less of Rubicon's technical advantage relative to crystal size (at least in the near term) and more downstream crystal processing. In essence, the key considerations that helped the company select a product focus now produced conflicting signals with regard to selecting core markets.

Further analysis revealed an additional troubling issue. Namely, more valuable, higher technology applications for sapphires tended to be subject to the greatest threat of substitute technologies.

Using “what if” financial analyses

The decision as to what the primary market focus should be was ultimately resolved via “*what if*” financial analyses of the margins available in end markets. Rubicon's sales and marketing force gathered selling price intelligence across major market segments. The company's senior management team was then able to construct pro forma projections for each market (and blends of multiple markets). Based on these pro forma financial analyses, the blue LED/LD substrate market was selected as a primary focus, with several other promising segments selected as potential secondary targets.

While this did not mitigate the threat of substitute technologies, it did promise the best near and medium term returns. Perhaps more importantly, it provided focus for the entire organization. Sales and materials engineering could focus on building a deeper understanding of customer needs related to substrate properties. Operations could fine tune processes to perfect products and improve yields for raw and polished substrates. And, the start-up could move relatively quickly to a break-even point.

Identifying core manufacturing capabilities

Rubicon knew that it had fundamental advantages relative to growing sapphire crystals. The question facing the company was, how far it should vertically integrate its manufacturing and crystal finishing capabilities? Its integration decision was influenced by a number of factors.

- Rubicon could lose established customer relationships if it integrated downstream.
- Rubicon would limit its accessible market (in its primary area of focus) if it did not develop wafer-finishing capabilities.
- Rubicon would be effectively “leaving profit on the table” if it elected not to vertically integrate its operations through crystal polishing.
- Finally, an analysis of the competitive environment uncovered a variety of successful business models, each employing varying degrees of vertical integration.

Given the trade-offs the company faced, it elected to embrace a strategy that kept its options open. Thus, the company focused available resources in the near term on perfecting its core crystal growing capabilities. Meanwhile, the company formed strategic alliances that enabled it to sell finished wafers to LED manufacturers who lacked crystal polishing capabilities. And, finally, the company began taking initial steps toward vertically integrating through crystal finishing operations.

The decision to keep its options open for future vertical integration embodied the principles of applying real option theory to a business. For a start-up, high tech manufacturing company, the analysis did not have to be incredibly complex.

Rather, understanding the relative cost of keeping future options open (at least in the context of manufacturing capabilities) was relatively easy. The cost of additional manufacturing space was known, as was the future cost of additional equipment. And, with alliances in place to mitigate the market risk associated with not vertically integrating immediately, a strategy of “keeping options open” was intuitively obvious.

Creating strategic alliances

Start-up companies – particularly high technology start-ups – are often strongly dependent upon strategic alliances to fill out important organizational capabilities and Rubicon Technology is no exception. The company has developed alliances and has outsourced a number of non-core capabilities as it concentrates on developing its core capabilities.

While the details associated with Rubicon’s strategic alliances are proprietary – both to Rubicon and its partners – the nature and focus of key alliances can be instructive to other high tech companies. Rubicon Technology focused on developing strategic alliances that either:

- Filled out manufacturing and crystal finishing capabilities, enabling Rubicon (in concert with its strategic allies) to meet the product specifications of customers in primary and/or secondary market segments;
- Aided Rubicon’s entry into key market segments and/or key customer accounts.

Interestingly, although Rubicon developed solid strategic alliances with proven companies in core markets, those alliances did not fulfill their original strategic intent. In fact, some alliances ultimately slowed Rubicon’s development in the specific areas where the alliance was intended to speed the company’s progress. Namely, key alliances limited Rubicon’s development of crystal finishing capabilities and knowledge of LED/LD customers’ specific needs. In turn, this limited the company’s ability to maximize its return on invested capital.

Rubicon has quietly dissolved strategic alliances that were not fulfilling their strategic intent. This has freed both sales and operations to take the next logical step in the company’s development – producing finished, polished substrate materials for LED and LD manufacturers. Exiting these alliance has forced the

company to move decisively from being a start-up with relatively limited capabilities to being a fully capable manufacturer of substrate materials in its primary area of focus. And this in turn has positioned Rubicon to move from breakeven to profitability.

The lesson learned – strategic alliances require constant monitoring and attention. And, when an alliance is not fulfilling its intended purpose, the company must be ready to terminate the alliance and press on independently.

Developing competitive market advantages

In Rubicon Technology's case, developing competitive market advantages is particularly challenging in light of the fact that three of the company's direct competitors are subsidiaries of multi-billion dollar global corporations. With such strong rivals, Rubicon is in no position to demand a price premium for the technical advantages it brings to the market. Thus, two years after starting manufacturing operations in the U.S., it would be arrogant for Rubicon to claim it has created sustainable competitive advantages.

On the contrary, Rubicon initially priced its unpolished wafers slightly below established market rates to encourage trials and adoption. Rather than try to convince prospective customers that they should pay a premium for Rubicon's superior quality (a hard sell for any start-up), Rubicon priced unpolished wafers aggressively. Customers in turn had an opportunity to test Rubicon's sapphire wafers through finishing operations and in LED/LD deposition processes. As Rubicon integrates its operations through crystal polishing, it has developed credibility and a track record for superior quality.

With that experience in mind, Rubicon can offer other high tech start-ups some lessons relative to developing competitive market advantages. At the most basic level, Rubicon has focused on gaining market advantages from its technological platform by doing two things relentlessly.

- First, the company has focused on aligning the continuing refinement and development of the Kyropoulos growth technology with broader development trends in the marketplace. For instance, the market needs exceptionally high quality wafers to capture high yields on finished products. Likewise, the market ultimately needs to move to larger wafer sizes to realize genuine economies of scale. Rubicon has positioned itself

as the producer of highest quality finished substrates and it is the producer best positioned to increase wafer sizes over time.

- Second, the company has focused on being highly collaborative with customers and intermediate sapphire processors. For instance, as Rubicon continues to fine tune its manufacturing processes, it works closely with key accounts to test next generation materials in customer environments – enabling Rubicon to embrace those manufacturing practices that best serve end users’ needs. As a result Rubicon has been able to develop very strong relationships with rapidly growing customers. And, that high level of technical collaboration has fueled Rubicon’s ability to focus its technical development on areas of greatest value and importance in the broader marketplace.

Time will tell how effectively Rubicon is able to translate its technological advantages into sustained market advantages. It has demonstrated an ability to make operational and/or technical improvements in response to expressed customer needs. And, those improvements have had a direct and positive impact on the performance of Rubicon’s products in the customers’ manufacturing environments. That bodes well for the development of meaningful market advantages over the long run.

By remaining focused, Rubicon has captured at least 10% of the LED/LD substrate market worldwide. More importantly, it has moved quickly from the high burn rate of a start-up to breakeven, and it is on the road to profitability.

Learnings startup high techs can use

There are several learnings other high tech start-ups should take from Rubicon’s experience.

- First and most importantly, having technological advantages is not enough. Concerted efforts are required to translate that technical advantage into product performance that makes a difference in customer operations.
- As Rubicon’s case demonstrates, by collecting some market intelligence, and performing an honest self-assessment and logical analysis, a start up can develop a sustainable market position. The company avoided the temptation of chasing the market with the greatest upside potential and

instead elected to target products and markets that were more accessible and aligned well with the experience and capabilities of the company's technical and operations staffs.

- Rubicon focused its early efforts on perfecting its capabilities relative to crystal growing. But, the company also adopted a strategic perspective. It invested enough (in manufacturing facilities and knowledge) to keep its future options open relative to additional vertical integration.
- Rubicon's experience with strategic alliances confirms that they can play a crucial role in closing capability gaps and delivering a total package of value to key segments of the market. But, it underscores the need to vigilantly monitor those alliances to ensure that they are fulfilling to their intended purpose.
- Rubicon's experience with strategic partnerships also highlights the need to be disciplined with regard to alliances – particularly when they are created to fulfill specific near and intermediate strategic needs. Start-ups and established companies need to exit alliances when they cease to fulfill their stated purpose.

A final lesson – perhaps the most difficult to put into practice – is to retain strategic focus. Rubicon has succeeded largely because, after selecting products and markets that offered the greatest potential returns, it focused relentlessly on improving and aligning its technology and its operations to meet expressed customer and market needs.

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