

Movers & Shakers Interview with Cathy
L. Lewis, CEO of Desktop Factory





Cathy L. Lewis, CEO

Desktop Factory, a technology start-up based within the prolific Idealab incubator, is the buzzword in the rapid prototyping market place. The company aims to develop robust and affordable desktop 3D printers that are priced lower than \$5,000. These printers are initially targeted at small and mid-size businesses and the education market, constituencies normally precluded from owning rapid prototyping technology due to high costs. S.Vidyaankar, Senior Research Analyst with Frost & Sullivan interviewed Cathy Lewis, CEO of Desktop Factory, to understand more about the company's exciting technology and its product.

Frost & Sullivan is honored to feature Desktop Factory as part of its Movers & Shakers program and thanks to Ms. Cathy Lewis, who agreed to share her views on the state of the industry as well as highlight the opportunities that lie ahead for vendors and Desktop Factory in this space.

S.Vidyaankar (SV): Desktop Factory – that's a name we hear from all the other participants in the rapid prototyping (RP) equipment market. Could you brief me about the history and vision for its formation?

Cathy Lewis (CL): Desktop Factory was actually the vision of Bill Gross, the CEO and founder of Idealab. The most prolific incubator of its kind, Idealab was started in 1996 at the beginning of the big tech bubble. It launched a number of very significant companies such as CitySearch, GoTo, etc. and was very successful. Then the tech bubble burst and all of the incubators pretty much went out of business. Bill Gross and Idealab continued with a broader focus beyond search and the web forming a couple of companies in other innovative disciplines such as alternative energy and robotics. In doing so, Bill got involved in building products – atoms versus bits - and once you build a product you become familiar with and a user of RP. One of the companies acquired a 3D printing system and was using it to print out parts one day when Bill pointed out that the system was basically an XYZ axis and a glue gun. "Why can't someone make this for under a \$1000?", he asked and immediately tasked an engineer to go off and do a proof of concept for a low-cost 3D printing system. Following an assessment of existing patents we selected a technology direction that was unique, and therefore could be patented, so the company was formed in late 2004. That's the germination of Desktop Factory.

SV: There is certainly a digital revolution happening in the market and I guess tomorrow people are going to sit at home and design their own toy or their own parts for a sprinkler. With Desktop Factory's product, being a low cost 3D printer is this going to be primarily directed at consumers or are you also directing to meet all the potential end user industries?

CL: The fascinating thing about Desktop Factory is while we're very appealing to the current market place I see us being accretive to the industry. A company with the funding, the expertise and the requirement for a higher end 3D printer or RP system is going to buy that system. An organization that doesn't have sufficient funding or has limited technical resources available and still needs access to 3D printing is going to acquire Desktop Factory's printer. Heretofore the second company would not have been able to acquire the technology, but now with Desktop Factory, they can begin the implementation of 3D printing. If you looked across our 277 orders today, you'd see about 40% in education because that's the market that has had the most difficult time acquiring

equipment because of cost and complexity. The small engineering and design firms make up another 35% of our backlog and the balance consists of very large companies – companies like Eaton Aerospace and Essex and Northrop Grumman. These larger companies are clearly committed to the current RP equipment but they want to see the technology used more frequently and they want to see it used earlier in the design process. So their goal is to add Desktop Factory's printer in remote offices and local departments so the engineers and designers will begin to integrate them into the design process earlier. This will also improve the workflow into the RP labs and they'll optimize costs, as well. So we're finding that there's a significant opportunity today for a lower cost 3D printer and, at just below \$5000, we should do extremely well enabling new users in the market. Our goal by 2011 is to have our 3D printer below \$1000 - but there is enough pent up demand in just the educational market alone to keep us very busy for the next 2-3 years. During that time we will drive the cost down, improve the product overall, move the consumable to a true cartridge based delivery system and work with other suppliers in the software space to create even more user friendly CAD based software. We envision software in the future that's icon driven, easier for children and home users to take advantage of and we also see a number of 3D scanners becoming affordable. At the same time we'll be building a library of 3D downloadable objects that will complement the multitude of sites that exist today where anybody can go to download a 3D object to print.

SV: How is it that you have been able to build the printer at such a lower price point and others have not been able to do it? Is it mainly because of your unique technology or what is that edge?

CL: Desktop Factory is built around simpler, proven technology. In our focus on low cost and ease of use we reviewed the existing systems which are very complex, expensive and have precision drive mechanisms. They generally require special handling for the consumables because many are toxic chemicals. So we took a page out of the 2D printing playbook and instead of using a high end laser to draw the image we went with a simple halogen lamp. Instead of using a bed of powder in which to draw the image we used a drum just like in a copier or printer. The drum is coated with a thin layer of powder upon which we draw the image of the part, layer by layer, with our halogen lamp. Then we use heat and pressure to bond each of the layers as the object is built. This technology direction helped drive the cost down dramatically and will continue to do so in the future. According to the market leaders - 3D Systems, Z Corp and StratasyS – the challenge in this industry is not price but lack of awareness. Desktop Factory will introduce an entirely new method of 3D printing at a price point that will accelerate adoption and market expansion. And, with our growing patent portfolio we can deliver this sustainable advantage to the consumer.

SV: Absolutely. I mean awareness is a major issue as our research indicates that only a handful of companies say about 15-20% of the end users worldwide take advantage of various RP technologies. Now, how will Desktop Factory overcome or improve the awareness levels? What strategy is there in place?

CL: I think that there was an automatic connection with potential users that began with our market research. Once we engaged customers to understand requirements we started a ground swell of interest around low end, low cost 3D printing. At the same time you have new entrants coming into a similar space like Hod Lipson, the professor who came up fab@home. While this is clearly a specialized approach similar to the early PCs that you built yourself, it does help increase the interest and requirement for this type of technology. With targeted public relations the interest and awareness will continue to grow. With one article in the New York Times in the month of May we had almost 4 million hits to our website. Not bad for a completely unknown, 17 person company - this truly demonstrates how compelling 3D printing technology is to the general market. Now the next step we've already started is working with every developer of CAD/CAM software. There are over 5 million licenses in the CAD environment today and growth continues at better than 20% per annum. AutoDesk and Solidworks are both engaged with Desktop Factory whereby we participate in and present at their annual

user group sessions. Along with these existing CAD software players you also have several new providers coming in at the lower end of that market, companies like Alibre and Rhino that are offering very low costs and really starting to kick up a lot of excitement and new users in the space. We plan to form relationships with the downloadable 3D objects sites and look to build a web based exchange program for free or fee based 3D objects. At the same time there's this 'Maker' trend where people like you and I want to build our own products. Mass customization, another name for this trend, is going through a major growth phase where thousands of people are subscribing to craft magazines and attending forums like the Maker Faire recently held at San Mateo County Fair Grounds to learn and share best practices. This is a huge facility and over 45000 people attended the 3 day weekend event sponsored by companies like Microsoft and Google. And, this is not a one time scenario – the next Maker Faire will be in San Antonio in October and plans are underway for Europe. So you've got a number of different trends that are feeding the interest for affordable 3D printing that we will leverage even as we explore other options to build awareness like relationships with gaming and toy companies, viral marketing via YouTube, etc.

This interview, by the way, is a great venue to showcase 3D printing.

SV: Do you think this low cost 3D printer is going to have an overall effect on the 3D printing pricing model?

CL: I don't think it will have an immediate effect. If you look at the last 3-4 years in the industry, pricing elasticity has been alive and well. For every thousand dollars that prices come down, the demand has spiked insuring continued double digit revenue growth. So I don't think the current market leaders need to do anything extra-ordinary. I think we will see the trend continue and over the next 2-3 years you'll see prices come down gradually. But at the same time existing users, the base that these companies support, are also demanding better detail, more robust parts, higher speed, they're looking for expanded capabilities – Z Corp introduced color and while many say it's a marketing ploy, there's going to be more call for color, particularly in the architectural discipline. Companies have demonstrated a willingness to pay for these enhanced features which help keep prices stable and even increase the costs of some models.

SV: Right exactly. They have a major portion of the architecture market.

CL: Right - they almost enjoy a monopoly and since the market abhors a monopoly there will be more attention focused on color. And one of the other great growth areas is Rapid Manufacturing – so the best and strongest players are going to be pulled further up market to invest in metallic's and help companies develop directly manufactured products, whether it's 1, 10 or 100 items – this is a new, accelerated way to actually manufacture final product. So given all of these dynamics and the fact that the current industry players, with the recent exception of 3D Systems, are enjoying double digit revenue growth, they've got too much going on right now to worry about chasing us into the consumer space. They've got large market potential; they've got shareholders that they have to please and margins that they need to maintain. Plus, they've got users who need and will pay for additional, enhanced products.

SV: But I would assume that the acceptance of your products in the consumer space might add some pressure on these leading manufacturers too?

CL: I think there will be some pressure initially but these companies will be able to justify their position based on the capabilities of their products as I have noted above. Plus they have made the investments in their channels, support, applications development and services which are central to their existing business customer base. None of these companies have the type of infrastructure typical of a direct or consumer business and it is expensive to build and manage both.

SV: In your opinion what are some of the key technology trends that you've witnessed in this industry?

CL: Let's look at software. We are seeing two very different dynamics in 3D solid object modeling software. Companies like AutoDesk where the bulk of their revenue comes from 2D CAD are working on improving their 3D offerings, making them more intuitive and providing greater capabilities. On the other end of the spectrum we see a number of players starting to introduce low cost 3D CAD software like Alibre and Rhino plus others with home based CAD software and design capabilities. Google's acquisition of SketchUp is an interesting phenomenon. They probably had one focus in mind i.e. –Google Maps, but they brought the concept of 3D design up a notch and introduced it to a wider audience. So I think the software phenomenon is going to continue and you're going to see more capability and lower cost offerings along with an increased focus on the consumer market. You're going to see artists start to use more CAD software and you're going to see icon driven simplicity in the user interface. Then if you look at the hardware scenario – I think rapid manufacturing is going to be a huge play at the high end of the market. I think across RP the products will continue to improve in terms of resolution, with more color and you'll see some pricing pressure in the 3D printer space. But the ultimate opportunity is when these trends converge with truly affordable 3D printing substantially increasing the numbers of users and applications for 3D printing. This will become a much more robust growth market with many more competitors watching and paying attention to it. This is great news because 3D printing and RP are critical tools. As you know we're facing a terrible shortage in terms of engineering talent. One in six engineers that graduate today will be hired by Lockheed Martin – that's their current appetite – meaning that the remaining engineering talent falls woefully short of the requirements for the rest of the businesses in North America. We clearly need to do everything possible to interest more students in this vital discipline and these technologies will help us do that.

SV: Rapid Manufacturing is usually high end of the RP market and your printers will mainly be used for concept modeling and RP applications?

CL: Correct. Within the industry there is a very broad set of opportunities and applications. But the main driver of market growth, even before the availability of Desktop Factory is 3D printing. Over 70% of the unit shipments in 2006 were 3D printers.

SV: What do you as CEO of the company want to accomplish in the next couple of years and how would you define success for yourself and for Desktop Factory?

CL: The vision for us is to enter the market with a product that provides access to a whole new generation of 3D printing users'. So that's first and most important. The next goal, in the not too distant future, is to deliver on the promise of a 3D printer below \$1,000 for the consumer. We need to realize this opportunity as it was the basis for the formation of our company. As long as we maintain the current trajectory we will succeed and, in doing so, we'll creatively disrupt the manufacturing value chain as we know it today. Imagine having the capability to build a replacement part or make a simple repair without leaving your home. Talk about a reduction in green house gas emissions – possibly 10 – 15% of the items built in China today could be printed 3D, on demand! We will also spark an explosion of creativity and innovation. In the interim, we need to deliver strong financial results to all of our stakeholders; which include our investors, our employees and our many customers. So success for us will be meeting those two primary goals while delivering solid returns to our investors, growing our customer base and maintaining a highly motivated team.

SV: What kind of growth platform do you envisage for Desktop Factory in the coming years?

CL: We are planning for a rather aggressive growth ramp for Desktop Factory. We are still in the design phase, which is an iterative process just prior to product launch. With a final design, about 8 – 12 months after launch, we can outsource our manufacturing which provides tremendous upside in terms of cost reduction and, just as important, it allows us to ramp up volume dramatically. Outsourcing, at the appropriate time also frees your resources to continue to iterate on process and products for the future. We will grow from sales of hundreds of units in 2008 to a plan of 3500 in 2009. Where it really begins to get interesting is 2010 when we will be at a price point of roughly \$2,000 and you will see us ramp up to somewhere between 20,000 – 30,000 units. So there's quite a significant growth curve in 2010. But the breakthrough year is clearly 2011 as we price below \$1000 and enter the consumer space. At this point we believe we will be selling well over a 100,000 units a year and have a business with a quarter of a billion dollars in revenue and a product /consumable margin that's just north of 50%. Because the consumables will comprise almost 70% of the revenue at that point we will also have a strong EBITDA margin that's somewhere in the mid 20s.

SV: Don't you feel profitability would be an issue by 2011 if the printers are going to be priced at \$1000?

CL: Actually we believe that profitability will not be an issue for a few reasons. First of all – this is a business model that mirrors the printer industry in terms of the dual revenue streams. Even at \$995 we will have revenue and profit coming from the engine – we estimate 20-25% margins on the device. There will be software at very high margins and the consumables. Once you're in the market for 3 years your consumables start to become an ever greater percentage of our overall revenue mix. And the consumable margin will probably be 65-75% at that point with a series of consumables for customers to select from. At launch we will have a single consumable. It is a very robust nylon that can be tapped, it can be milled, and it can be drilled, making it possibly the strongest output in the industry. But when you start thinking of other uses, we also see the need for a very pliable material, a rubberized material that will be very important once we enter the home market. Each consumable may have a different business model in terms of the profitability but my current assessment, given some of the early work done, would suggest that none of these materials will be below a 60% margin. And the business case is rather conservative. For planning purposes we have kept consumables at roughly the same price, even for the consumer, simply taking advantage of volume and our installed base to improve margin. So that's why I'm very comfortable with the profitability picture that we're looking at in 2010/2011.

SV: Will you be offering services also?

CL: That is a great question. We believe there is potential to provide application services, help people learn how to use 3D software and scanners, etc., but this usually introduces the requirement for incremental employees with different skill sets. Using the web, we will probably first look at developing a low cost delivery mechanism for training and support. I think that one avenue we will want to consider is printing parts for customers and prospects. I'm not suggesting that we build a stand-alone business but more of a marketing toolkit to create demand and close orders. Based upon our price we will need to move away from traditional distribution channels and emulate, as much as practical, the Dell model where we will take advantage of the web to sell the product and the consumables. Therefore, parts printing may be just the ticket to use as a closing tool. With 277 orders to date, we found that over 60% of them could be closed without a part being exchanged and without a face to face interaction. However, as you go to a broader market we suspect that some physical interaction is going to be required. So printing and selling a low cost, 3D part might be the perfect solution.

SV: What have been your biggest challenges so far and how have you realigned your strategies to overcome them?

CL: The greatest challenge for a company that's creating a brand new technology without a large, mature R&D department - is the technology itself. You know it's always difficult to create something brand new, even for a larger company. So our mitigation approach was to procure enough talent from the industry to augment some really strong engineers out of local schools; we have a number of CalTech, MIT and Harvey Mudd engineers. Our industry talent includes 3D Systems, Z Corp and Canon. So when it's a hard core technology play your strategy suggests that you better attract the right people no matter how expensive that might appear. So that was the first challenge and I think we've handled that really well with our focus on recruitment and each person we've brought in has a piece of the company so they're wedded to our success. The second challenge as a small company is liquidity. How do you fund a start-up when you have nothing to sell early on? We have had the advantage of Idealab providing us with initial funding which has been terrific. They have been the sole investor and they made sure we had all of the right resources to get to where we are today. Now we are in the market for our first round of external funding – and the strategy is to find a partner that understands the concept and believes in our vision. That can be a real challenge because there are thousands of Venture Capital firms in the market today, most of them comfortable with software, search or life-sciences investments. Few know anything about 3D printing and many don't want to take a risk in terms of a new technology. The strategy is to very selectively pick the firms and align your outreach to them. So we've literally gone through the database and tried to understand the players. Have they funded hardware companies in the past? Have they done so successfully? We are attempting to identify and pick potential suitors and pursue them. We are getting close to the final selection and should be entering into due diligence soon. I think we're making some really good headway but that's always one of the challenges for a small company – liquidity and funding.

SV: How will equipment vendors differentiate themselves in 5 years time and how will that be different from today's competitive landscape?

CL: I do not think the current vendors will all survive – there will be fewer of them. So you'll see some consolidation in the future but the result should be improved differentiation and better products targeted deep and broad into the market. More choices in rapid manufacturing will become available. Much more sophisticated but easier to use RP capabilities will also be available. We're still at the very beginning of this industry. My competitors today are \$100 million firms. These are relatively small companies – so there's upside opportunity for them to grow organically and through consolidation. They will be busy over the next 5 years and they have a very large market that is highly under penetrated. The unit play in this landscape is going to be the distribution of low cost 3D printing at the consumer level. Desktop Factory is going to start that phenomenon and we intend to lead it for the foreseeable future. I suspect you will see traditional 2D printing companies trying to enter the space, as well. And you could see other consumer oriented companies, whether they're gaming or toy companies, trying to launch 3D printing. So the current vendors, with some level of consolidation, will remain in position and grow the RP market based on existing potential. And, in the broader consumer market companies like Desktop Factory will certainly create the opportunity and awareness – enticing players from 2D printing, from gaming and potentially other consumer electronics areas to get involved in 3D printing.

SV: Do you have any idea of getting into any specific partnership or alliance with any of the other companies and what can we expect from Desktop Factory on this front moving further?

CL: I think strategic partnerships have been underplayed in this industry. What we're trying to do is comprehend the value of these partnerships early on and we're starting some dialogues now. Our current engagement includes companies in the existing industry that we think are top notch suppliers and have similar goals to build the market. We're also looking at software suppliers because those kinds of partnerships can only

help expand the market, expand the user base and help simplify the use of CAD and 3D. Thirdly, we're looking at partnerships with companies that will ultimately want to enter this market. These companies are strong either in consumer or 2D printing, they are looking for different avenues to expand their revenue and many need to make up for margins lost to commoditization. So we're trying to be intelligent about having dialogues with these folks and finding the best way to work with them. We believe the vision for Desktop Factory is very important and could radically change the landscape for you and me over the next 3-5 years. We want to make sure that this creative disruption happens, whether we drive it directly or while playing a role in a strategic partnership.

SV: As a conclusion – what does the future hold for Desktop Factory more specifically or what can we expect Desktop Factory to play in shaping the future of the RP market?

CL: Well clearly Desktop Factory is going to lead the industry in awareness and therefore, adoption. We're going to revolutionize the market with our focus on accessible technology that is both low cost and easy to use. Most importantly, for the consumer, we will enable the creative disruption of the manufacturing value chain, unleashing a new wave of personal innovation and mass customization. Yes, we intend to deliver 3D printing to the masses.

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