PCB Manufacturing (R)evolution in the Making

Stephen Las Marias, I-Connect007 | 04-11-2018


Les Sainsbury

At the recent HKPCA and IPC Show 2017 in Shenzhen, China, I was able to interview Les Sainsbury, CEO, and Andrew Kelley, CTO, of XACT PCB, as well as Alex Stepinski, vice president of Whelen Engineering's PCB Fab Business Unit, to discuss process evolution and technology developments in the PCB manufacturing industry.

Stephen Las Marias: Les, for anyone who's not familiar with XACTPCB , give us a quick background.

Les Sainsbury: There's sometimes some confusion around XACT because we have a software system but we're not software people. We consider ourselves unique; we're actually PCB manufacturing guys….. We developed the software system to solve PCB manufacturing problems. We are currently the world leader in PCB registration control systems. Very specifically our target market are companies manufacturing technology product, if I can use very broad terms, HLC ,HDI , Flex and Flex Rigid boards.

Our first sale was about 10 years ago; now, having enjoyed enormous success we have a leadership position in the PCB manufacturing world. For XACT to accurately control registration processes in real time, we have to interface with other manufacturing systems and machines, it's part of our DNA. Guess what? As an industry we have started to talk about Industry 4.0, Smart Manufacturing, Smart Factory, and other terminology's where interfaces between machines, equipment and systems are critical. XACT has always connected to machines and equipment so that we can access data, so we find ourselves today in a very enviable position to take advantage of Smart Manufacturing initiatives that require communication between discrete machines and devices.

As there is no current IPC standard for PCB manufacturing in terms of machines communicating with each other, we have had to develop a very open business model for writing interfaces; we look to connect to everything and so can control everything. An easy thing to say, but very difficult to execute as it relies so much on a mix of experience, technology and capabilities.

We have an intelligent manufacturing system that collects data, models behavior patterns, and actually predicts in real time. Critical to our capability is we have to have reliable and accurate data. To this end you've got to have reliable and accurate machines. Which begs a question as we are here in China “Is the China market ready?”. From XACT’s experience we would have to say its work in progress, historically domestic manufacturers do seem to have gone with lower cost machinery (a just enough approach). Therefore, capability becomes an issue with regards to being able to do many of the things necessary to move towards a real “ lights out operation “ , but certainly you can start diming the lights. PCB manufacturing does not lend itself easily to 4.0 and mass process automation specifically, because to date, real traceability at an inner layer processing level has not been possible. Frankly for most people you build it, you get to the end of the line, electrically test and go, “Oh, it doesn't work.”

Las Marias: How long have you been in China?

Sainsbury: Our first Chinese customer was booked in 2006? Back then being a startup, we used local agents supplemented by regular sales visits from the UK. As we grew it became obvious that we needed our own local staff, this move has resulted in a lot of success and momentum. We have a sales cycle that frankly requires experts, we have seen this in the USA and Europe, China is no different — we are pcb registration experts engaging with the customers experts.

Las Marias: Has the market evolved in that time ?

Sainsbury: Obviously the market has changed. Today the Chinese government says 2025 initiative, Industry 4.0, all those Smart Factory terms, senior management are influenced by this and are asking us to advise them how we do it. The guys on the shop floor are going, ‘Yeah, we’ve heard there’s a new machine, a new system.’ In practical terms I think we will meet in the middle. Some companies will go full lights out, others will implement automation, others some aspects of smart factory. We can do that. The great thing about our system is you can implement on a step-by-step basis. You don’t have to do the whole factory. There’s a model that says you can incrementally get to be a lights-out factory. It’s a pretty long road. I'm not quite sure we're going to get there in my life time. Certainly it will get more automated.

Las Marias: What is the challenge in convincing people to adapt those advanced technologies?

Sainsbury: It depends on the level. I think, if you’re engaging with senior management, ‘convincing’ is an absolute word. I think they’re receptive to it and would like to know more. We’re seeing real manufacturing challenges coming from today’s designs and there’s recognition that better equipment and intelligent systems are needed. A people only

approach of attracting and retaining skilled people ,training them to manufacture today's challenging products in a repeatable manner is no longer a sustainable strategy.

Even if senior management in China recognize the need I think the general workforce in China still has a culture of "a glass ceiling", when it comes to transmitting new ideas/needs upwards. The engineers might know, but they're not willing to tell their boss that they need to change. In the West, we don't seem to be as uncomfortable in pushing our bosses when change is required. Obviously, China will get there, but the cultural aspect just seems to slow that whole development process down. But we recognize it, so we try to work with it. At the management level, I think there's certainly a 'we're not sure what to do, but a realization that we need to be doing something.

Las Marias: Are you seeing competition here for your industry?

Sainsbury: If you look at our core business registration control, it's a very complicated process issue and therefore requires a sophisticated solution. Our system is intelligence driven, based on bespoke algorithms that we have developed over many years, it looks at behavioral patterns. We see no one in our market place reaching the levels of capability that we have, in our experience normally the customers ""human expert"" is the competition.

Now, to move that up a level to Smart Manufacturing you're talking many aspects, I think there are many unforeseen challenges, we don't know yet because it's not been done before .The big question in my mind is confusion .Are you confused about Smart Manufacturing? Why? Because you hear so many phrases like China 2025, 4.0 and other Smart Factory initiatives such as cyber physical systems. The customer has to be confused. He knows, he wants to be more automated, but then automation itself means different things to different people.

Many companies say they are automated when in reality they have automated their material handling with conveyors that may have a robot stacking. In our mind, that's not automation. Automation is process control, automation not material handling.

So where do XACT see itself in this emerging landscape? We're not an MES system. We're not an ERP system. There isn't a neat acronym to describe what we do; we would describe ourselves as "a PCB shop floor intelligent process control company". We do not solve the entire 4.0 puzzle but we do see ourselves as a very important piece of the future PCB manufacturing 4.0 challenge. We are very much on the factory floor, very much talking to the engineers and saying, 'How are we going to solve this problem? How can we help you?'

That's not for every shop of course. We are focused on providing PCB companies the ability to adopt a step-by-step approach to smart manufacturing. We don't try to promote, 'We can solve your entire manufacturing problems.' No, we solve the basics first, and then we integrate with your MES, ERP or PRE-CAM or CAM system. Our core products already communicate with all those installed systems so we have a solid foundation to build upon for anyone wishing to implement a Smart Manufacturing project.

Las Marias: Have you always been open to other equipment manufacturers? I can see on your graphic your system talking to materials, imaging, layout, drill, optimization….. You have to be open to all of these things?

Sainsbury: From our inception as a start-up, your strategy has to be open. You have no leverage. You're not the big gorilla and therefore you can't force people to do what you may prefer to do. Our strategy has always been accommodating. A customer would say I have a certain brand of machine and it performs this function. We agree to write the interface. The next customer says, 'Oh, I don't have one of those, I have this manufacturer.' We'll write the interface. We've developed our position in the market with an open accommodation approach with all machine manufacturers and all associated systems'.

Now, from a business model point of view, you may think that must be a little costly. Yeah, okay, but that's the cost of being in business. That's part of what we consider—a product cost. Generally we find adopting a one solution fits all customers strategy just doesn't work. We responded to market needs. We accommodate our customers' requirements or type of equipment. That can work against us, don't get me wrong but we look to deal with every machine a customer presents to us.

Las Marias: You mentioned earlier that you're working with Alex?

Sainsbury: Yes. I think Andrew and Alex may take over when this gets really technical because it's their project. On behalf of Alex, I'm sure there's only so much he would wish to say about the really confidential things that are still covered by NDAs between the various parties supplying Whelen. There is a lot of equipment arriving at Alex's new factory that is not available in the market today. For XACT that means we have to adapt with new interfaces, new behavourable models to work with the new machines. This is not an insignificant challenge in itself but we have embraced this challenge in the knowledge that it will keep XACT in a market leadership position.

Alex's factory will collect new data from sources that have not been available before. Andrew will be locked away with our PhDs and algorithm experts doing research on these requirements developing and incorporating them into our AI engines. Personally, I think this is a big ground breaker in our industry; we don't get change like this. It's always so

difficult to create change; we work in a culturally old-fashioned business. People say, "We've always done it this way. …Please don't tell me this new idea, I've made boards for 30 years." ….. a silo mentality persists in PCB fabrication with each department doing is its own thing they're not naturally inter connected; Alex's philosophy is to have a single central engineering group across the entire factory.

Las Marias: Alex, do you think the industry will be open about adopting such a strategy?

Alex Stepinski: I think what's going to happen is, as soon as we go on the merchant market, which is happening soon, it's going to drive some change in the industry. I don't know how fast, but it'll be very interesting for a lot of people. I think there's tremendous interest in what we've done in Asia. A lot on the automation side and a lot on the environmental side. I've been approached by many people just in the past 24 hours asking questions, a tremendous amount of interest. I think once we realize the factory, you're going to see a lot of people trying to do something similar.

Las Marias: What for you has been the challenge so far?

Stepinski: The initial major challenge was to convince and bring together suppliers who would embrace my strategy and philosophy and agree to develop the product, metrology and systems necessary to bring the project to reality. Now it's just lots of hard work and lots of travelling

Las Marias: What about the skills required?

Stepinski: We've been able to bring on technical people out of school, new grads, as well as a couple of very experienced people in the industry for the engineering teams. For the non-technical positions, we haven't had a problem recruiting people.

Las Marias: That's good. Andrew, you have presented a topic called "Advances in Smart Manufacturing for PCB Production" at the technical conference. Can you please give us a brief summary of your presentation?

Andrew Kelley: We hear a lot about Industry 4.0, smart manufacturing, and so on. If you cut through the confusion, there's no clear directive as how to implement this. We wanted to give some practical examples, ways forward, how data can be captured, what data can be used for, and how it can process through from data into information into knowledge and wisdom and then action. We wanted to take our example of registration control and show real examples of how we take that from the machines and drive the next processes. We talked about data pipelines, if you will. All the machines are either producing data or using data. Often, that goes into separate pipelines. You put it into the production pipeline, it goes into the machine, and it comes out and goes into the manufacturing pipeline.

What we do is we take all that information and we learn from it. If you can learn from it, you'll know what happened, you'll know why it happened, and you can predict what's going to happen next. We added a third pipeline, a prediction pipeline. With this information, we now have foresight. The other two give us hindsight and insight, but having foresight, we can now really drive through the process.

Las Marias: Definitely everything is driven by data, right?

Kelley: Absolutely, yes data is a strategic business asset, but the real value is in the information and analysis from that data that provides insight and drives actions.

Las Marias: I would say the marriage of operation technology and information technology.

Kelley: Yes, definitely.

Las Marias: Do you think people are receptive of that idea right now?

Kelley: Everybody would like Smart Manufacturing. In China, as Les mentioned, you have possible cultural barriers to address. There's an element of job protection as well. They're very protective of what they do…..they're the human experts. Our challenge is to make these people understand that we're empowering them. We're not taking them out of the picture. We're actually trying to empower them. We're breaking them out of their silo to encourage a more holistic view of their entire process. They become more beneficial to their company with new more powerful expertise.

Las Marias: Are there critical parts of the process that you think these new advances will provide the greatest impact right now? And from your perspective, where are the challenges hidden?

Kelley: The challenge is people have a piece of equipment that takes measurements, they assume those measurements are correct. They don't look at the process for example and see it's sitting in a high-temperature, high-humidity environment and at night it's gone cold. It's giving completely different measurements for the same products throughout the day. If you don't learn to understand controlling the machine that's moving the process, then that's where the challenges are going to come. If they don't understand, the data isn't actually driving improvement but is making things worse. Bad data in, bad data out is the problem that we see.

Las Marias: What about if you've got companies that have legacy equipment that is still working. They paid so much capital to acquire that. How are they going to go to the next level?

Kelley: That's also a challenge. We've got to educate them that they need the better equipment. We'll send our guys in and we'll do data analysis with the engineers to show them how repeatable and reproducible the machines are and whether it's capable. We won't let them take our system if they don't have the capable equipment.

Las Marias: If you are setting up a new factory or a new line, this is a good technology that you can demonstrate this ability and the advantages that it provides the manufacturers.

Sainsbury: Yes. At one level, you're trying to improve machine capability. That would be at an engineer level. You would say your machine isn't good enough. Go and spend $250,000 on a higher performance machine and then we will come and talk to you. That's a specific something: How do I convince my boss to spend $250,000? If it's management level, you're talking a broader spectrum of smart manufacturing. I've listened to Alex in a few presentations, and it's a whole cultural mindset of change 'I'm going for high investment ROI, not labor dependent. I want to change my indirect to direct ratios in my factory and make money.' If management doesn't cross that hurdle, you can never get to the ultimate goal of where you started your questions. It isn't the model you've used historically. That has to be a senior management decision.

One thing Alex didn't say when you asked him about the product, was that there's so much new equipment that he had to convince vendors to design and supply. He had to convince them to admit their equipment was not capable of doing what he wanted it to do. It required the next generation. He's convinced them to build new machines for the next generation or the next generation wouldn't have happened. Actually, I'm a big advocate for Alex. Why? Because he's creating change. That requires a special set of circumstances. His boss bought into what Alex wanted to do, gave him tens of millions of dollars to go do this. That's also unique.

Someone has to go around the world and talk to suppliers. They have to believe there's a market. 'I'm going to build one for you, Alex. Now I'm going to sell 100.' He's had to convince them this is the right thing to develop. They're the things that condition the change. They're the enablers. I say we have a small enabling wheel. Alex has convinced other people to hitch their wheels onto his wagon that's going to get to 4.0. We can't do it on our own. He's not quite doing it on his own, but he's got people to buy into what he wants to do. That will make it happen.

Las Marias: Definitely, everything that's happening right now is really good for the industry.

Sainsbury: Even this interview is sort of unique in the sense that this is about to happen. Honestly, you can tell we're really excited about it. I've been on the inside and now we can

talk about it a little bit. As 2018 unfolds, obviously that will be extended. This is the first real Smart Manufacturing factory in PCB industry.

Las Marias: Alright guys, thank you very much for your time. Do you have any final comments?

Kelley: No, I think it's probably gone really well. Thank you.

Sainsbury: Thank you, Stephen.