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# Driving Operational Efficiencies at Summit Interconnect

Interview by Barry Matties

I-CONNECT007

As the largest privately-held printed circuit board manufacturer in North America, Summit Interconnect is headquartered in Irvine, California, and has eight facilities, including one assembly shop. Summit COO Sean Patterson came back into the industry after a career move that took him to Amazon and now reflects on issues including cultural alignment, the new workforce, and PCB capacity in the United States.

**Barry Matties:** *As chief operating officer for Summit Interconnect, what's a typical day like for you?*

**Sean Patterson:** My day starts with checking in on the day's production, working

with sales on upcoming quotes from a customer perspective, and then getting into larger projects for the rest of the day with an eye toward our long-term vision. Overall, I'm looking at our operations from the day before as well as trends from the prior weeks for all eight facilities. Seven are fabrication facilities and one is a quick-turn assembly shop.

*You have made some acquisitions, the most recent being Royal Circuits in Hollister, California. Is that right?*

Yes, we acquired Royal Circuits in Hollister, Advanced Assembly in Denver, and South Coast Circuits in Santa Ana, California.

***You're operating in California, perhaps one of the most expensive states to do business. What's your strategy for offsetting costs?***

We focus on efficiency and verifying our processes up front before we start production. This maximizes our workforce to keep labor costs down. We also focus on employee retention by providing long-term career planning with opportunities to move into higher-level engineering positions.

***How do you help your employees take advantage of paid training?***

At IPC this year, of the 20 people who went through the Emerging Engineering program, eight were from Summit, so we had the largest team there. It's healthy that we all cooperate to bring more people into the industry and not just move them from site to site. That's not helping our industry. We want to continue that IPC training, developing a career path throughout our company and within the industry.

***How do you manage operational effectiveness across multiple locations?***

You focus on alignment, but you can't do everything all at once. For example, what is the best process for yielding a circuit board? In my facilities, I have seven design of experiments (DOEs) happening at once and we are finding the best process that is also the least expensive. Then we implement that cooperatively throughout all facilities. Each site is making continuous improvement unto itself, so while we can implement certain "best in class" processes across the board, each site also deals with its own issues. We have a roadmap for achieving it but getting there is challenging. This is "change management."

***When you acquire a company, you acquire their culture, which is another aspect of change management.***

Summit acquired eight new facilities within seven years, so we're working to bring the cul-



Sean Patterson

tures together and implementing operational improvement programs where there are varying mindsets. Culture is a long-term plan.

I really like the culture at Amazon, where I used to work; they have one of the best "at scale" cultures in the world because it has meaning to them. It's not just lip service. For Summit, it starts with sites talking to other sites, suppressing geographical barriers as much as possible, and having our general managers and engineering teams go from site to site to observe and implement best practices. We are getting to know each other. But we have to move away from ad hoc requests on individual processes at a specific site to systematic process improvements across all sites through a culture of helping each other. That is the culture we are working on.

***Culture is built through the operating process.***

Yes, and it's really important, especially on the quality management system side, to have registered processes that everyone follows across

the corporation. We are also intentional about making space for employees who have ideas about how to do something better. We are careful not to shut down any idea because there's no monopoly on good ideas. We shouldn't have hubris about that. That builds our culture as well. We haven't written down our principles and such just yet. Right now, we are determining what those are.

***Culture is not written policy; it's how you act.***

We have two cultures: the internal culture and the customer-facing culture. The end customer's needs can be lost on those in the plant when they are dealing with a problem right in front of them. So, communication becomes our most important tool. Are you putting your best foot forward to service that customer, and remembering that every customer has a customer? It's a little easier at companies like ours that do a large portion of our work in aerospace and defense, but we have to remember our internal customers as well. At the plant level it comes down to a level of customer service that we need to continually work on.

***Sean, market conditions have been up and down. If you're in the defense industry, they may be on the way up again. Is that what you are seeing?***

While defense has maintained expectations and even seen growth, commercial projects are of some concern. Other executives tell me they're seeing this same trend. It's important to maintain a balance and we like our portfolio right now. The market segments help balance one another.

***One of the great challenges for companies right now is hiring—finding people who will actually show up. How are you offsetting or managing that?***

About a year ago, it was difficult to hire. We just didn't get in applications. But it's been better recently. Now we get candidates, and we don't see as much competition when it comes to compensation. You need to have a hiring culture too, where you engage people as they're coming in the door. There's a lot of opportunity for our industry to do things differently.

As far as training, we really like IPC's Emerging Engineer program. It's cross-functional and promotes cooperation among normally competitive manufacturers to improve the entire industry. I can have my engineers mentored by someone in another company. Europe provides a good example of this "cooperation," where they have apprenticeship programs in the trade skills. They learn how to do everything with their hands.

Broader education must happen within the industry, at our facilities, and at the operator level. We think about it at the engineering level, but we need to do a better job for the operators by giving them full visibility of PCB plant operations. You can understand everything end to end if you put the time in. That's something I like about PCB manufacturing. It's a multi-engineering sort of discipline—a butterfly effect. If an operator sees something happen but doesn't understand where it came from to even know who to call, they just pass on the defect. We can also do a better job of educating beyond what a specific operator does.

That's what I really like about I-Connect007, and I'm always pointing people to your content because outside of that, there's not much literature. The textbooks are confusing. Look at metallization, for example. It should start with hands-on training, and then go back to the textbook to read about every possible way to metallize something. Start with hands-on, then move to a more traditional academic environment.



**“ We have two cultures: the internal culture and the customer-facing culture. ”**

***Sean, where is technology headed? In what areas are you looking to grow?***

We are watching the organic growth in the United States. It's certainly the first time in a while that we see investments being made—TTM in New York, Calumet in Michigan, and SEL's new plant. Northridge and SpaceX also made announcements of new facilities. It's probably the most capital investment toward PCBs the United States has seen for decades, and there's a lot of conviction around that, which needs to be maintained throughout the supply chain, including our customers. We need to truly understand the market environments in which we are working, like Mil/Aero. The complexity we see now in engineered products is not what it used to be, so we must get out of the commoditized pricing world. If we are forced to play down in that commoditized pricing world, it's simply not enough to feed the industry in a meaningful way. Through all that, I believe, we can get the flywheel going and get the continued investment that's needed.

***But not all PCB fabricators can afford a large capital investment.***

Yes, that's true. There are too many that require large cap recapitalization and are on the edge of going out of business. I'm concerned about capacity in the United States as a result. While we now see companies investing in that capacity, much is captive and does not support difficult or complex boards. We need the capacity for complexity, and that takes a whole other level of investment.

***Some believe the U.S. has a lack of capability as well as capacity. What are your thoughts on that?***

It's a chicken and egg problem. You need the conviction so you can get beyond the purchase order/transactional relationships to more genuine relationships with your customers. The customer then understands the challenges of the industry, particularly so that the tens

of millions of dollars in investments that are needed can happen. This needs to happen with the legacy companies, in particular. We must continue to work on this with our customers at the right levels, which is not on the supply chain buying side.

***It is the design conception side.***

Right. As an industry, we are hurting ourselves with the mentality of just getting a purchase order in the door. Anyone can build anything once. This discussion needs to start in the engineering halls with the same people who go out to the supply chain.

***What drives that? Oftentimes, it seems like the fabricators want that, but the customer is not receptive.***

You need to be the squeaky wheel. For example, you can lose a job from a customer, but they go to the next company, and encounter the same problem you already told the customer about. That's an unfortunate process. Occasionally, you can get the right customer's attention, but it's also a recognition that we have a capacity crunch in the United States. At the engineer level, there's a technology gap, and that's well understood in the procurement world. Summit takes a partnership approach with customers, often working with them during the design process to improve manufacturability and help alleviate previous issues. This benefits both sides, resulting in faster time to market and improved repeatability.

***We've talked a lot about people, but what about automation?***

Automation is the right thing to do in the long term, and the U.S. has different problems than Europe with access to people and the cost of that labor. Machines are good at repeating quality. But let's look at inner layers, for example. Most well-run factories are at a 98% yield without automation. So, should I install an entire system that costs seven figures for a 1% increase in yield?



***Is it always about yield, though? Are there really many factories able to achieve 98% inner layer yields?***

That's the quality argument. And yes, I think that everyone can expect 98% inner layer yields through a focused engineering effort with the board designs we see in the United States. They can get it done, even with an old etcher or whatever non-automated equipment we are talking about. It just takes the right focus, unless you are making all PTFE or all flex.

***It depends on what capability you're building.***

Correct. As line widths go down, you can do some automation, but that plays into the need for very expensive automated equipment like etchers and developers. It's the right thing to do when it makes sense for the investment, so you strike a balance. There is an ROI, but it's not one or two years. It's more like four to six years. When we have a capacity constraint inside the United States, as we do right now, and with current cost of capital, my choice for investment goes with capacity over automation. You also have the people argument side. You still have to train people to see and understand how these things are done, which happens better on non-automated lines.

***So, you're looking at smart choices, which does reduce workforce and cost.***

A big focus for me is making sure we bring more people into the industry and teach them, as opposed to only relying on people with industry experience, which drives up our labor costs, worsens our age gap, and does not support the future of the industry.

***Sean, is there anything we haven't talked about that you'd like to cover?***

We've covered a lot, but let's talk for a moment about the industry from a cultural perspective. We need to be builders again. I wasn't in the industry in the 1970s, '80s, and '90s—the roaring PCB times. But from my view, there were some important dynamics.

First, most of the technology was founded inside the OEMs, and then spun off because some of the people working for the OEMs who thought they could do it better on their own started their own PCB shops. Those outsourced, independent shops then became the ones developing the processes. Engineers were excited to make the next new thing, so in those early times, PCB engineers were the builders of an industry. They had a greater, more altruistic motivation and there was excitement around that. This kept people in the industry. However, much of that excitement shut down through the dotcom bust, offshoring, and simple aging.

Now, you can take an established process, put a process engineer on it, and maintain the line. But it's a maintainer mindset. It's hard to get builders to do maintainer things. They'll do it, but they're gone within two or three years. If we are so good that something becomes just standard and is not exciting to do, then we should figure out how to fully automate the process controls. But with that, our industry has not done a good job of planning for machine-to-machine connectivity—a challenge when many of our

machine suppliers are family-owned companies in Europe.

Still, there are opportunities. With the right culture and the right story, we'll bring people on a new journey of building again in the United States. Maybe it will be building the connectivity between things or building some of these automation systems. Maybe it will be trying to establish the Six Sigma process again, because, in the United States, we've been pretty dismissive of ever achieving that. We've become product-focused instead of process-focused.

With the right story and motivation, engineers can create an ecosystem that feeds off each other. How do we get that going? One way is through "cooperation," because one company in and of itself is not enough to feed that. We have to create the environment. I am really looking forward to seeing something along those lines.

***Operational effectiveness is where you have to start. It is not your business strategy; it's your foundation. Part of that is the digital factory and benchmarking process to become a digital factory so you can have digital twin. How far along are you on that?***

We've put effort toward that, but it's a process. It is extremely important, because of the complexity of manufacturing, to be able to tell our customers when they will receive their products and actually hit those commitments.

***As I look at benchmarking and digital goods, and as you're talking about sensors, does having a digital twin of your entire manufacturing process give you predictive engineering to eliminate the problems before they occur?***

Yes, it does. That's the balance, just like with automation. Where's the right investment for the right kinds of returns? You could put a tempera-

ture and process pressure sensor on everything and say, "I've got everything online and it looks great." But you just spent \$5 million and what did you get for it? There's a lack of education.

***And a lack of skill, honestly, that can help implement these changes.***

But getting the builders of the world to do it now? You know that those kinds of skill sets are more ubiquitous. You don't have to hire a PCB engineer to do it, because you can use an Arduino to do Internet of Things. You can set it up.

***It's almost like hiring a coder.***

Yes, every engineer should know how to code.

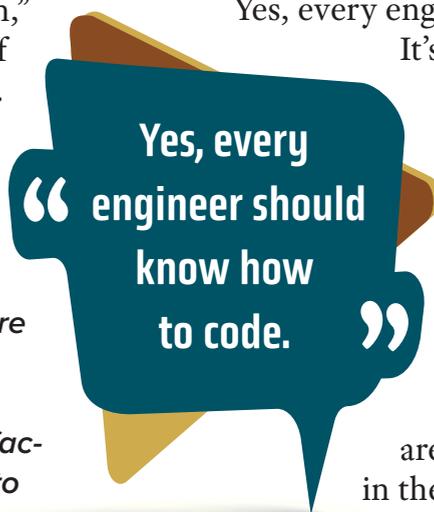
It's like knowing a foreign language.

I heard one AI thought leader propose that, in the future, every position title should be added onto, including the words "and Automation Manager." Everyone in every position should be charged as part of their job responsibilities to automate out their jobs. Those are the people that will be useful in the future, and automation doesn't have to mean robots. There are many free tools to take advantage of to drive your cost efficiency and communicate with your customers better.

Everyone has the ability to be creative. It's a muscle that you have to exercise and be encouraged to use. I tell my team that every time I push them hard on process, it's okay to fail. If you're not failing, you're not advancing or you're not advancing fast enough. There's too much risk aversion today. We have to make sure we don't make a bad board, but on the process side of things, you have to play, which really engages that creativity muscle part of your brain.

***I think that's a great place to end this. Thank you, Sean, for spending your time with us.***

Thank you, Barry. PCB007



**“ Yes, every engineer should know how to code. ”**

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