White Paper
Launching a product from post crowd funding to first protoype run

Originally presented at PCBWest 2015 "Launching a product from post crowd funding to first prototype run, an EE/CM persepective" by Patrick Davis, Senior Vice President of Rocket EMS

Overview

One of the more desirable positions in business is a WIN-WIN situation. In the case of a start-up using a contract manufacturer (CM), a WIN-WIN means the CM gets everything they need to successfully create a final board on the first try, and the startup gets this done quickly and on budget. Unfortunately, in the world of Contract Manufacturing (CM) this is not often the case, and specifically with crowd funded startups, it is usually a LOSE-LOSE. To help mitigate this, Rocket EMS partnered with EMA Design Automation to come up with a systematic approach to change the often LOSE-LOSE relationship between a CM and startup to a WIN-WIN. Before we go into our methodology on how to LAUNCH a product, I need to present both point of views.

The Client's Story

"The four of us have been kicking this idea around for a while, and then a few weeks ago over drinks it all came together. You hear stories of napkin concepts turning into real products, well ours is the one with the wine stain in the corner. The next several weeks are kind of a blur. We created a company with the help of my brother, who is now the CFO. His wife is a Graphic artist who sketched up our concept which we took to an ID Company who tweaked it for a few weeks and then we had our corporate identity! A perfect box for the perfect product…and the 3D printed model looks stunning! While this is going on, the EE was doing some high level prototyping to see if this crazily brilliant idea will really work. He came back with a resounding 'I think so'… with that vote of confidence we hired a multimedia team out of the city to do our video and set up our web presence. In a matter of 6 weeks we went from a napkin to crowd funded startup. After a sleep deprived month, on a Friday afternoon, we

Highlights

- Learn about the common causes of product manufacturing issues from a CM perspective
- Discover ways to improve communication with your CM to drive success
- Learn how your PCB tool set and workflow can have an impact on product delivery
- Learn about a new service to automate and solve common issues during the PCB design and FAB process
- What to look for in a CM to build a WIN-WIN relationship

put this site live to see who else agrees to our dream. By Monday afternoon we stopped taking orders, and we currently have orders for 58,422 units!"

"All of us have been in the hi-tech field for a while now, we have all brought products to production in one way or another, and for the past few weeks I have been setting up my current suppliers, so I will have their support when I leave—after all, I have given them hundreds of millions of dollars of business over the past few years, and they like and trust me. I cannot fail!"

And we all know how the story finishes, the suppliers do not call back, the EE is doing the design and the layout, and after way too many weeks they have a design that is ready to be built…or so they think.

The CM's Story

Friday afternoon at about 3pm I get a call from a new client about doing a quick prototype build. The design should be done by 7pm and they want day 1 to be Monday morning at the FAB shop. It is a turnkey job - we will need to buy the parts for them with the exception of a few samples that they have. Not a problem, we do this all the time! I ask for him to send over the data package (BOM, Gerbers etc.) to see what we are up against...what a mess! The BOM has 116 line items and most of the caps and all the resistors have values only (no manufacturer or manufacturer part number or even a footprint!) The IC's are for the most part OK, but a few have 8-12 week lead time, and one part number does not come up at all. The connectors are only built by a Chinese manufacture that take...well we do not know how long it takes because the web site is so poor and the CAD data: there is no ODB++, the Gerbers are questionable, solder mask is overlapping on large parts of the board, poor fab drawing, and no assembly drawing to speak of. Not to mention the client is asking for a 24 hour FAB and 24 hour assembly because they have a potential investor meeting in one week, and they want some time to bring it up. "Ohhh, by the way, on our tour we saw that you have a great 3D printer. Can you do a quick 3D plot of the board using our Gerbers so we can see if our mechanicals are close?" This is a disaster in the making and a perfect LOSE-LOSE scenario.

Common Issues - Client

"When the CM received our data, we had expected a few small issues, but not the week delay that it caused."

- "Once the CM could use our data, we had more delays due to availability of parts and BOM to CAD differences (the parts on the BOM did not match the part on the board). Several more days were wasted sorting through all of this to make the CM happy. While in the process of doing this, we came to the realization that we need to spin the board before we even build the first board due to issues that were found."

- "Both the fab house and the CM had issues with our Gerber data. The FAB house found opens and shorts in the design, and the CM had issues programing some of their inspection tools due to the data received. We used an economical design tool that was open source—we assumed the tool really did not mater. Gerbers are Gerbers after all, right?"

- "Once the boards were done we ended up getting charged extra for multiple setups and a lot of re-work to get all the parts on the board. So we were weeks late, AND we ended up spending a lot more than we planned on! This has not been a positive experience!"

Common Issues - CM

- The expectation of the client was unrealistic for the state that their project was in. IF the data was good and they had a handle on the BOM, we could have made miracles happen. Instead we had tempers flare, delays and cost overruns.

- Not having intelligent Gerbers (Gerbers that have the netlist and component data embedded in the data) means that it will take us much longer to create the test programs, and the DFM is not as accurate. This increases the likelihood of a line going down (at the cost of $1000 an hour) and our NRE engineering cost increasing dramatically.

- Pre-engagement was too short…it was hours instead of weeks or days. If the client would have engaged with us sooner, much of the frustration and delays could have been mitigated by us educating them on how it is done and looking at the data ahead of time.

- There was no concept of control over the BOM or how to hand off parts to a CM. We received a box of parts with some of the bags labeled and some not. To prevent attrition, the line operators spent a lot time to get the parts to work the first time—much more time then needed. The BOM was not updated to the current rev of the board (the engineer could not keep up with all the changes in the design and on the BOM), so when the board finally hit the line, we have several points where we had to stop the line to manually adjust the programming. We lost money on this job, and there is a very unhappy client that may never work with us again.

Solution

All of the previous issues can be condensed down to two decisions to change this lose-lose to a win-win:

- Which CM do you partner with?

- What is your tools set and how are they being utilized?

When you have solid solutions for these two decisions, you are well on your way to a successful launch.

Partnering with the right CM at the appropriate time will make a substantial difference in both the timeline of your builds, the quality of your product and a notable decrease in your blood pressure. By engaging early in the development cycle, a start-up can leverage the experience and resources that a good CM will have. Here is what you should expect from a good CM:

- Preliminary BOM check. This will look for parts that are long lead, excessively expensive, ROHS compliant, EOL (End of Life) and a verification of manufacture and part numbers. Your CM has worked on hundreds projects in the past and already has a database of parts. Starting with a subset of that database for your design ensures that the majority of your parts will work first time with your CMs processes.

- Guidance in choosing a tool set. A good CM should have a design team or a good relationship with a design team that can bring in experts in the field to help you decide which tools are best for you. Here are a few questions to consider:

  a. Are you going to outsource some of the engineering? (For example, simple schematic work, library work, simulation.)

  b. For schematic capture, will you need to support simulation? If so what kind? How will you support the library creation (paid service or will the engineer be doing this)

  c. BOM creation, will this be managed within the tool, in a database, in a third party tool?

  d. For layout resources, are you going to use external resources to start, then eventually hire internal resources? How complicated are your designs? How fast will your turns be done? Do you need 24/7 access to a layout engineer? What skill set do you need for layout, high speed, advanced via technology (blind, buried, microvia etc.), RF, high power, high voltage?

- Preliminary DFM. Ask for a preliminary DFM of your design before it is completed to locate any potential issues that may arise at the time of assembly. You may have a small charge for this service but you can potentially save days by recognizing potential pitfalls PRIOR to starting the fabrication process.

- A CM that is on your side. A CM should want a comprehensive understanding of your product so they can help you sidestep landmines that you have not predicted. For example conformal coating issues, issues when you go to high volume with labor intensive assembly instructions, how are you handling program parts (on board or off?), what kind of special tooling will you need (specially for some press fit parts it can take a few weeks to get the tools in).

CAD Tool Selection for Project Success

The tool set in conjunction with a vetted work flow is the other half of the equation. Engineers are often attached to a certain tool, and when they start a new job, they will often choose what they have been using in the past and are comfortable with. This is not an issue, and on the surface it may seem to be a logical decision. But in the startup environment resources are limited and over taxed, so picking a tool set that allows the engineer to leverage high quality layout and library resources will decrease the time the engineer plays with the creating parts and tweaking BOM's, which has a measurable impact on overall project time. Just envision how much more effective an engineering staff of 1 or 2 would be if all they had to do was engineer the next great widget instead of playing with BOM's and creating library parts at 3am—and if it is happening at 3am how good can it be?

A tool set should have the following characteristics:

- Be mainstream enough that you can find support for it in multiple of places

- Be flexible enough to grow from 1 seat to 20 seats without breaking or causing logistical issues

- Capable of connecting to a database to control the library (very important in a multi engineer environment.)

- It must be stable and backed by a world class company.

Work Flow

How should it work?

1. At the beginning of a project, the EE sends off 20 or so datasheets to the library team (they are a service so you only pay for what you need) and they create the schematic part, PCB footprints (to IPC 7351 standards) , STEP files, assign your companies part number, assign the correct manufacture and manufacture part number and a second person verifies all information prior to being uploaded to a database in the cloud that your tools are in sync with.

2. The engineer will just place the part in the schematic and hook it up! No need to waste time with the "bookkeeping" side of engineering.

3. During the design the engineer can easily add parts that are not in the library by using a custom built API that will allow the engineer to browse several different resellers for parts (Arrow®, Avnet®, Digi Key®, Mouser®…etc.) once they find the part that are looking for, they simply add a temp part to the schematic. When this happens a request for this part is sent to the library team, the next morning this new part is built and is in the engineer's database, ready to be placed and hooked up.

4. Once the schematics are done, layout can proceed. The advantage of this workflow is the parts are already created and verified, so the time that it normally takes to create a part (which can be up to 25% of the total job) is never lost.

5. Once placement is done the layout engineer can send off a 3D drawing to the ME for verification (since all parts have a STEP model built at the same time) which will save days of work for the ME.

While engineering is designing the product, the CM's library team keeps the database updated and correct. Pulling a BOM at any point in the design is a button push. The CAD data will always be correct and in sync with the BOM, and at any time the engineer can request a preliminary part check from their CM to check for availability and costing.

Conclusion

The greatest challenge to a startup is how NOT to fail! For failure is easy! Rocket EMS and EMA Design Automation have seen the cycle hundreds of times and grew tired of seeing startups struggle and sometimes fail for no reason other than disorganization and poor execution. The underlying reason for failure tends to be fairly simple:

• Not engaging with a competent CM early enough in the design cycle

• Using inferior tools that do not allow for proper work flow.

To assist the startup, Rocket EMS and EMA Design Automation, collaborated together to create LAUNCH. LAUNCH is a systematic approach to design that uses industry standard PCB design tools connected to a cloud parts database that is pre-populated with known good parts and customizable by the startup. LAUNCH address all the issues that are outlined here and provides a startup with a big head start on design, while at the same time reducing risk in procurement and manufacturing. Does one need to use LAUNCH to be successful? NO! By understanding the principals outlined here and realizing that the most precious commodity that a startup has is time, then you will be just fine. BUT LAUNCH is designed to save the one thing that startups do not have enough of...time.

About Rocket EMS

Rocket EMS, founded in 2011, is an aggressive new company specializing in Electronic Manufacturing Services for fast growing high technology companies with a heavy focus on New Product Introduction (NPI).   Rocket EMS's exceptional team takes on projects that are conceptualized from an entrepreneur's vision and brings them to reality. Rocket EMS has become the pre-eminent EMS provider in Silicon Valley, with successive 5x growth year after year, and prides itself on having the right people, with exceptional experience, a shared drive, and a pursuit of excellence, along with a facility with top of the line equipment that rivals the best engineering and technical schools in the world. Visit rocketems.com for more information.

About EMA Design Automation

EMA Design Automation is a trailblazer in product development solutions offering a complete range of EDA tools, services, training, and technical support. EMA is a Cadence® Channel Partner serving all of North America. EMA manufactures TimingDesigner®, CircuitSpace®, and a host of custom solutions to enhance the OrCAD products, and all are distributed through a worldwide network of value added resellers.

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