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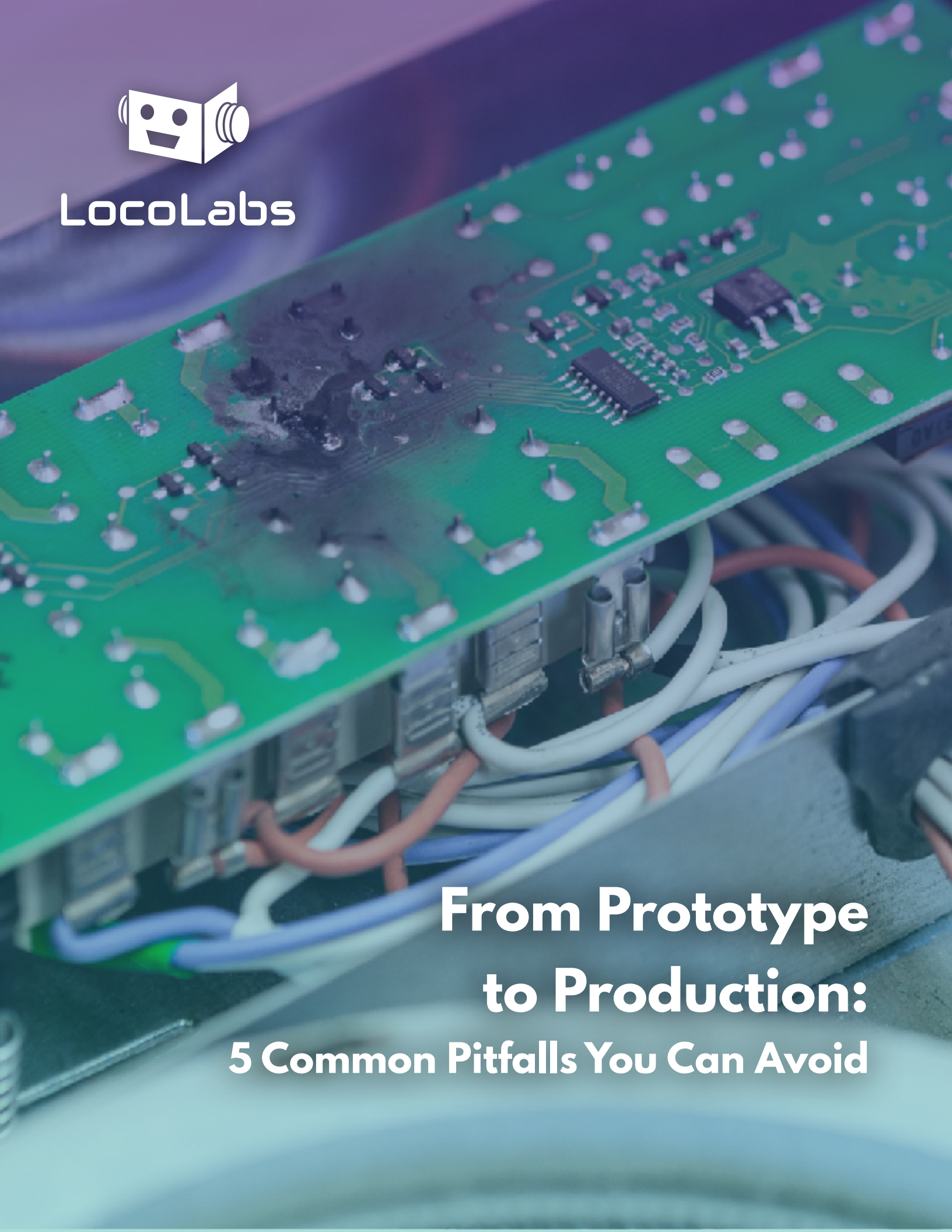

From Prototype to Production:

5 Common Pitfalls You Can Avoid

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How to assess production readiness of your design and prevent costly production issues

For product managers and engineering teams, the pressure to get to market quickly can be overwhelming. A recent NIST survey of global manufacturing companies reveals that most executives think increasing prototyping speed and engineering productivity would have a significant impact on their business.

Experienced product leaders know that releasing a prototype to production too early can have severe consequences, but other executives often fail to fully understand the tradeoffs between features, quality, and timing. The truth is that shipping a product that isn't ready can be far worse than a missing a sales number.

The examples of Samsung and Razor illustrate the principle. Each of these companies is a well respected global brand, yet both discovered product defects only after worldwide customer delivery. (Less well known are the issues caught before the general public was affected, but which still increased costs for the company.)

Two years ago Samsung was forced to recall all original and replacement Galaxy Note 7 devices since the devices can overheat and pose a safety risk. Airlines took the unprecedented step of banning the products by name. The company is still processing recalled units and suffering from damage to its brand as it launches the new Galaxy Note 9.

Similarly, in 2016 Razor was forced to recall its hover-board due to overheating that could cause the product to smoke, catch fire, or even explode. The company already survived another embarrassing electric scooter recall in 2006 due to a weak weld that could cause the handlebar to detach while in use.

Product failures, unexpected manufacturing costs, damage to reputation, and even bankruptcy have resulted from products that were not ready. With stakes this high, how can you be sure that your prototype is ready for production?

The issues affecting production can occur at every stage - from idea, to proof-of-concept, functional prototype, launch, and large-scale production. Assessing the production readiness of a prototype can eliminate problems affecting full-scale production.

Foresight Can be 20/20

An outside consultant with the right expertise can find minute design flaws that, if left unresolved, would impact getting the product to market successfully. LocoLabs, with more than 20 years of experience assessing hardware, software, and electromechanical designs, has this expertise and shares the top five pitfalls that

prevent a smooth transition from prototype to production. They are:

1. Design fails to meet manufacturing and assembly requirements
2. Design validation test (DVT) was not completed
3. Inaccurate or vague bill of materials (BOM)
4. Assembly instructions fail to describe critical pieces or don't provide enough detail
5. Issues with component sourcing

1. Design for Manufacturing and Assembly

You have an amazing product idea, a huge market opportunity, and perhaps even a working prototype. Can the product be manufactured? All too often, brilliant ideas and prototypes, as envisioned, simply can't be produced in an efficient or affordable way. For example, a design must use components that are compatible with the volume targets of your product and the equipment at your contract manufacturer. This requires hands-on due diligence and experience with components and the equipment in question - and ensures high-yield results.

Example: Torquing Group Limited

Although they acquired almost $3.5M from a crowdfunding campaign, Torquing lacked the engineering depth required to produce its palm-sized drone, and they eventually filed for bankruptcy.[1] Their product was wanted, but what they delivered fell way short of what was promised. An engineer with deep prototyping experience that spans hardware, software and electromechanical pieces could have caught their design flaws early in the development process.

2. Design Validation Test (DVT), Automated Test Equipment (ATE), and Test Plans

Chances are that your testing was done manually on a workbench. In the production setting, however, ATE equipment is used to achieve consistent and documented results. Beyond ATE, DVT is another important step - and it is often overlooked. DVT validates that the item produced matches the design intent and customer requirements. Thermal and voltage margining, for example, can be a critical step to uncovering weaknesses early and, if applicable, needs to be part of your test plan. One last tip: Produce a Golden Reference Master early and test it thoroughly with your production partner.

Example: Takata Corporation

Takata could not financially withstand the fallout from 37 million vehicles (in the U.S.) affected by exploding airbags. Environmental moisture, high temperatures, and age are associated with the defect that can improperly inflate the airbags and even send shrapnel into the occupant.[2] More extensive test plans, including ongoing long-term reliability testing after product release, could have prevented the injury and deaths caused by this product defect.

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[1] "How Zano Raised Millions on Kickstarter and Left Most Backers with Nothing," Jan 18, 2016, Kickstarter

[2] "Takata Airbag Recall: Everything You Need to Know," July 18, 2018, Consumer Reports

3. BOM

The bill of materials, or BOM, is the complete list of all individual parts and assemblies that make up a single production unit of the product. Check your BOM and make sure that it is accurate, then check it again. Problems can occur when descriptions are vague or are overconstrained, leading to sourcing issues. Having sufficient detail in your BOM to properly constrain the purchasing process is critical to making sure the height, shape, value, thermal range, and many other factors are in spec each and every time a production run is completed. Implementing a quality product lifecycle management (PLM) system is essential to proper BOM release and maintenance. This system is the critical link that holds all participants in the process accountable. If it is skipped or not rigorously maintained, trouble will follow.

Example: Samsung

Rushing to manufacture Galaxy Note 7 replacements, missing insulation tape contributed to a global product recall.[3] As Hall of Fame basketball player and coach John Wooden said, "If you don't have time to do it right, when will you have time to do it over?" No matter the urgency, a methodical review of the BOM, even hiring a consultant as a second set of eyes to review it, is never a waste of time.

4. Detailed Assembly Instructions, Effective Communication

When you hand off your design to a contract manufacturer for production, they will generate assembly instructions for their team. But unless your design handoff is complete and well-documented, there will be design specifications that the contract manufacturer is not aware of - and these can lead to serious problems with product quality. Therefore, it is best to have the Research and Development (R&D) teams that designed the product draft extensive assembly instructions that capture critical details, then review them with the contract manufacturer/assembly team for refinement before the final design handoff. This early, open communication is critical to building team dynamics and setting quality expectations. Additionally, when transitioning from early production to volume manufacturing, there could be transition issues that are not obvious to the volume production team or to the R&D team. When the volume manufacturer has a standardized (aka "generic") volume transition process, and the R&D team knows a product inside and out, it's important that these two teams communicate and verify that they are on the same page as to assumptions and expectations. It helps to take a step back and look at every part of the process without preconceived ideas.

Example: Samsung

Irregularly sized batteries for the Galaxy Note 7 made by a subsidiary didn't properly fit into the Android phone, causing it to overheat and catch on fire.[4] Any part can be improperly produced, but creating detailed acceptance specifications and QA procedures will help to catch these issues early in the process and provide a checkpoint to stop unintended changes after

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[3] "Here's why the Samsung Galaxy Note 7 batteries caught fire and exploded," January 23, 2017, Techradar

[4] Ibid.

qualification. Bringing on someone from outside the team to look at the overall big picture can be invaluable in identifying gaps in documentation or communication that need to be addressed to ensure consistent outfitting and assembly. For example, companies expect the documentation provided by the engineering team to be accurate, but might be unaware that toleranced drawings are often not provided with the design documentation. The manufacturing team can go ahead and produce products without fully toleranced drawings (and they often do), but if a problem arises because parts arrive that match the design documentation but are out of tolerance in a key but unstated metric, the customer has no recourse.

5. Sourcing Components

The supply chain for components is not static, it is a dynamic market that ebbs and flows with the activities of major manufacturers. If IBM, Apple, or Cisco design in a relatively common component that is also used in your design, and they place a high-volume order of that component, you may find yourself in a supply shortage with long lead times. A situation like that could leave you unable to manufacture for weeks or even months. Be sure to secure the availability of your critical components in case of an unpredictable disruption in the supply chain. Consider stockpiling inexpensive components that are subject to these disruptions and bonding inventory of more expensive components, and keep an eye on end of life (EOL) notifications. Avoid designing in components with a "not recommended for new designs" designation. Before you design in a new component, talk with your suppliers to verify lifecycle status. An experienced team that understand the constraints of the design can alleviate stop-ship situations by enabling alternate but equivalent parts to be sourced. Understanding the difference between alternate, substitute, or equivalent parts can mean the difference between a smooth production process and a nightmare. Approved Vendor Lists (AVL) and Approved Manufacturer Lists (AML) are the common means to navigate this tricky part of component sourcing - but they are only as good as the engineering process behind the approvals.

Example: Boeing

A shortage of fasteners caused suppliers to fall behind as Boeing tried to transform airplane manufacturing to a "plug and play" model with its 787 Dreamliner.[5] While most products aren't as complicated as an airplane, this Boeing example shows that every component of production, no matter how small, needs to go through the rigors of supply chain analysis.

Conclusion

Recalls, respins, and defects can turn even the best ideas into production disasters. The good news is that 90% of expensive production issues get created in the earliest phases of design. That's when big mistakes are still easiest to correct. Often, all you need is an experienced set of eyes outside the project to spot serious design problems right away.

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5 "Supplier problems led to new delay of Boeing 787," January 17, 2008, New York Times

We're Here to Help

For over 20 years, we've helped dozens of products cross the production chasm. LocoLabs has the tools and experience to quickly assess the production readiness of your prototype, correct critical design issues, ensure a successful first production run, and to support the product throughout its lifecycle. Contact us today for a free manufacturing readiness assessment.

CLICK HERE

"I've worked with hundreds of prototypes over the span of my career. When something goes wrong, it's nice to have people you can trust to turn to. Sometimes all it takes is a conversation with someone outside the project to diagnose and fix a problem."

Mike Nuttall, Award-winning Industrial Designer and Founder, IDEO