77 Tips for Prototyping

1. Done is better than perfect.
2. Use a crude prototype to test an idea before investing your time in CAD.
3. Print multiple variations at once to shorten your development cycle.
4. Choose your wall thickness and feature size appropriately for your prototyping process. Hint: the prototyping dimension may be different than your production design.
5. Pair and a Spare. If you need one, order two. If you need two, order three. You will find a reason to put the additional parts to good use.
6. Share your designs with your team early, they will provide different perspectives.
7. 3D print internally before using a service bureau.
8. Design rework jigs/fixtures for prototype modifications. Sometimes one of our prototypes needs some rework. If the prototype is complex, we may not have time to reprint it.
9. Don't let your current printer/tools limit your design - outsource the technology appropriate for the task.
10. Keep your 3D printing machines running. Constant feedback improves designs.
11. Ask an expert on prototyping if you can’t find a way to build something.
12. Only buy prototyping tools/software that will bring you joy to use. (Make sure you have the time to learn how to use them correctly) otherwise, the time spent will slow you down.
13. It's possible to 3D print silicone-like materials, but in 2022 you’re usually better off casting silicone parts.
14. Don't wait until you think you have all the answers to print your design. Print, print, print. The material is not expensive when compared to your time and the value it provides.
15. Put your product in your user’s hands and get their feedback ASAP. Don't let “perfect” be the enemy of “good enough”.

16. Build the entire device beginning to end as early as possible. Even if you don’t know everything about all the details yet. Try assembling it. Create drawings. Design a crude package for the shelf. Don’t wait. Put the entire design package in front of your manufacturing partner. Get feedback early and often. You’ll be surprised how many times that full build will come in handy.

17. Put the prototype in the hands of your ideal clients/customers and get their feedback.

18. Remember, just because you have a prototype doesn't mean that the idea is good, or worth pursuing. Test your prototypes with ideal customers early to validate your efforts.

19. Thomas Edison built something like 10k prototypes of his lightbulb. Don't spend too much time on one prototype.

20. Prototype quality should increase with confidence in design. Start with crude methods when ideas are not well formed. Transition to higher-fidelity models as the ideas become more defined.

21. Prototype critical features early. Features can usually be tested independently. Separate and prototype using appropriate techniques.

22. Rapid prototyping does not equal 3D printing. Foam, cardboard, hot glue, and xacto knives can be much faster when used correctly.

23. Prototypes don't have to be pretty. A mockup can be used to quickly analyze size and weight. We once used several 12-packs of LaCroix to simulate the weight of an electronic console.

24. Bench models should not be ignored. Build functional "works-like" models in parallel with presentation "looks-like" models to ensure mechanism or electronics are functioning.

25. Prototyping on your own equipment might be limiting your creativity. Outsource prints when your in-house technology can't meet your testing needs.

26. Prototype CAD can be hack-n-smash, doesn’t need to be robust production CAD. We can't afford to invest time cleaning up a model tree if the idea is bad. We just need to get some geometry that can be output for prototyping. Everything can be rebuilt later when the idea has been validated.

27. Time is our best asset. Don't think in weeks or days. Think about hours or minutes. How quickly can we validate this idea? How quickly can we prove this idea has merit or is worth more time.

28. Prototyping doesn’t mean 3D printing. A good concept sketch can unlock discussions that will change the course of a project.

29. Learn faster by building more iterations. More learnings = more improvements.

30. Don't take it personal. When someone attacks our prototype, it's because they want to see it improved. The prototype doesn't have feelings. Go ahead, rip it to shreds. The idea is what we're trying to improve.

31. If you're not slightly embarrassed to show your first prototype build, then you waited too long to build it. Show it earlier.

32. Build multiple design concepts at once to shorten your development cycle. Save days of waiting around for parts to test.

33. In early-stage prototypes it’s faster to buy things, rather than starting from scratch. Look on ebay, Amazon, McMaster-Carr, Alibaba, etc

34. More prototypes is better. Each one will improve the understanding of the idea.

35. Design prototypes to satisfy testing strategy. Plan your tests first. Build only what is needed to pass the test. Then plan your next tests.

36. Proving an idea with a prototype can reduce risk for later investments, in Time or Money.

37. Focus on usability before technical details.

38. Start over. This build will be better than the first one.

39. Treat your requirements more like assumptions until they are tested.

40. Faster is key. What can you build today?

41. More iterations build confidence in the design.

42. Run your designs past your vendor as early as possible.

43. Use color wisely, customers focus on the weirdest things. (Keep your prototypes neutral colored)

44. Have a test in mind in mind for each prototype you build.

45. Ask lots of questions when you show your prototypes to learn what’s working, and what needs improvements.

46. Build an MVP (Minimally Viable Prototype) An MVP has the fewest necessary features to prove an idea is worth investing time in.

47. Print faster for faster learning. Lower quality prints on janky printers can still be very helpful learning tools.

48. Think about what you're trying to learn. For small devices like wearable electronics, maybe a 2:1 scale would be better, to see the component interfaces.

49. Rapid prototyping is an art, not a science. There are many ways to prototype, and different processes that only work at low-volume production.

50. 3D Print Material is not expensive compared to your time. Print more samples.

51. Start a low-res print overnight, your tomorrow self will thank you.

52. Print stuff early, even if you know it won't fit together.

53. Build and test. Then start over and do it again.

54. Label your prototypes to ensure you can quickly sort them and organize your development. Time sorting through parts to identify them is time that could be spent on design.

55. Learn to love critiquing and testing your prototypes. Don't fall in love with your first idea.

56. Plan to accelerate each iteration. Instead of 2-3 months between prototypes, can that become 2-3 weeks, or (gasp) 2-3 days?

57. Limit your design efforts to no more than 3-5 days, and you can build an iteration every 2 weeks using rapid prototyping methods like Protolabs, Xometry, PCBWay, etc.

58. Spend your design dollars on prototypes, instead of labor. Time is our greatest asset in development.

59. Rapid Prototyping is about adapting proven principles of design and engineering in new (faster) ways.

60. Prime your testing audience with a few sentences or images of the final product vision before showing them the prototype. This will prevent them from focusing on the little details.

61. If your part is symmetric about a certain plane, consider using a single prototype to show two (or more) design options.

62. Think of each prototype as an experiment. What works? What needs to change?

63. Bookend the design requirements. Prototype a version you think will be too big, and a version you think will be too small. Or a version you think will be too squishy, and a version you think will be too firm. Then, you can select variables inside the bookends to make an ideal design.

64. Focus on usability before technical details.

65. Define a prototyping strategy that fits your schedule and budget.

66. Keep your testing strategy front of mind.

67. Learn what works and what doesn't every single build. Document it somewhere.

68. Sneak up on success by taking small steps that validate assumptions.

69. Prototypes don't have to be physical! Draw, sketch or render your idea!

70. Focus on the cheapest, fastest way to test the assumption that you're interested in. Hint, it might not involve a computer.

71. The only way to find good ideas is to have a lot of bad ideas. Keep cranking out bad ideas (quickly) to get to the good ones.

72. Prototype everything.

73. Design your parts with the manufacturing method in mind. This will save time redesigning for manufacturing later.

74. For some design decisions, no amount of design and simulation will replace a physical prototype in your hands. Ignore manufacturing feedback in early design. Just build something that works. Once it works, then redesign for manufacturing.

75. Ask yourself, is this feature still necessary or can we cut it out? Is it worth the additional effort to continue developing this?

76. Don't constrain yourself to only practical questions when thinking of solutions in prototyping. Good ideas come from different places.

77. Ship it.