

# NewTech Development LLC

## Small lot product development process

W. E. Lawson  
Feb. 23, 2006

The primary objective is to develop a documented and manufacturable product as fast and economically as possible.

This process must start with a design spec that is focused on functionality not specific components. Ideally the design engineers should have been involved in the customer contacts and spec. writing so they not only know the obvious specs but also understand the unwritten specs defined by the target customer personality, business conditions, environment etc. The product definition team should include many different areas such as, target market sales and marketing, applications people and design and manufacturing people. If this is not a product that is well known in the target market “informed intuition” must be used by the team to define the desired end objective.

Note: The personalities and basic design styles required are different in the different stages and different people may need to be on the team at different stages to efficiently achieve the goals.

### **Stage 1 Modeling of critical components**

Define and test, with actual hardware testing, any design or technical questions that do not seem to have straightforward solutions.

### **Stage 2 Breadboard**

Build a functioning breadboard prototype as quickly and simply as possible to define the actual parts needed to achieve the functional requirements. This will not have covers, power supplies mounted, etc. It should be able to operate at the design speed and quality but would normally not be shown to anyone outside of the design team. This will allow the concepting of what a possible final product will look like. There are very few drawings at this point and perhaps just a listing of the parts used. The breadboards are usually built by an expert in the technology and the primary documentation is in the design team’s heads.

### **Stage 3 Functional prototype, sometimes called an alpha model**

The objective is to build as fast as possible a model that looks and feels like a possible production machine. The game here is to use as little documentation as possible and build the model very quickly. Only drawings that are required to build the major parts are needed and things as holes, wire routing, fasteners, etc. should be at most 80% documented. These will all be changed in the next models and many of these things are most easily determined when the actual parts are sitting in front of the engineers. The actual designers must do the assembly and testing of the unit. The more the designers are part of the assembly and test process the faster it will go and the less iterations will be required to get to the finished alpha model.

This unit can now be shown, demonstrated and actual production parts must be run on it. Potential customers can be brought in to evaluate its usefulness. As my dad said “Make a model and the janitor can tell you how to make it better.” Remember, the objective is to have a useable device as quickly and inexpensively as possible. Drawings and documentation do not make parts for the customer.

#### **Stage 4 Production prototype sometimes called beta models**

The objective in this stage is to build devices that are reproducible and can be sold to customers. It may be best to throw away many of the drawings from stage 3 so that each part can be designed for DFMA etc. without the influence of previous designs. The device from the alpha stage is used as a benchmark so any changes can be immediately be checked against an accepted operating model to verify that no functionality has been lost.

These units will be reproducible; that is, an experienced technician, given a pile of parts and other components will be able to build more of them. These units will be sold to selected customers so the performance of the units can be monitored and improvements and fixes quickly made. These are documented much like a special machine so that they can be serviced in the future by an experienced technician with minimum documentation. Life and environmental testing as well as other tests are typically performed at this stage.

#### **Stage 5 Production models.**

After enough beta units are sold to feel that we understand exactly how the product must be built, one more design iteration should be done in order to reduce cost, improve manufacturability and document the design well enough that it can be reliably produced, tested, shipped, and the customers trained by people not intimate with the original design and build process. The team must be careful to not continue using the designs developed in stage 4 just because they exist. In addition, a prototype test unit of the final production model must be assembled before large groups of parts are ordered to insure that all the parts will fit and work before to prevent generating lots of scrap inventory. It is very important at this stage to have an operating beta model available to check every change for its effect on performance, functionality, etc. versus the prototype production model.

Note:

Usually the people that do the first 3 stages well and are part of the team for stage 4 have a very difficult time finishing things in enough detail to make stage 5 work. They get frustrated, bored, and lose interest. Stage five is usually done by detail people who like organization and like to write procedures and assembly instructions. The group that does stage 5 must be very careful to keep checking the production model against the alpha and beta models as most of the real functional documentation is contained in the models and in the original product specification teams minds not in documentation.