



Solutions for PCB Engineering Changes  
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## PCB Engineering Change Orders (ECOs) Cost Millions and there are Options

*Every electronics manufacturer has experienced a last minute ECO that causes costly delays. In some cases it's a prototype that can't be proven out or a new product introduction (NPI) that must be delayed. In other cases the ECO requires connections to fine pitch pads, vias or BGA pads. Most added SMT pads simply can't be done. Perhaps hundreds or thousands of PCBs are in the supply chain and need modification. There are options!*

**The following table considers the effectiveness of ECO options available to manufacturers of printed circuit assemblies.**

<i>Program Requirements</i>	<i>Available ECO Options</i>			
	Re-Spin Design	Hand Rework Post-assembly	Polymer Ink Pre-assembly	Additive Web Circuit Pre-assembly (Solid Copper)
High Quality	Yes	?	?	Yes
High Reliability	Yes	No	?	Yes
RoHS Compatible	Yes	Yes	No	Yes
Short Process Time	No	Yes	Yes	Yes
Cost Effective	?	?	?	Yes
Looks Good to Customer	Yes	No	Yes	Yes
Low Thermal Exposure	Yes	?	No	Yes
Connections to Fine Pitch, BGA Pads, Added SMT Pads	Yes	No	?	Yes
No Scrapped PCBs	No	?	?	Yes
Any Surface Finish	Yes	Yes	No	Yes

**Design re-spin is always the first choice of PCB assemblers but not always viable as illustrated by the following real cases:**

1. A large network systems company has one **prototype PCB** to prove out its design change before re-spin and ordering new prototypes. However, the change requires traces connected to **BGA pads** under the device to be brought out and new **SMT pads** installed. Additive completes the bare board modification in a few days and the customer proves out the design change.

2. One of North America's largest electronics firms has production scheduled with its Mexican EMS provider and **(6,700) RoHS PCBs** are in the supply chain. Traces and SMT pads need to be added and reliability is a major concern. Additive gets this program back on schedule within a couple weeks and saves the customer re-spin costs and many weeks of delays.

3. Another major company has (5) boards requiring (4) added components and the boards are **OSP surface finish**. Additive completes the work in just over a week and assembly is trouble free.

4. A major EMS company has just under (1000) boards in inventory for an **aerospace/defense** customer. Additive processes the boards and they are sent to the customer after assembly to save the inventory.

**Electronics OEMs and EMS providers should consider all available alternatives to deal with engineering changes and select the best solution for their particular application.**

Re-spin should always be the first option considered. However, if the cost or lost time prohibits this alternative, all other options are considered. The table above can serve as a guide to help determine when hand rework, polymer ink or the additive approach should be considered.

For information on the Additive approach:  
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