



## Create a Clear Picture of Cost Savings with Axiomatic Design

**Context:** The picture tube is the largest, most expensive component of a modern television set. Consequently, building a high performance tube that is at the same time safe and reliable requires intricate design.

**Problem:** The combination of thermal stresses produced when the front screen and back gun are sealed together (sealing ovens reach up to 500° C) and the stresses induced by evacuating the tube can often cause picture tubes to shatter during manufacture or in handling either because of poor design characteristics or weak structural qualities. However, a tube manufacturer wanted to speed up its tube design process, without losing any of its superior structural quality.

The design process had been labor-intensive. The engineers first created a 2-dimensional drawing. Then, they converted the drawing into a 3-dimensional model using CAD software. The conversion always resulted in incongruities between the two renderings which had to be reconciled iteratively until both were identical. Finally, the model was loaded to a structural analysis tool to simulate and test the strength of the model based on various impacts and thermal effects. Areas of weakness were identified, and subsequently redrawn in the 2D rendering. This three-step process was cycled through until all structural weaknesses were eliminated and the design optimized. The iterative process normally took three weeks.

**Solution:** Axiomatic Design examined the draw-model-test cycle and pinpointed where it was coupled. An automation solution was then developed based on a more efficient design process. Each of the previously independent applications were linked to a SQL database so that a designer could enter changes to a drawing and immediately see the simulated effects on the strength of the design. A customized GUI guided designers in decoupling coupled designs so that re-works were either unnecessary or done earlier.

Initial results showed the following:

- Design labor reduced from 120 to 6 man-hours
- Design cycle time reduced from 3 weeks to 6 hours

*Axiomatic Design Solutions is a business and technology consultancy that delivers measurable results and value through the application and support of axiomatic design methods as a basis for quality-driven design processes.*

## The Axiomatic Design Process

- Improves the quality of designs
- Facilitates the creative process
- Requirements driven
- Captures design intent and traceability
- Provides early phase risk assessment
- Gives objective metrics for design evaluation
- Reduces the Design-Build-Test-Design Cycle
- Scalable from small projects to very large
- Fully compatible with:
  - Six Sigma
  - QFD
  - Lean Process

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