Win and Influence Design Engineers--- Change Their Affordability DNA

Authors:

Timothy G. Morrill
Sr. Principal Electrical Engineer
Design Performance, Architecture and Testability Department
Raytheon Missile Systems
1151 E. Hermans Road
Tucson, AZ 85756
520-545-8291
tgmorrill@raytheon.com

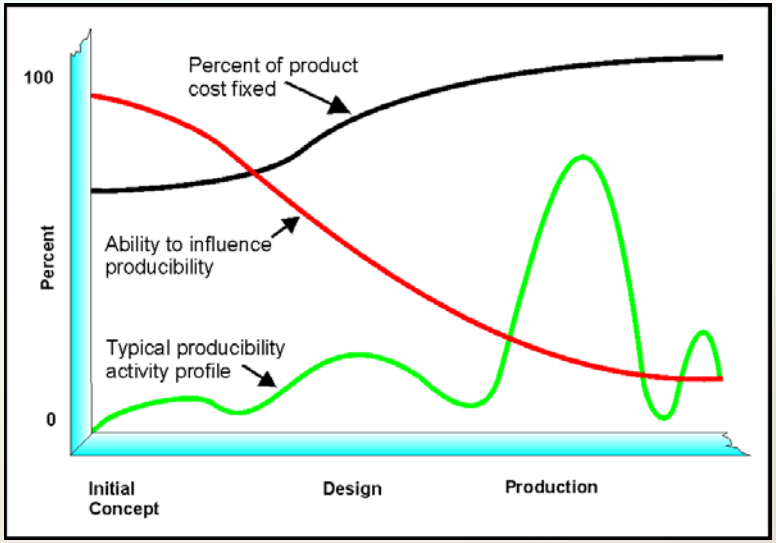
S. Diana Patane
Sr. Systems Engineer, II, Cost Engineering
Affordability and Robust Design Methodologies Department
Raytheon Missile Systems
1151 E. Hermans Road
Tucson, AZ 85756
520-794-2583
S_Diana_Patane@raytheon.com

Introduction

- **Develop a plan that will enable design engineer to include producibility and affordability as well as other "specialty" engineering into the design process**

- **Specialty engineering is usually flowed to the team as an edict**
  - **Thou shalt be producible!**
  - **Thou shalt be testable!**
  - **Blah.. Blah.. Blah.. "Generic" trap**

- **"As a design engineer why should I care about producibility or any other 'ilities'?"**
  - **Functional requirements are verifiable**
  - **Environments are verifiable**
  - **How do I verify an illity?**



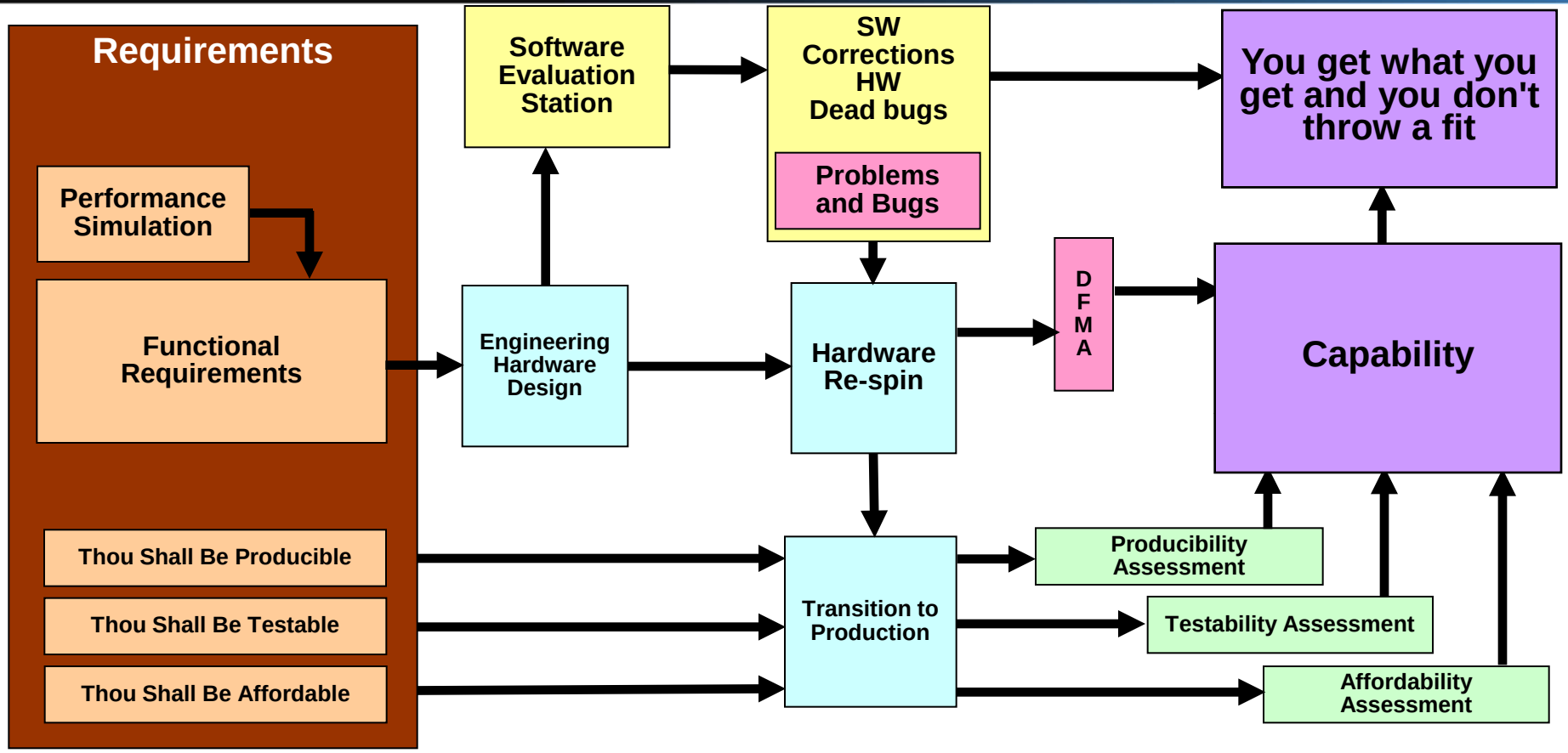
NRE in a good design is the same as the NRE in a bad design

- If I can’t verify it, then it shouldn't be a requirement
  - Shifting requirements drive the cost during this phase
  - Specialty engineering is difficult or impossible to quantify
  - A good design should incorporate specialty engineering
  - The cost impact during development is minimal
  - Hardware Development takes time and costs money

- It has to become part of the process
  - Philosophical vision of the product (clearly communicated)
  - Understanding of the Life cycle of the product
  - Assessment of the cost drivers within the life cycle (this is product specific)
  - Discipline within the design community

- Identify product characteristics that historically drive producibility
  - Limit or eliminate Key Product Characteristics (KPCs)

Traditional Method



- **Engineering Hardware Design**
  - Supports Software Development
  - Initial Requirements Evaluation
  - Initial Hardware Evaluation
  - Ignore Specility Engineering as NVA for engineering design
- **Hardware Re-spin**
  - Correct problems found by SW
  - Updates to Requirements
  - Capability assessment for speciality engineering
- **Transition to Production**
  - Incorporation of assessment recommendations
  - Design Verification testing
  - Cost Increase For Transition to Production
  - Usually abandoned because its to expensive
- **Actual Hardware Design**
  - Incorporates recommendations from DFMA as long as performance is not impacted
  - The Design is assessed for Capability with respect to specialty engineering
  - You get what you get

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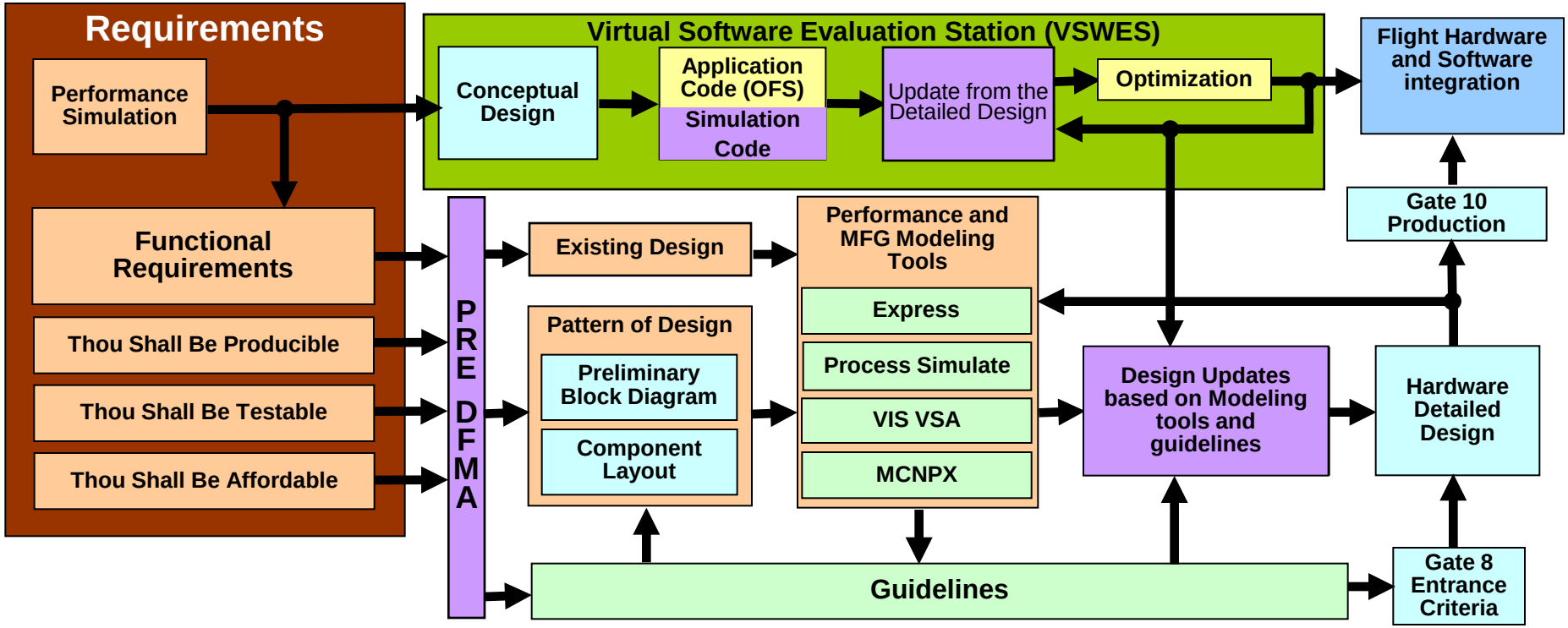
Design Optimization Approach



- **PRE DFMA**
  - Disciplines that represent the Life Cycle of the product
  - Generate or tailor design guidelines applicable to the program
  - Communicate the accountability to all involved with the product
  - Vision, Philosophy, Heuristics
- **Hardware Development**
  - Create a Conceptual design to drive the VSWES
  - Establish the baseline design from either an existing design or the accepted pattern
  - Analyze the baseline design and trade studies
  - Preliminary Design Traditional DFMA
  - Use the guidelines to gate the Detailed Design
- **Design Optimization**
  - Designed to be compliant to the requirements and the guidelines
  - Continue to analyze the design
  - Feedback recommendation into the detailed design
  - Update the VSWES model to the detailed design
  - Use a CIL/HIL to FQT software
- **Flight Hardware Design**
  - Designed to be compliant to the functional requirements
  - Optimized to incorporate specialty engineering

Summary

- **Specialty Engineering is difficult if not impossible to quantify**
- **Specialty Engineering is cheaper up front**
- **Define the “Ilities” for your product early and make it a priority**
  - **The product life cycle and the Concept of operations (ConOps) need to be understood**
  - **ConOps should help to identify major cost drivers**
  - **Identify what the customer cares about**
    - **Affordability, Maintainability, Durability**
  - **Identify what the enterprise cares about**
    - **Producibility, Testability, Modularity**
  - **Don’t fall into the “generic” trap**
- **Use a PRE DFMA before the start of preliminary design to establish guidelines and run rules for the designers**
- **Use the guidelines to gate through the process**

Summary – Cont'd

- **Model the baseline or conceptual design with the manufacturing tools as well as the performance tools as soon as you can to establish a baseline and to create stretch goals.**
- **Use the data from the models to resolve the trade studies during preliminary design and to identify the metrics you need to evaluate progress**
- **Update the models as the design is refined**
- **Know your requirements and avoid Key Product Characteristics**
- **Traditional DFMA as you progress to detailed design**

"ilities" must be controlled by the process and enforced from the top down

Backup Slides

Affordability Enablers

- **Cost as an Independent Variable (CAIV),**
- **Design to Cost (DTC),**
- **Design for Manufacture and Assembly (DFMA),**
- Statistical Design Analysis (Design for Six **σ**),
- Digital Lean Manufacturing, and
- Statistical Process Control.

CAIV & DTC

- CAIV starts a first design decision
- DTC engages as requirements and architecture develop