



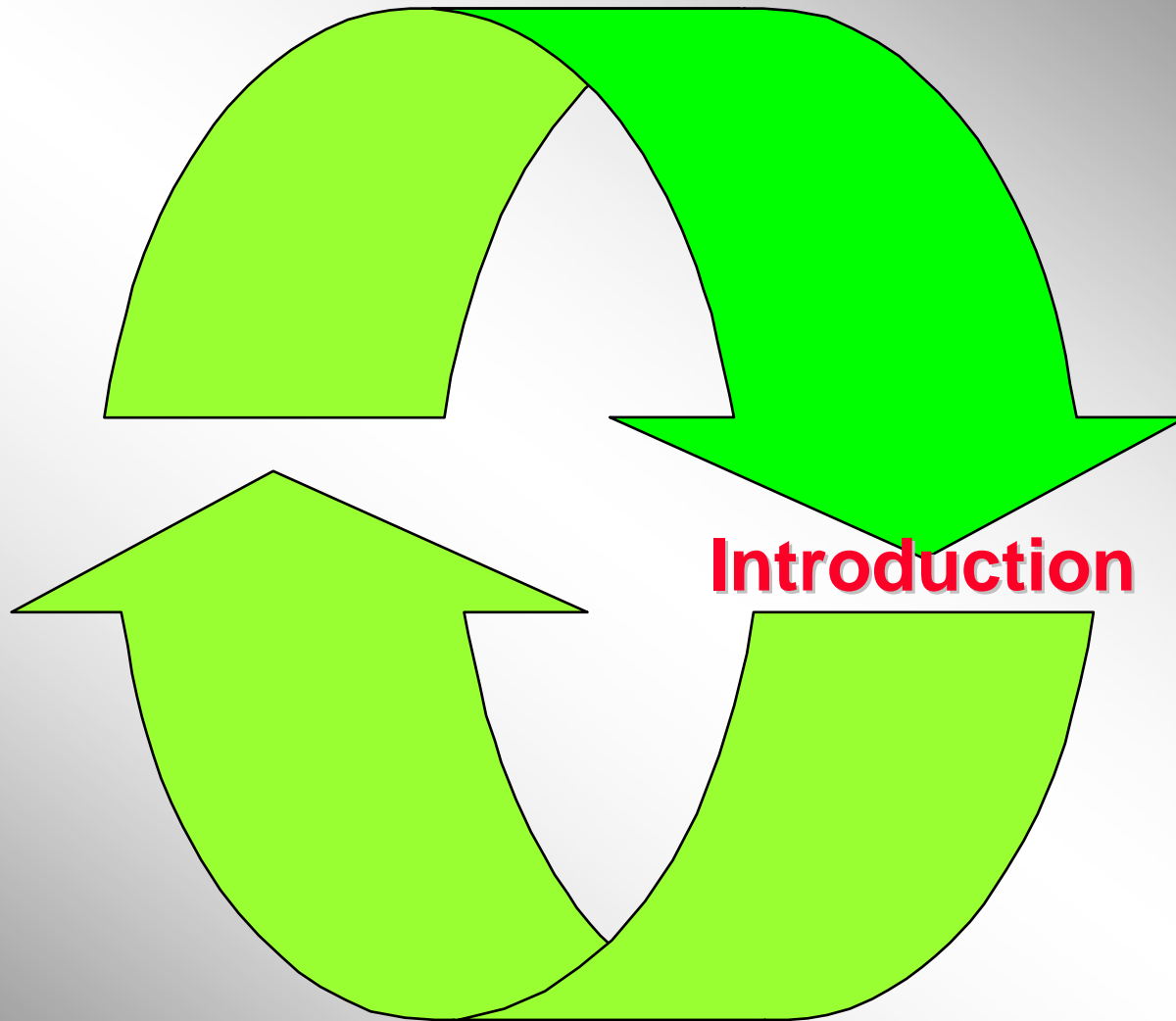
**S.V.P**  
**Please be seated**  
**SILENCE!!**



 ***Revisiting***  
**Concurrent Engineering** 

**The Relationship of  
Value Analysis within CE Environment**

**By: Angelo Segall** Ind. Eng. MBA. P.Mgr  
**November 20, 2007**



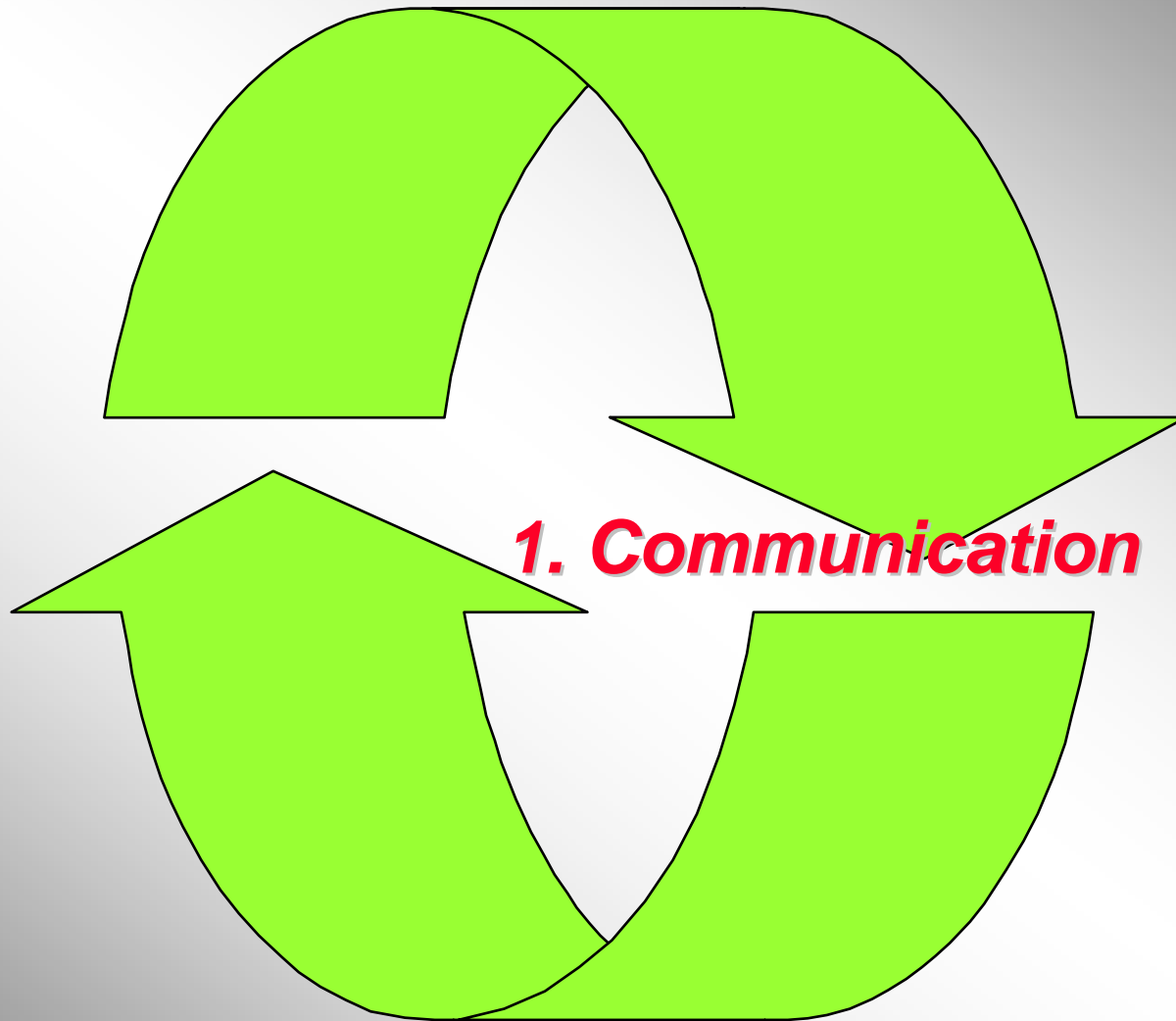
# Changes in Competitive Environment

- Global, world-class competition
  - ♦ Rapidly evolving technologies
  - ♦ More complex products
  - ♦ More highly fragmented markets
  - ♦ More sophisticated and discriminating consumers (both organizational and individual)
  - ♦ Accelerated product life cycles, time to market [ TTM ] is being reduced
  - ♦ Less government regulation

**INTRODUCTION**



By the early 1990s, companies recognized that **Concurrent Engineering** was not a fad and will be one of the management practices that will endure well into the 21st century, and allow companies to remain competitive



# Communication and Collaboration

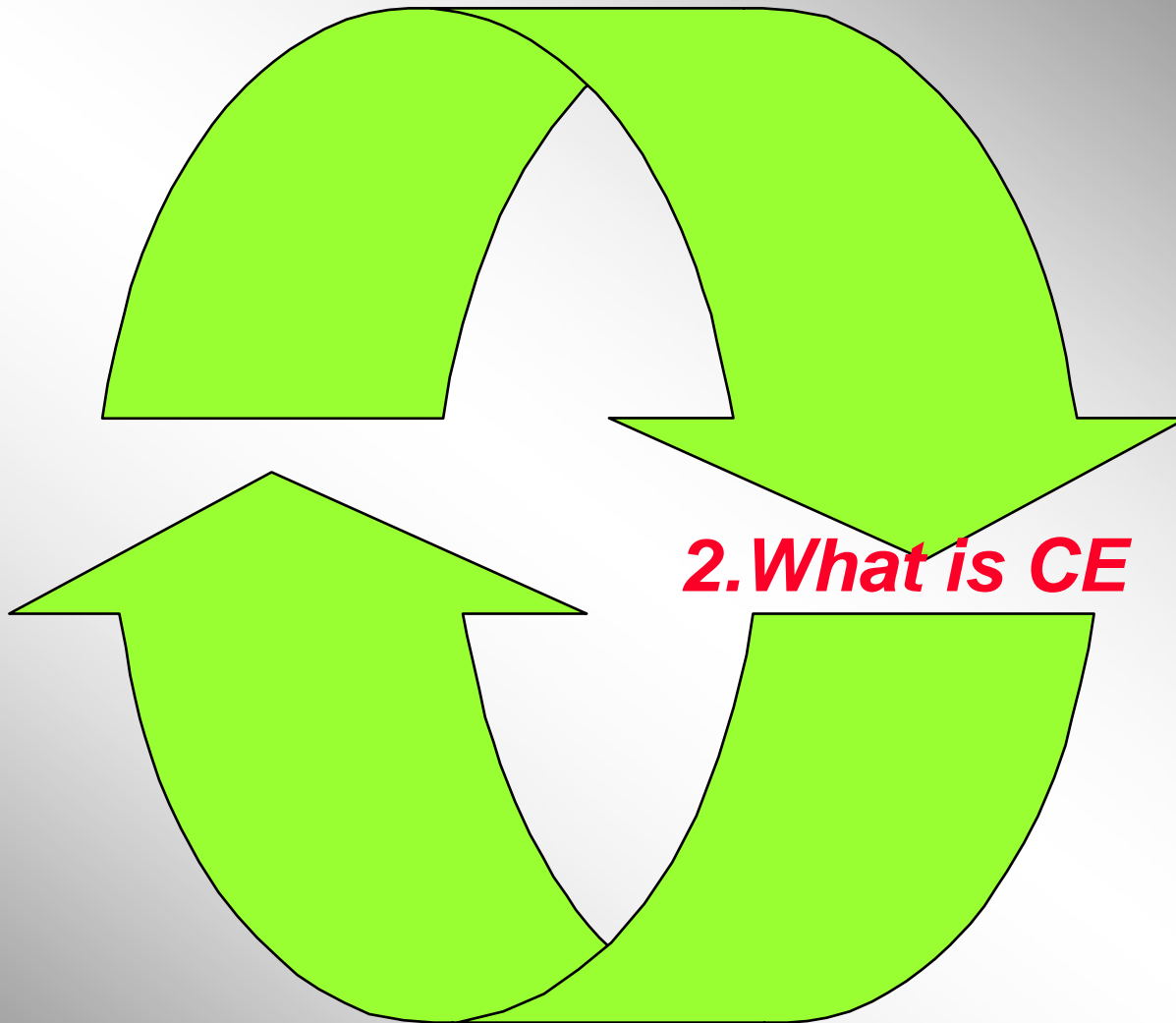
Single most important strategy of a business.

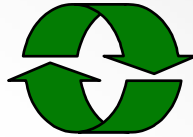
The implementation of **CE** begins by:

- Creating a corporate environment that facilitates communication and
- Collaboration not just between individuals, but also between separate organizations and departments within the firm.



## Ranking of Top CE Skills !





## Definition

- **Concurrent Engineering** is a business strategy which replaces the traditional product development process with one in which tasks are done in parallel and there is an early consideration for every aspect of a product's development process.
- This strategy focuses on the optimization and distribution of a firm's resources in the design and development process to ensure effective and efficient product development process.

# People, Product and Strategy

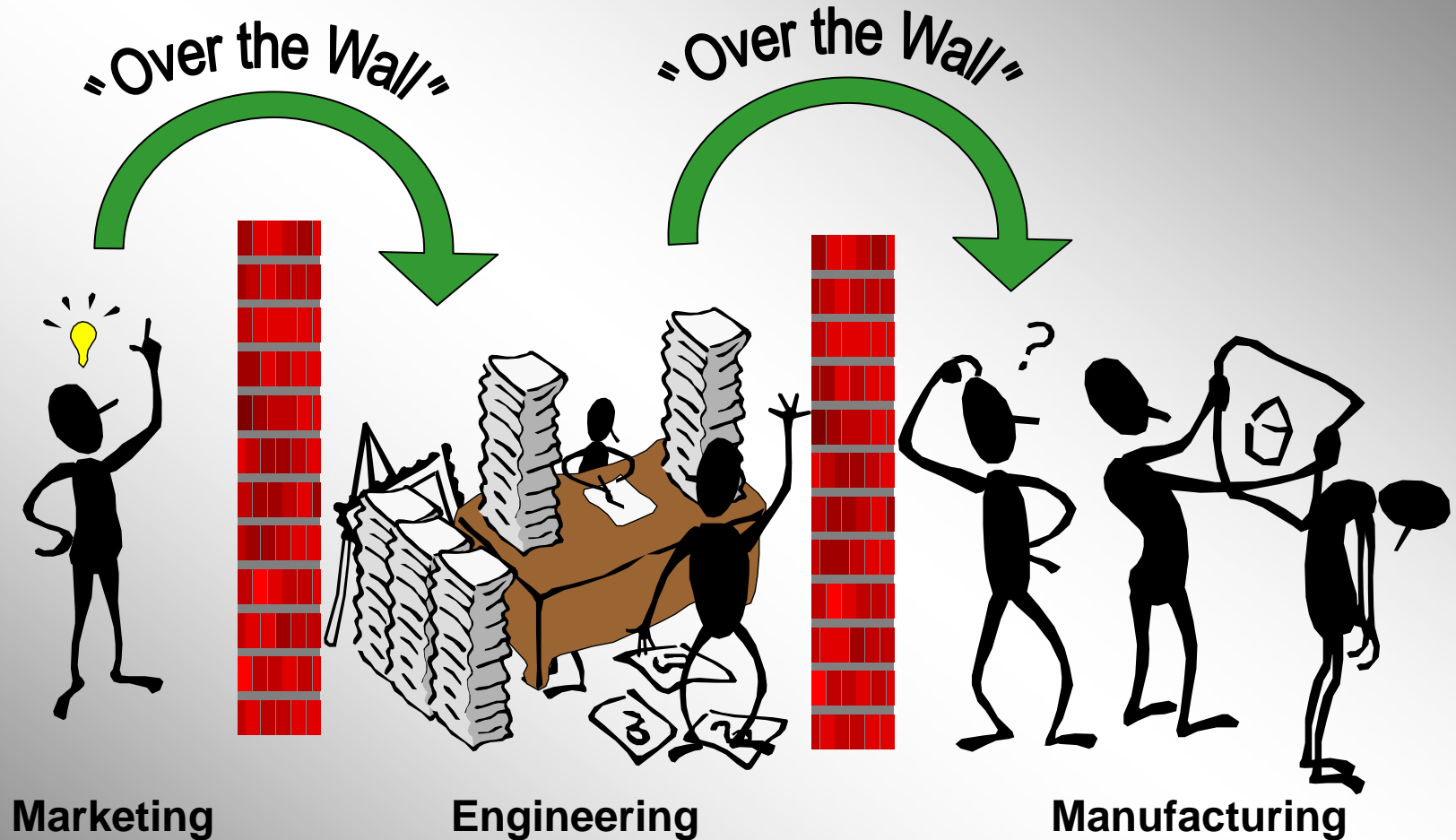
## Key Characteristics of CE

- **Cross-Functional Teams**
  - ♦ Early integration of product life cycle elements
- **Concurrent Engineering**
  - ♦ Simultaneous Development of Product and Process
- **DFM Strategy**
  - ♦ Design for Manufacturing is communication and collaboration between manufacturing and design in order to produce quality products with minimal manufacturing hindrances.
- **IT Tools - IT Infrastructure**
  - ♦ To enable and support the CE process

## Common CE Techniques

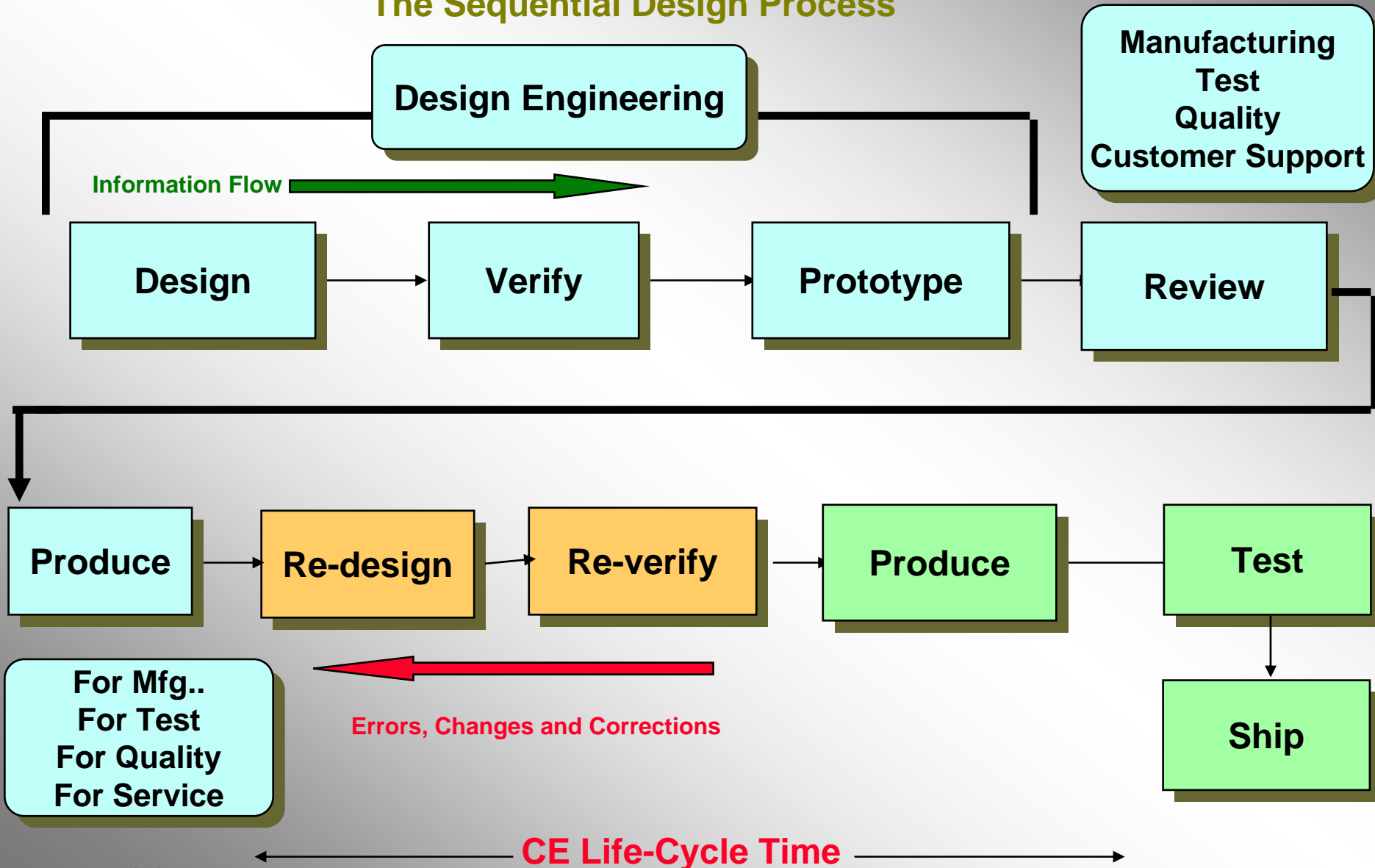
- **CIM** Computer-integrated manufacturing
- **LM** **Lean Manufacturing**
- **DFX** **Design for X-ability**
- **TQM** **Total Quality Management**
- **QFD** **Quality Function Deployment**
- **VA** **Value Analysis**
- **VE** **Value Engineering**

# Traditional design process



# Traditional Design Process

## The Sequential Design Process

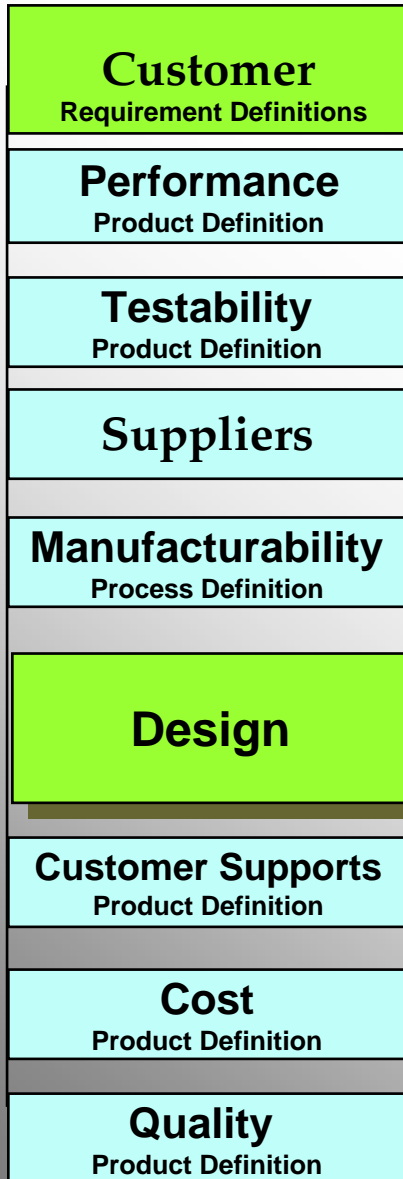


# Problems with the Process and Product

## Sequential Design

- Traditional relationship between the Designer and the Manufacturing personnel: one of **INITIATOR** and **IMPLEMENTOR**
- **Production**, QA, Customer Support and other staff don't see a design until it **is virtually complete** (at the design review stage)
- **Revisions** resulting from design reviews **are costly** and time-consuming, or not even implemented because of these factors

***Time-Based competition is adversely affected !***



# Concurrent Engineering

- Problem **Prevention** Instead of
- Problem Solving and Redesigns



- **Lowest Overall Life-Cycle Cost**
- **Time to Market Greatly Improved**



# Concurrent Engineering

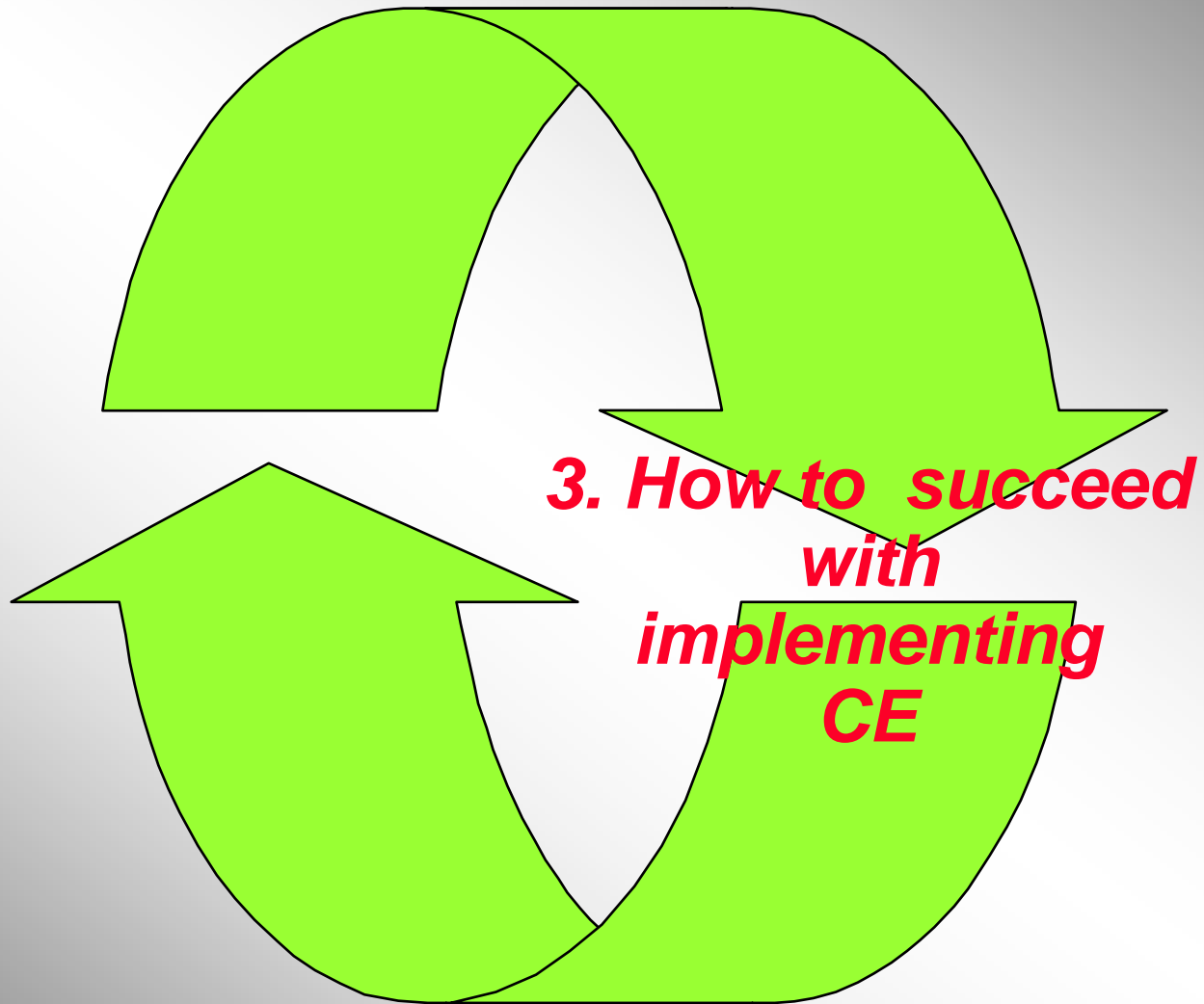


- In contrast to the traditional sequential process, it treats all design inputs equally and in parallel
- Provides **early visibility** for changes
- **Integrates** various engineering and production disciplines at the design stage
- Results in **real-time design** trade-offs
- **Eliminates** revisions/redesigns to reduce product costs and shorten *time to market* **>TTM** .

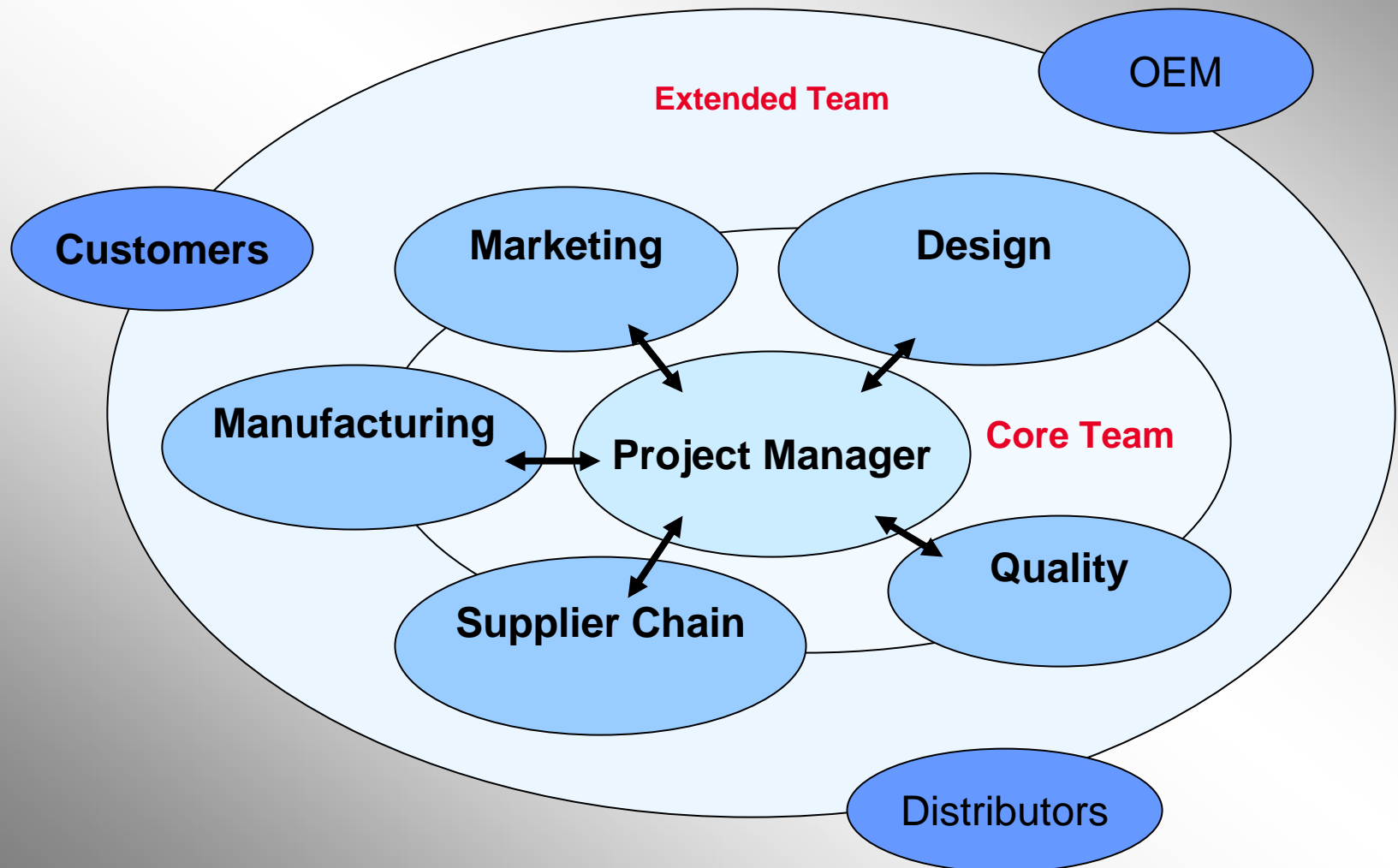
The word “**Engineering**” in CE is used in a generalized sense. It meant to include involvement of personnel from all required disciplines: *engineers or non engineers*.

# 5 - Five Principal Elements

- **Design to Cost (DTC)**
- **Design for Performance (DFP) / Quality Function Deployment (QFD)**: provides a method of rating the importance of specific product features using customer input; These features are then compared to competitive products
- **Design for Manufacturability and Assembly (DFMA)**: the ease with which a product can be assembled and tested quickly and with the least LABOR, without introducing defects
- **Design for serviceability (DFS)**: the ease and speed with which a product's status can be assessed, and any faults repaired ( effective BITE )
- **Design for compliance (DFC)** with customer/ internal / regulatory requirements



# Product Design Team



# Product Development Team

**Concurrent  
Engineering  
Model**

**Collocation  
as much as  
practical**



**Synergy and Teamwork**

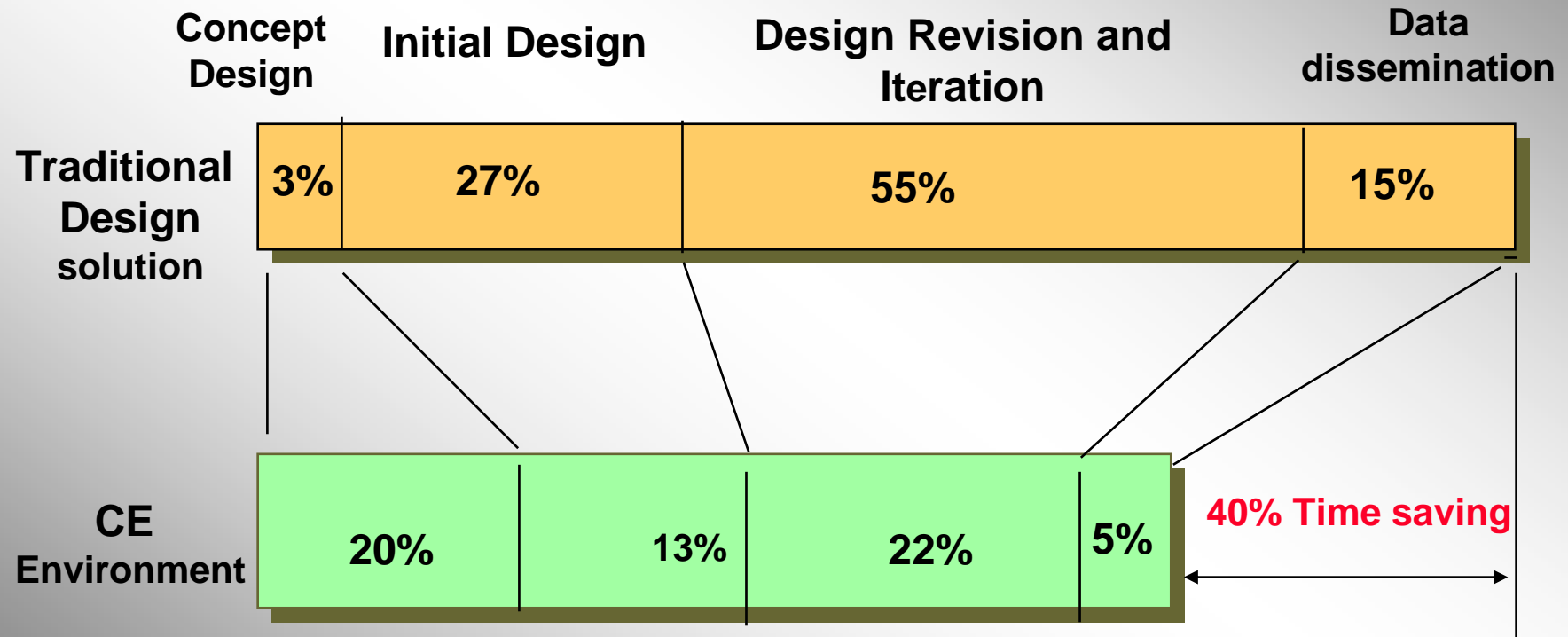


**Product "X" Development  
Team # 1**

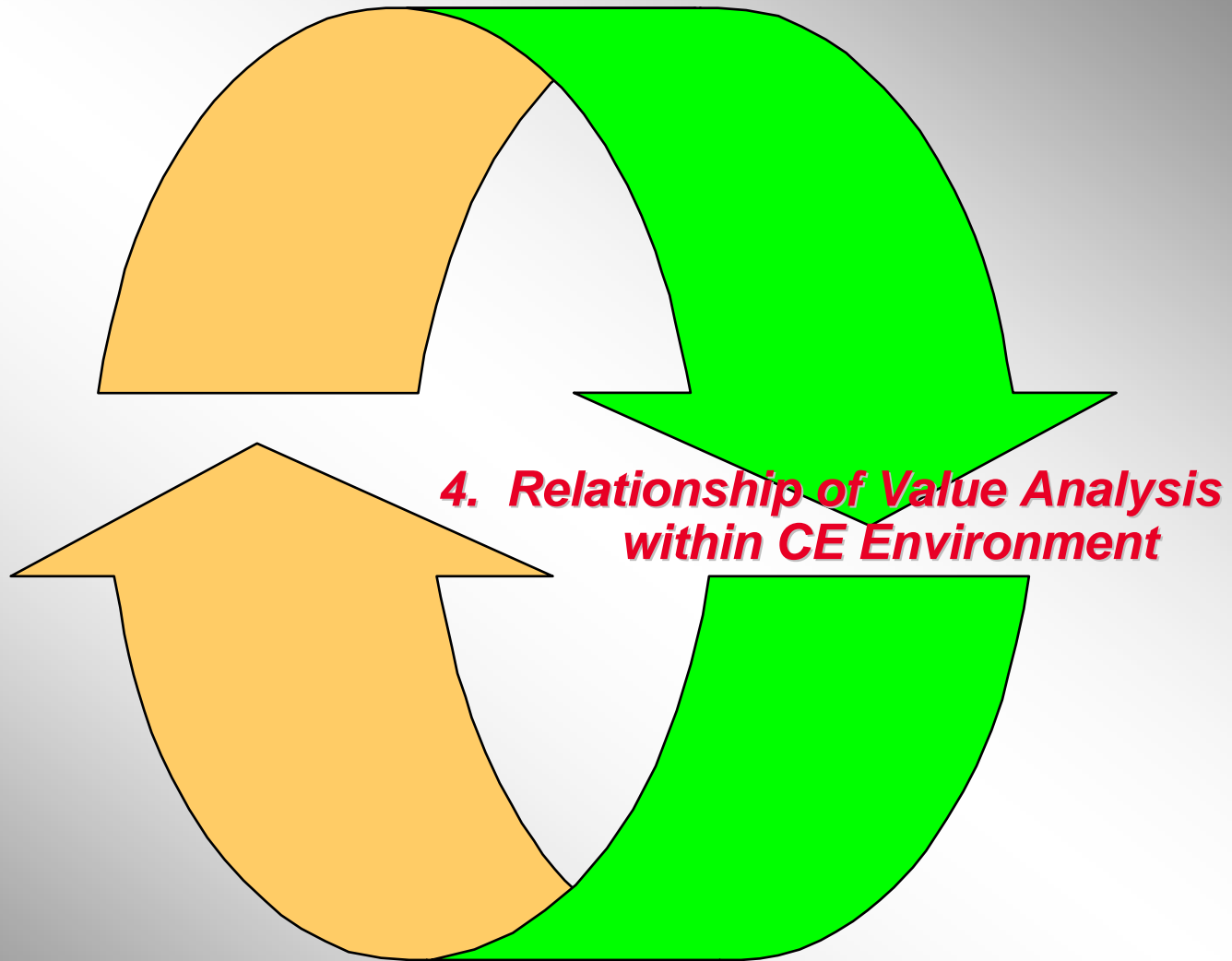


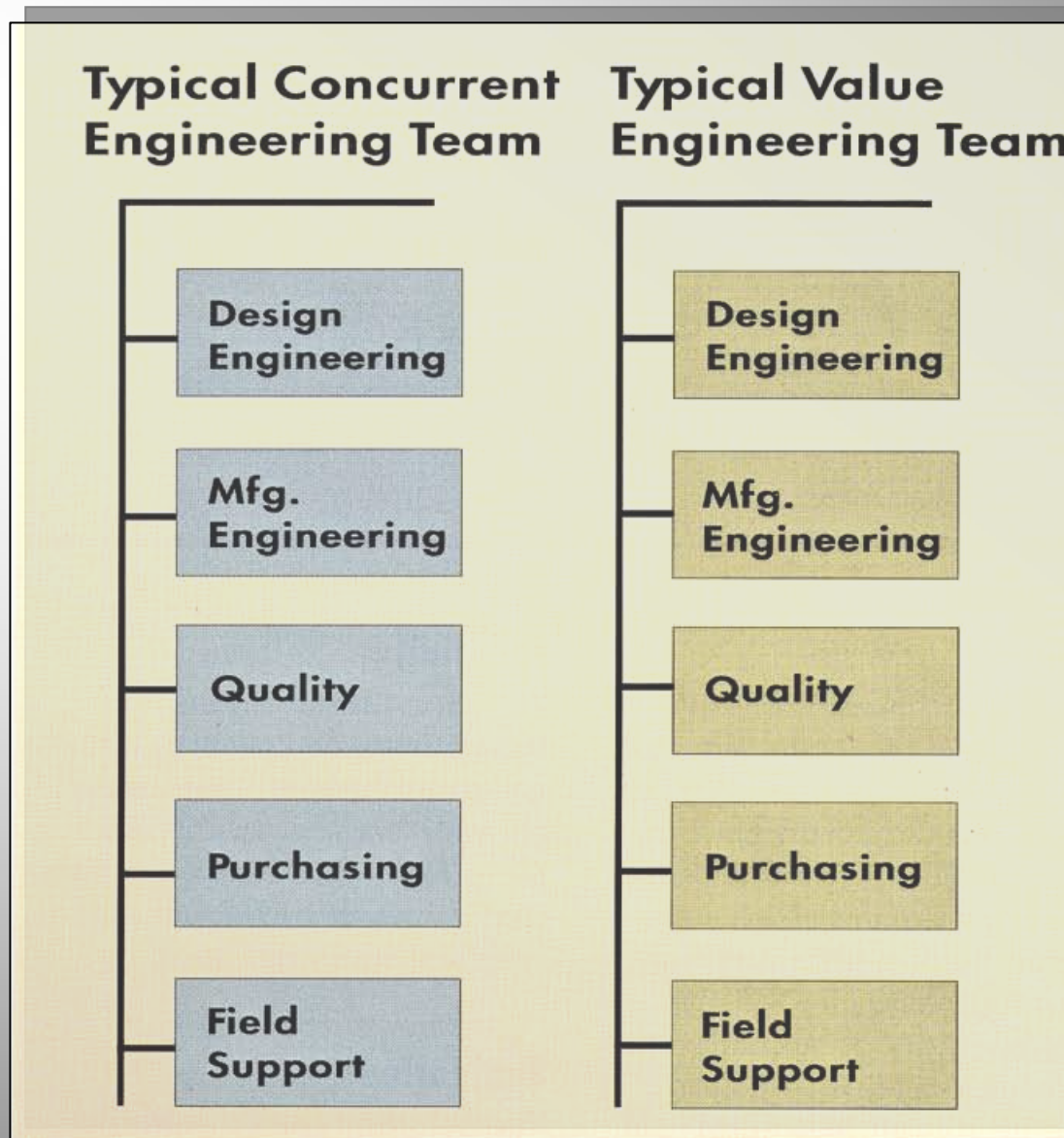
**Product "Y" Development  
Team # 2**

# Concurrent Engineering Statistics



Source: US Air Force Study





- **Information Phase**
- **Analysis Phase**
- **Creativity Phase**
- **Evaluation Phase**
- **Implementation Phase**

- 1. Gathering information about being studied**
- 2. Analyzing what is being studied and developing functions**
- 3. Using creativity to investigate all possible alternatives to obtain goal**
- 4. Evaluating the creativity phase and**
- 5. Implementing the ideas.**

# Workshop Plan

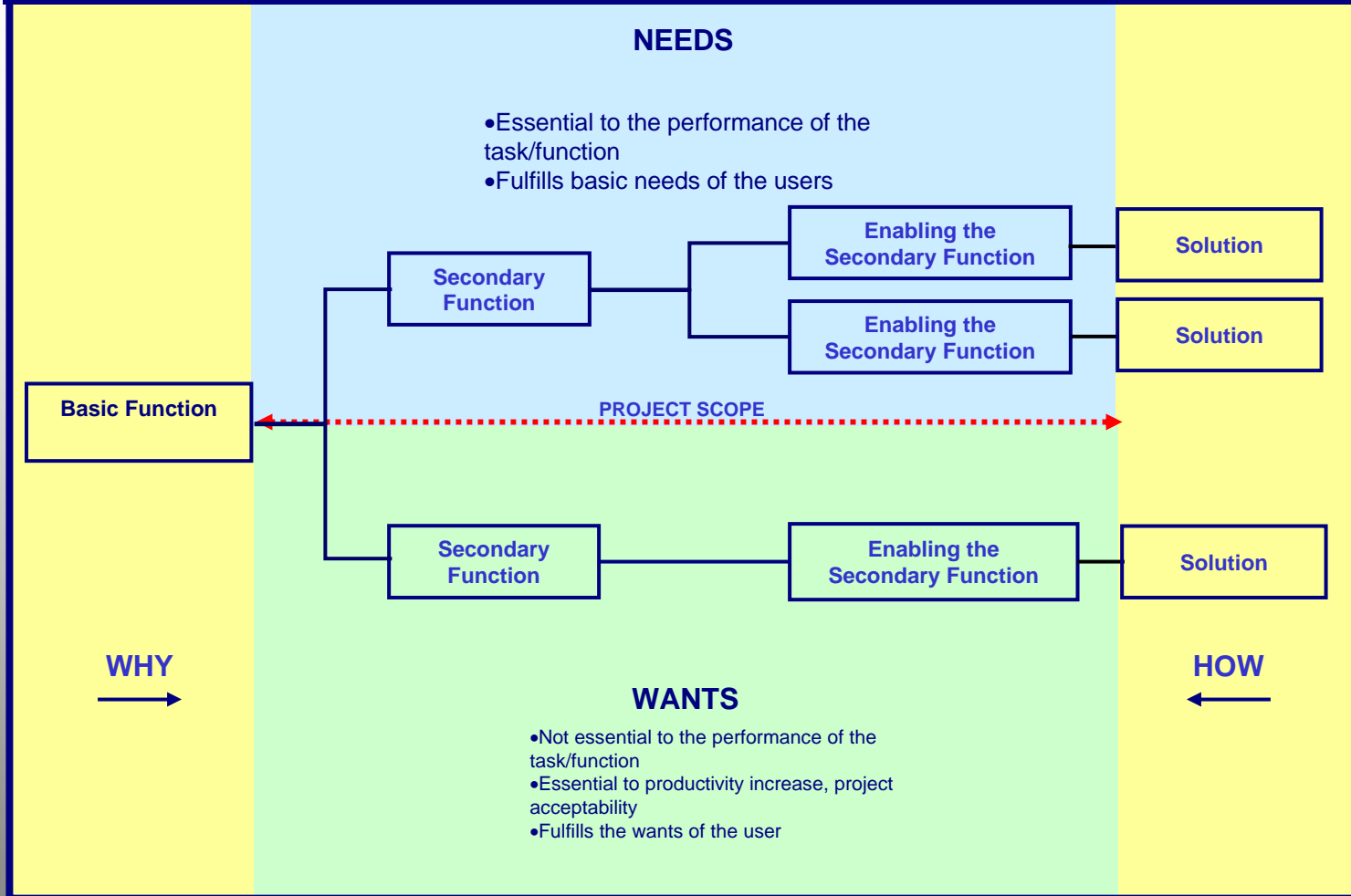
| <u>Pre – Study</u>  | <i>Project Framework</i> | <u>Study</u>  | <i>Phases</i>         |
|---|--------------------------|---|-----------------------|
| <ul style="list-style-type: none"> <li>▪ <b>Concerns/Expectations</b></li> <li>▪ <b>Problem Definition</b> <ul style="list-style-type: none"> <li>◦ Separating Cause from Effect</li> </ul> </li> <li>▪ <b>Project Goals</b> <ul style="list-style-type: none"> <li>◦ If Accomplished, Will Resolve The Problem</li> </ul> </li> <li>▪ <b>Attributes (Project Matrix)</b> <ul style="list-style-type: none"> <li>◦ Identify Market Driven Value Added Characteristics</li> </ul> </li> <li>▪ <b>Performance Profile</b> <ul style="list-style-type: none"> <li>◦ Baseline Current Performance And Set Stretch Targets</li> </ul> </li> <li>▪ <b>Constraints</b> <ul style="list-style-type: none"> <li>◦ Identify Perceptions of Road Blocks</li> </ul> </li> </ul> |                          | <ul style="list-style-type: none"> <li>▪ <b>Collect Knowledge</b> <ul style="list-style-type: none"> <li>◦ Project Review</li> <li>◦ Technology Review</li> </ul> </li> <li>▪ <b>Develop Understanding</b></li> <li>▪ <b>Creative</b> <ul style="list-style-type: none"> <li>◦ Generate Ideas (Brainstorming Evaluation)</li> <li>◦ Clarify, Merge, and Purge Ideas</li> </ul> </li> <li>▪ <b>Develop and Sell innovations</b> <ul style="list-style-type: none"> <li>◦ Write Up Surviving Ideas</li> <li>◦ Develop Proposal (s)</li> </ul> </li> <li>▪ <b>Presentation</b> <ul style="list-style-type: none"> <li>◦ To Workshop Sponsor (s)</li> </ul> </li> </ul> |                       |
|   |                          | <u>Post - Study</u>   | <i>Implementation</i> |
|   |                          | <ul style="list-style-type: none"> <li>◦ <b>Implement</b></li> <li>◦ <b>Track Progress</b></li> <li>◦ <b>Celebrate Success</b></li> </ul>   |                       |

Event Plan

F.A.S.T.

When to Conduct

### Customer Function Analysis System Technique Diagram (FAST)



Event Plan

**F.A.S.T.**

When to Conduct

# Function Analysis System Technique Diagram (FAST)

**FAST** Diagrams are used to prioritize the objectives or functions of the product. Targeting true customer **needs and wants**

- ♦ Delivering requirements but still enabling cost reduction by focusing on “**what the function accomplishes**” versus “**what the product is**”.
- ♦ **Elimination** of unimportant requirements
- ♦ **Adding incremental costs** to achieve larger performance benefit
- ♦ **Improving performance** and reducing cost simultaneously

Event  
Plan

F.A.S.T.

When to  
Conduct

# When to Conduct a Workshop

- **Value Analysis** has its Organized Approach. This is a step by step procedure for the elimination of unnecessary costs.
- The group charged with the task of **removing unnecessary cost** from the product assigned to it and completing each step of the job plan.
- The ideal size **team is six people** - have representatives of each functional group to skillfully execute the inter-functional review and redesign - Engineering, Manufacturing, Finance, Purchasing, Sales and Quality Control.
- The organized **group** integrates **is diversified** and brings together the various **knowledge, skills, abilities, and experiences**, forming a resource much greater than the sum of each individual part.

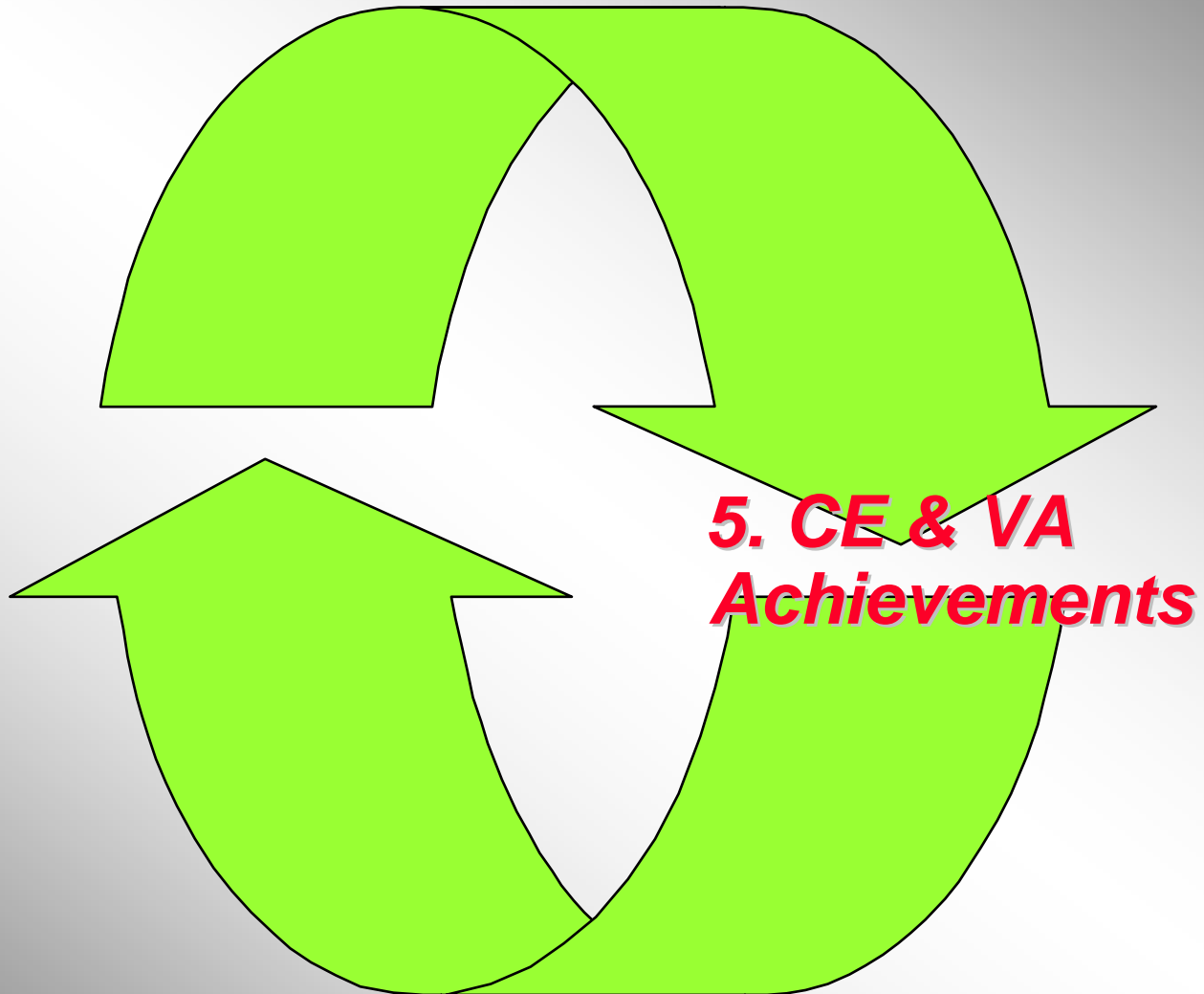
Event  
Plan

F.A.S.T.

When to  
Conduct

## *Benefits Attributed to VA*

- **Lean Manufacturing** Team spent six months to reduce component cost and lead time by 50%.
- **Value Management** Workshop spent one and half days [ 1.5 Day ] to eliminate the component.
- **Value Analysis processes** are results oriented that drive directly to the Bottom Line, with performance that generally exceeds **Return On Investment (ROI) ~ of 10:1**



## CE International Success

- **Boeing 777 & 787 Dreamliner [new design]** used design-build teams as a major method to include manufacturing and suppliers in the early decisions so that aggressive weight goals could be achieved
- **CHRYSLER** has invested more than \$ 1 Billion to build a new facility that houses all of its Car-Making functions under one roof.
- **Pratt & Whitney' team** of Longueuil Que., produces a design for its PW500 turbofan engine for use in a proposed business jet **<12 months** normally such a project takes **18-24 months**

# Benefits Attributed to CE

| Concurrent Engineering Techniques and Benefits |                        |  |                                      |
|--|------------------------|--|--------------------------------------|
| Aerospace company                              | Airplane program       | Benefits attributed to CE  | CE techniques                        |
| The Boeing Company                             | 777                    | 50% reduction in engr. changes due to design errors. Significant reduction in defects that reached the factory.  | IPT, CI, SI, DPD, DPA, DFX, CIM      |
|  | 737-X                  | Currently in product development using IPTs and concurrent product and process definition.   | IPT, CI, SI, DPD, DPA, DFX, CIM      |
|  | F-22                   | Currently in product development using IPTs and concurrent product and process definition.   | IPT, CI, SI, DPD, DPA, DFX, CIM      |
| McDonnell Douglas                              | C-17                   | Saved \$68M due to common automatic test equipment. Reduced number of parts and fasteners on cargo door assy.  | IPT, SI, CI, DFX, TQM, LM, QFD       |
|  | F-15                   | Fuselage formers, 38% fewer parts, 49% fewer fasteners, 45% fewer fastener types, 55% fewer fab. and assy. tools, 75% less assy. time, 29% reduction in defects. | IPT, SI, CI, CIM, DPD, DFX, TQM, QFD |
|  | F/A-18E/F              | 33% fewer parts (4400 parts, fewer fasteners) 1500 lb under weight First major airplane join significantly below cost estimate.                                  | IPT, SI, CI, CIM, DPD, DFX, TQM, QFD |
|  | MD-11                  | Reduced number of parts by 3800, weight by 240 lb, and cost per airplane by \$127,000. Reduced assembly flow from 200 to 109 days.                               | IPT, SI, TQM, DFX, QFD, LM           |
| Dassault Aviation                              | Military Fighters      | Used CE techniques, but did not cite benefits.   | IPT, DPD, DPA, CIM                   |
| British Aerospace                              | BAE146 Airbus wings    | Development time reduced from 36 to 18 months.   | IPT, SI, QFD, TQM, LM                |
| Aérospatiale                                   | A300, A320, A330, A340 | Used CE techniques, but did not cite benefits.   | IPT, SI, CIM, DPD, TQM               |
| Raytheon Beech Aircraft                        | Not specified          | 80% reduction in flowtime, 94% reduction in WIP, 80% reduction in facility space, 600% increase in inventory turns.  | IPT, SI, LM                          |

|  |  |
|--|--|
| <b>IPT</b> = Integrated product teams            | <b>SI</b> = Supplier involvement on product team |
| <b>CI</b> = Customer involvement on product team | <b>DPD</b> = Digital product definition          |
| <b>DPA</b> = Digital preassembly/mockup          | <b>CIM</b> = Computer integrated manufacturing   |
| <b>LM</b> = Lean manufacturing                   | <b>DFX</b> = Design for X-ability                |
| <b>TQM</b> = Total quality management            | <b>QFD</b> = Quality function deployment         |

**Value Engineering and Value Analysis is an integral part of the CE process!**

# Bombardier - Challenger CL604 Junction Box CMA - 2038

- Design & produced **first units in 3.5 months**... All in one go
- Had **customer participation** at all stages of design
- **Used CE process** to the fullest in meeting the aggressive schedule imposed on us by the end customer
- Had **suppliers participation** in selecting critical parts(i.e.. relays). In doing so reduced the cost of PWB procurement significantly



## CMA-2000 Microwave Landing Systems

- A cross-functional, multi-disciplinary team was formed [ members from Engineering and Operation] with the objective of reducing material and manufacturing cost
- An extensive **VE** and **VA** cost reduction was performed
- The **CE** process was used throughout all phases
- Reduced BOM by 10% and Mfg. by 15%.



## *At CMC Electronics Avionics - Global Navigation Satellite Sensor Unit CMA-3012; 3024 and derivatives*

- A critical customer parameter was delivery of RED Label units..... CMC First to Market and competitor was unable to meet schedule demands
- CE process used for designing and manufacturing the units
- Met and exceeded the technical requirements
- SUCCESS IN PRODUCING NEW DESIGN and marketing it
- Tremendous **Customer Satisfaction** - Honeywell / Boeing
- During the 3<sup>rd</sup> Production Phase McGill participated in a VE and VA cost reduction project



2015  
2014  
2013  
2012  
2011  
2010  
2009  
2008  
2007

**CE - VA & VE  
Go Hand in Hand  
Is Up To you**

**You Can Make It Happen !**

# Thank You !

## *Value Links*

### **Lawrence D. Miles Value Foundation**

- <http://www.valuefoundation.org/>

### **SAVE International**

- [www.value-eng.org](http://www.value-eng.org)

### **JJ Kaufman Associates, Inc.**

- [www.valuemanagement.com](http://www.valuemanagement.com)
- The Institute of Value Management <http://www.ivm.org.uk/>

### **VEAMAC - Value Engineering Analysis and Management Academic Community**

- <http://www.brookes.ac.uk/other/veamac/home.html>