

# Six Sigma Systems Principles Module 2.1

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**Presentation for:**

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*These materials were developed as part of MIT's ESD.60 course on "Lean/Six Sigma Systems." In some cases, the materials were produced by the lead instructor, Joel Cutcher-Gershenfeld, and in some cases by student teams working with LFM alumni/ae. Where the materials were developed by student teams, additional inputs from the faculty and from the technical instructor, Chris Musso, are reflected in some of the text or in an appendix*

# Overview

## ➤ Learning Objectives

- Review core Six Sigma concepts
- Explore the relationship between “lean” and “six sigma”

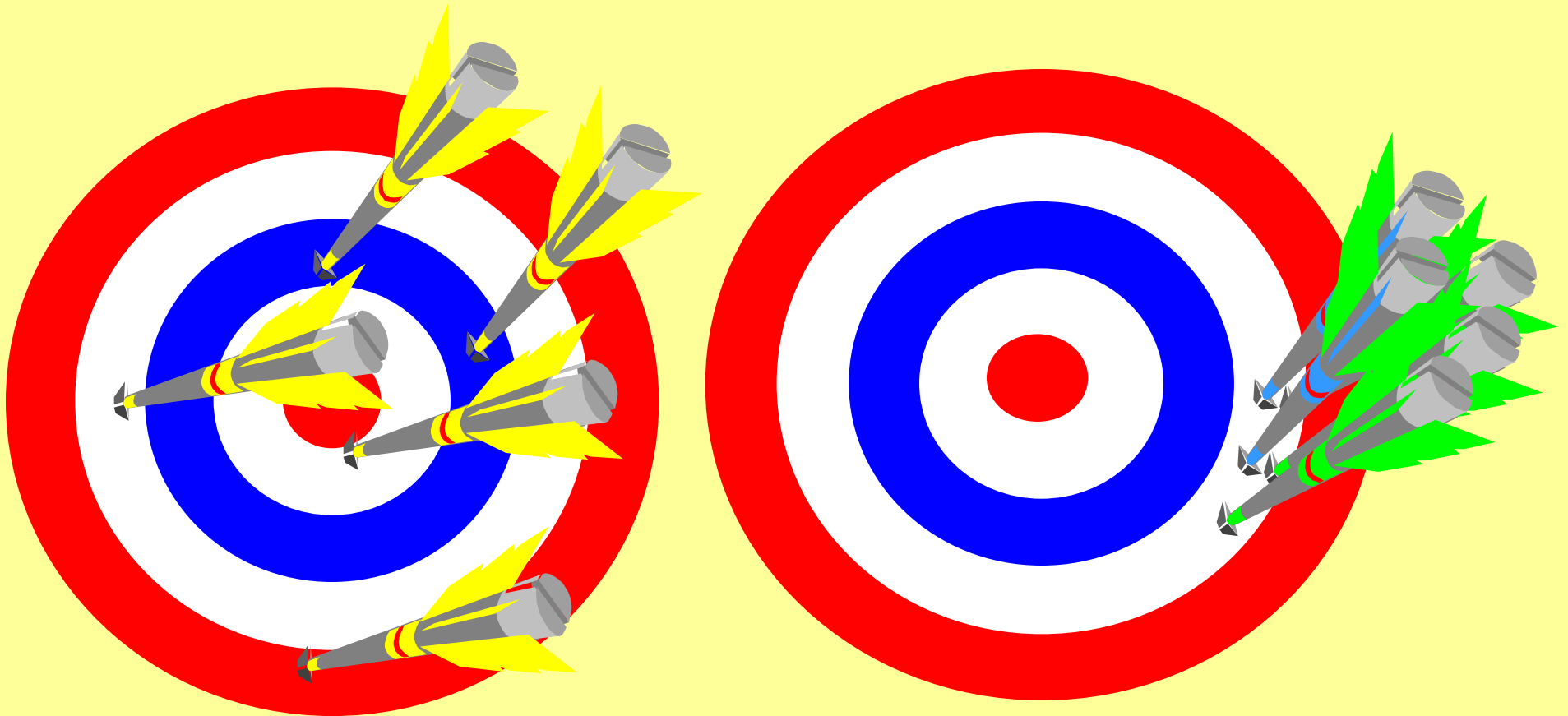
## ➤ Session Design (20-30 min.)

- **Part I:** *Introduction and Learning Objectives (1-2 min.)*
- **Part II:** *Key Concept or Principle Defined and Explained (5-7 min.)*
- **Part III:** *Exercises and Activities Based on Field Data and Scenarios that Illustrate the Concepts or Principles (5-7 min.)*
- **Part IV:** *Common “Disconnects,” Relevant Measures of Success, and Potential Action Assignment(s) to Apply Lessons Learned (3-5 min.)*
- **Part V:** *Evaluation and Concluding Comments (2-3 min.)*

# Six Sigma

- Concept:
  - The Goal: To produce goods and services at a Six Sigma level. As your organization moves toward Six Sigma quality, you will:
    - eliminate defects
    - reduce production and development costs
    - reduce cycle times and inventory levels
    - increase profit margin and improve customer satisfaction
  - The Vision: Drive industries to design and produce products/services to Six Sigma standards.
  - The Strategy: Use a data-driven structured approach to attack defects to improve the sigma level of your goods and services.
- Application:
  - Useful in any enterprise that provides products or services for companies

# Core Concept: Stabilize Before You Improve



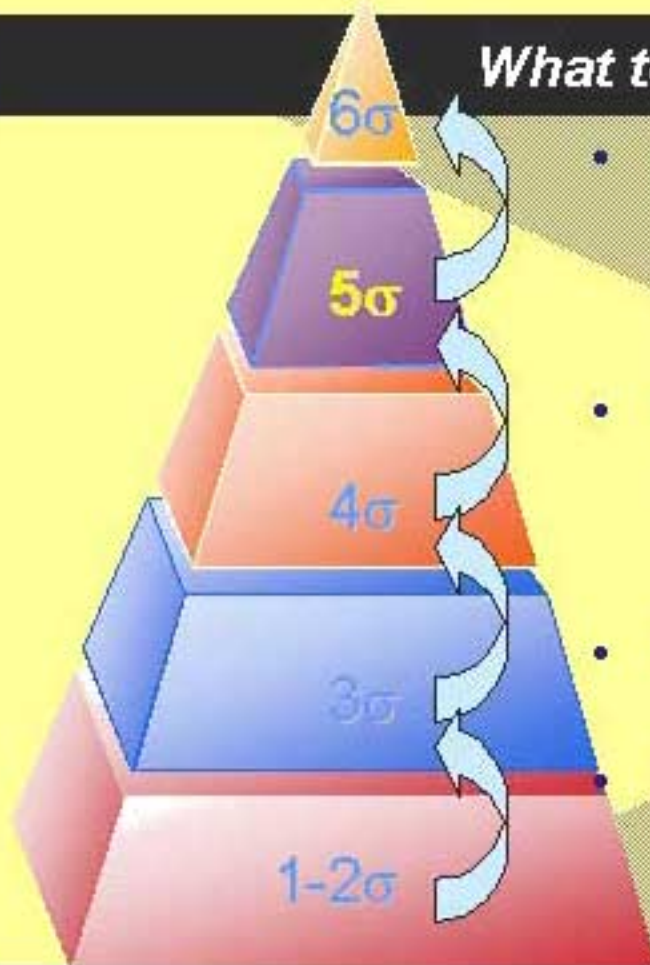
*Which player did better in this round?  
Who will do better in the long run?*

## Core Concept: $y = f(x)$

- How do you determine “y”?
- How do you determine the “x”s?
- How do you collect the data on the “x”s?
- How do you conduct the  $f(x)$  analysis?

# Six Sigma

*What tool(s) should we focus our efforts on?*



- **Tools:**
  - Design for Manufacturability
  - Design for Six Sigma, 6 s Tolerancing,
  - Product Scorecard
- **Tools:**
  - Process characterization (mapping, MSA, etc...)
  - Process optimization (DOE, etc...)
- **Tools:**
  - Seven basic tools (paretos, fishbones, etc.)
- **Tools:**
  - Common sense
  - Tribal knowledge

*Where is your organization? What kind of tools should you be using?*

During your project you want to use the right tool for the problem at hand. The Low Hanging Fruit can be obtained via the basic problem solving tools (check sheets, paretos, fishbones, charts, team interaction, training, etc...). To really leverage process knowledge, we will apply new tools to take us from the 3 - 4 sigma range to 6 sigma levels.

Source Six Sigma Qualtec



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Source: Six Sigma Materials from Qualtec and Aerojet Corp. as utilized in: MIT's LAI Lean Implementation Fieldbook, developed by Michael Chapman, Joel Cutcher-Gershenfeld, Gregory Manuel, Gina Mile, Jeanine Miller, Mike Packer, Robert Reifenberg, and David Veech.

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# Six Sigma -- DMAIC

## Measure

- ▼ Define project scope
- ▼ Select output characteristics (Y's)
- ▼ Assess performance specifications
- ▼ Validate measurement systems
- ▼ Establish initial capability (for Y's)

## Analyze

- ▼ Define performance objectives
- ▼ Document potential X's
- ▼ Analyze sources of variability

## Improve

- ▼ Screen potential causes
- ▼ Identify appropriate operating conditions

## Control

- ▼ Determine process capability (for X's)
- ▼ Implement process controls
- ▼ Document what you have learned

Source Six Sigma Qualtec  
Source is Aerojet GenCorp

The six sigma strategy is summarized above. This is only an outline. The detail behind this information will be presented later. In the next four weeks of training you will learn how to characterize and optimize any process.

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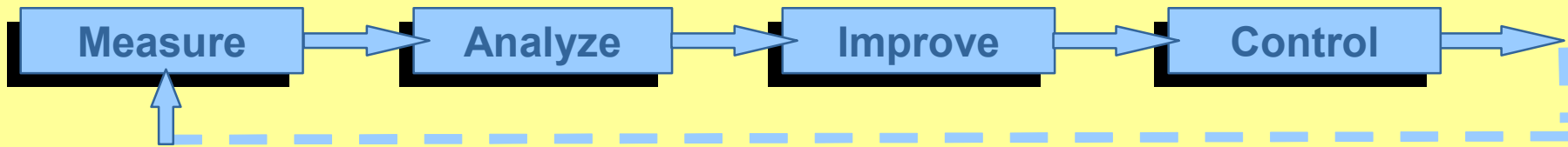
LFM

# Six Sigma

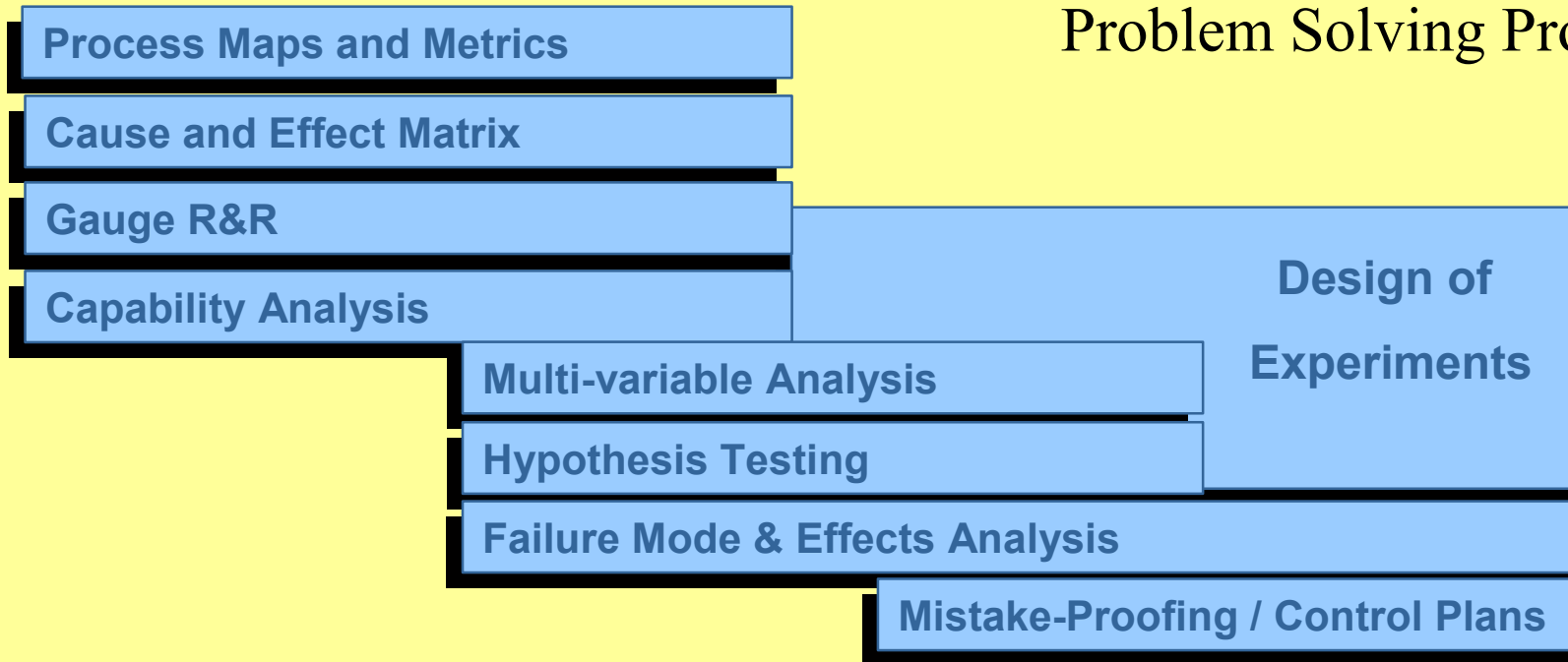
- Master Blackbelt
  - Complete Blackbelt Certification
  - 18 Mo. Additional training to broaden skill set, Professional Development, acquire expertise in ability to train others
  - Complete a Project with Significant Importance to the Success of the Company
- Blackbelts
  - 240 Hours Focusing on Business, Engineering, Manufacturing Processes Improvement
  - Project Worked in Parallel to Reinforce Training
- Greenbelts
  - 80 Hours Focusing on Assisting Blackbelts, Running Small Scale Projects
  - Project Worked in Parallel to Reinforce Training
- Leadership (300+) - 8 Hours of Six Sigma Awareness and Project Support



# Six Sigma



## Problem Solving Process



## 4 Phases of Improvement Using 9 Key Tools

Source Six Sigma Qualtec 



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# Six Sigma at GE

## *Key Concepts of Six Sigma*

<b>Critical to Quality:</b>	Attributes most important to the customer
<b>Defect:</b>	Failing to deliver what the customer wants
<b>Process Capability:</b>	What your process can deliver
<b>Variation:</b>	What the customer sees and feels
<b>Stable Operations:</b>	Ensuring consistent, predictable processes to improve what the customer sees and feels
<b>Design for Six Sigma:</b>	Designing to meet customer needs and process capability

***Our Customers Feel the Variance, Not the Mean***



Source: <http://www.ge.com/sixsigma/sixsigstrategy.html>

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# Six Sigma and Lean

- Based on the information in the prior slide on Six Sigma at GE, what can you infer about the relationship between “lean” and “six sigma”?
- What do you see as the potential risks and benefits of “lean” and “six sigma”?