Course Description

Breakthrough Performance using DFSS

This 1-week hands-on workshop is specifically tailored to the product and process design environment. It teaches participants the *Identify*, *Design*, *Optimize*, and *Validate* (*IDOV*) strategy for getting better products and services to market faster and at a lower cost. The course is taught using a "Keep It Simple Statistically" (KISS) approach that includes many in-class examples and exercises. Participants have ample opportunity to practice what is taught to ensure they have a practical, working knowledge of the IDOV tools and methodology. This 1-week workshop is designed for participants who have a strong background in Design of Experiments (DOE), Measurement System Analysis (MSA), probability and basic statistics or who have completed a 1-week DFSS Foundations course.

The proven and powerful Design for Six Sigma (DFSS) methodology can be used for both initial design as well as re-design efforts, and provides a way to implement the Six Sigma methodology as early in the product or service life cycle as possible. Participants will learn how to "design in" quality when costs are the lowest in order to create new game-changing products and services which exhibit outstanding performance right from the start. Participants will learn the details necessary to identify the voice of the customer, design products and processes which satisfy the customer's requirements, optimize products and processes to maximize performance, and test and validate designs to ensure capability. Emphasis is on developing leaders and practitioners in the organization who are focused on improving customer satisfaction and generating business growth and breakthrough improvements, and who can repeatedly apply the Identify-Design-Optimize-Validate (IDOV) strategy to generate success stories and improve the corporate scorecard. During the workshop, participants will complete a hands-on design activity in teams, during which they will follow and apply the IDOV strategy for a product they will design, build, and ultimately test. The intended audience is anyone who desires to become a practitioner of DFSS. Researchers, scientists, engineers, and practitioners from all disciplines including quality will benefit from the use of this proven methodology.

Course Agenda

Breakthrough Performance using DFSS

Detailed Course Content

Introduction to Design for Six Sigma (DFSS)

- The Identify, Design, Optimize, Validate (IDOV) Methodology
- DFSS Goals and Benefits
- Key Ingredients for success
- Quantifying Savings and Benefits

The DFSS Scorecard

- Keeping Score using the DFSS Scorecard
- Scorecard Elements and Construction
  - Parts
  - Process
  - Performance
  - Software
- Methods for Computing DPU
- Hands-on practice completing a DFSS Scorecard using DFSS Software

Identify: The DFSS Project and Team

- DFSS projects and studies
- Key elements of the business case
- Initiating and Scoping the project
- Project charters
- The DFSS team
- Stakeholder analysis

Identify: The Voice of the Customer (VOC)

- The Identify phase of IDOV
- Kano's Model
- Determining Customer Wants and Needs
- Sampling Methods
- Identifying Critical to Customer Requirements
- Prioritizing Customer Requirements
- Introduction to Quality Function Deployment (QFD) and the House of Quality
- Hands-on Practice Completing House of Quality #1 to identify Measurable CTCs (critical to customer measures)

Design: Concept Generation and Selection, Product Design, and Requirements Flowdown

- The Design phase of IDOV
- Assigning Specs and Formulating Design Concepts
- FAST diagrams
- Overview of Triz and Axiomatic Design

- Comparing Alternate Design Concepts using Pugh Concept Selection
- Risk Analysis and Management
- Building House of Quality #2

Design and Optimize: Transfer Functions and Expected Value Analysis (EVA)

- Importance of Transfer Functions for IDOV
- Methods for Obtaining Transfer Functions
- Meaning of expected value
- Expected Value Analysis (EVA) for Quantifying the Distribution of the Output
- Comparing Methods and Strategies for EVA
  - Root Sum Square (RSS)
  - Monte Carlo Simulation
- Using DFSS software for EVA Analysis
- Determining distribution of inputs
- Working with Normal and Non-Normal Input and Output Distributions

Optimize: Robust Design

- Understanding how input means affect output performance
- Noise factors and P-diagrams
- Robust Design: Finding Optimal Mean Settings for the Inputs to Minimize Variation in an Output
- Methods for Robust Design
- Hands-on Robust Design experiment using the Statapult®
- Computer Based Robust Design (Parameter Design) using DFSS software
- Robust design examples and exercises

Optimize: Tolerance Allocation

- Quantifying the Sensitivity of the Output DPM to Changes in the Input Variable's Standard Deviation
- Tolerance Allocation Examples and Exercises
- Setting Tolerances
- Methods to Reduce the Standard Deviation of Inputs

Design for X-ability and Scorecard Updates

- DFX Concepts – beyond just designing for performance
- DFX principles and examples
- Introduction to Design for Reliability (DFR)
  - Designing with Reliability in Mind
  - Common life data distributions and analysis
- Mistake Proofing and Error Proofing
- Capability prediction
- Design scorecard updating and analysis

Validate: Sensitivity Analysis

- Sensitivity Analysis
- Quantifying the impact of mean and standard deviation shifts in design inputs

Validate: The Achievement of Breakthrough Performance

- Developing prototypes, test cases and pilots
- Introduction to high throughput testing for validating performance
- Performing gap analysis if results don't confirm

DFSS Case Studies and Examples

Design Exercise: Applying the IDOV Methodology

- Hands-on practice with the IDOV process
- Teams Design a Product to Meet the Customer Needs, using the IDOV process; Teams optimize their design using the IDOV tools and ultimately build and test their designs to validate performance

References and Course Evaluation Forms

Course Materials

Participants receive the following materials which are integrated and used throughout the class:

Participant Guide

Textbooks:

- Design for Six Sigma: The Tool Guide for Practitioners by Reagan and Kiemele (CTQ Media)
- Basic Statistics: Tools for Continuous Improvement by Kiemele, Schmidt, and Berdine (Air Academy Press and Associates)
- Understanding Industrial Designed Experiments by Schmidt and Launsby (Air Academy Press and Associates)

Software:

- SPC XL
- DOE Pro XL
- Quantum XL

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Prerequisites

Participants must meet one of the following criteria:

1. Have successfully completed AAA Six Sigma or Lean Six Sigma Black Belt training.
2. Have a strong background in Design of Experiments (DOE), Measurement System Analysis (MSA), probability, and basic statistics and pass the AAA pre-requisite qualifying exam with a score of 70% or better.
3. Have successfully completed the 1-week AAA DFSS Foundations course.

Participants are expected to have management sponsorship and a project selected prior to, or at some point during, the training. DFSS projects should be completed within a reasonable timeframe, not usually longer than 6-8 months following completion of the training.

Participants should bring a laptop computer to class with Excel 2000 (or later) so that they can install the supplied software and practice using it during many in-class exercises. A basic working knowledge of Windows and Excel is helpful.