Introduction

In late 1986, Motorola announced the achievement of Total Customer Satisfaction as the corporation's fundamental objective. To support this goal, five interrelated key initiatives were defined. Of these initiatives, achievement of Six Sigma Quality is paramount.

Put simply, Six Sigma denotes a statistical way of measuring quality. Motorola has converted its yield language to parts per million (ppm), and the Six Sigma Quality goal is 3.4 ppm defect level. Motorola applies this principle to services as well as products throughout the company. In other words, Motorola is striving for absolute perfection.

The Six Sigma thrust provides distinct advantages in this continuing quest for Total Customer Satisfaction. This must be achieved in the presence of increasing global competition and rapid technological change. These two factors emphasize the continuing need for a single foundation to unite the many aspects of product and service quality into an integrated strategic thrust.

The Six Sigma Research Institute was created in May of 1990 to provide that unifying thrust. Since strategic training forms the cornerstone of Motorola's quality efforts, the Six Sigma Institute is affiliated with Motorola University.

Mission Statement

The Six Sigma Research Institute's mission is to research and develop the theoretical framework and supporting tools necessary to accelerate the achievement of Six Sigma Quality, and to facilitate the subsequent transfer of such knowledge to Motorola's technical and managerial communities.

Partnerships

The 1990s will be known as the decade of total quality in education. A renewed emphasis on acquiring knowledge is evident, moving major corporations toward a culture of total quality. To remain competitive, many corporations are forming strategic partnerships to provide Best in Class products and services to their customers.

Motorola's Six Sigma Research Institute has formed partnerships with five major companies:

- International Business Machines
- Digital Equipment Corporation
- Asea, Brown, Boveri Inc.
- Texas Instruments
- Eastman Kodak

The partners' contributions to the Institute include funding, technical review support, training and implementation, as well as ongoing support of a structured authoring process.

The Six Sigma Research Institute, in turn, will share with its partners the entire output of its efforts.

Technology and Information Transfer System

The Six Sigma Research Institute is focusing its efforts on creating a collection of analytical tools to be used for achieving robust product and service designs. Such designs will be immune to the long-term, dynamic variations that naturally occur in the production, delivery, and use of products and services.

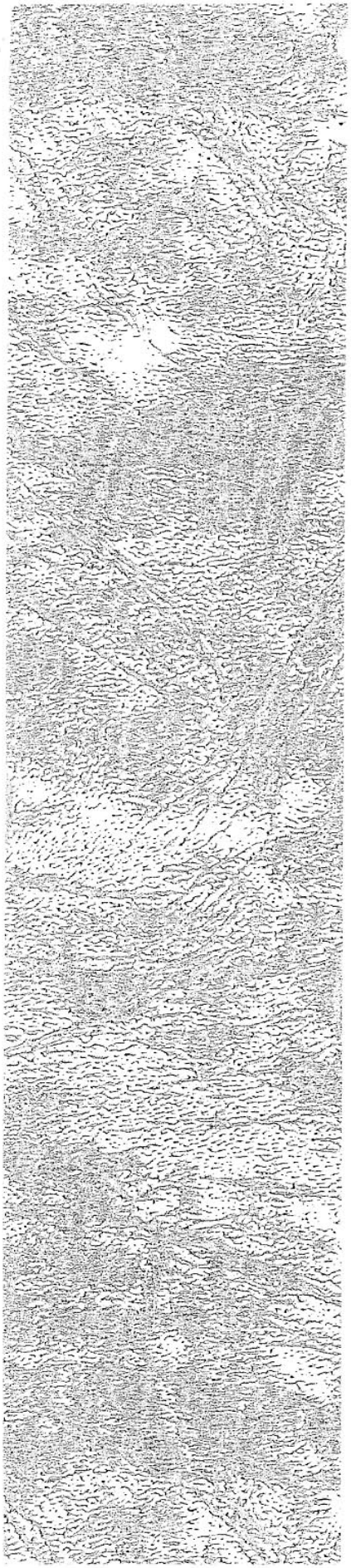
The result will be a series of discipline-specific *application methodologies* that will demonstrate how Six Sigma Quality can be achieved.

Products

BLACK BELT DEVELOPMENT PROCESS

In order to implement Six Sigma Quality goals throughout Motorola, it will be necessary to identify, select, and train a cadre of individuals in the statistical tools and methodologies necessary to accomplish this key corporate strategy. The Six Sigma Research Institute has established a program for the selection and training of "Black Belts," who are defined as:

> *Individuals who have developed a synergistic proficiency between their respective technical discipline and the Six Sigma strategies, tactics, and tools. They will continually work towards institutionalizing the effective use of these tools throughout the corporation, its customers, and its suppliers.*



PUBLICATIONS

The Six Sigma Research Institute has chosen the contents for several publications which are now being written by authors drawn from within Motorola, our partners, customers and suppliers.

The first set of this series is *The Encyclopedia of Six Sigma Tools,* a collection of both basic and sophisticated statistical methods for use in process and product design and optimization.

The second collection, *The Encyclopedia of Six Sigma Applications,* spans 13 topic areas using case studies to demonstrate the successful application of statistical tools to solve specific problems.

The third major publication, *The Handbook of Six Sigma Methodologies,* is a collection of detailed, step-by-step approaches, written by Dr. Mikel Harry. The handbook guides an individual in solving a particular problem using *The Encyclopedia of Six Sigma Tools* and *The Encyclopedia of Six Sigma Applications.* The Handbook, together with both sets of Encyclopedias, are referred to as *The Six Sigma Owner's Manual.*

These publications are more fully described in a separate brochure provided in the back pocket of this booklet.

SOFTWARE

Limited-use software tools are also being developed by the Six Sigma Research Institute to support the full implementation of SSRI's publications. Development areas include quality control, manufacturing capability, product producibility analysis, and process characterization study.

*Concurrent Engineering, The Foundation of Six Sigma Quality**

This videotape utilizes a four-part question-and-answer format to illustrate the concepts of concurrent engineering and how they apply to the Six Sigma Quality initiative. Part One provides background on a manufacturing process that is the basis of the four-part presentation. In Part Two, the theory of dynamic mean behavior and its impact on a typical manufacturing process are presented. Dynamic mean behavior is then related to the financial performance of a business in Part Three. In Part Four, the concepts of robust design and how they can be used to optimize a process are discussed. The role of the Six Sigma Research Institute in Motorola's quest for Total Customer Satisfaction is also presented.

* Available only to SSRI partners and selected customer and supplier companies.

Order Information:

The three videotapes comprising The Vision of Six Sigma series can be ordered individually or as a complete set. For a full understanding of Motorola's vision of Six Sigma, the Six Sigma Research Institute strongly recommends viewing the three videotapes in the proper sequence. Written transcripts and copies of key illustrations are included with all video orders.

For more information about these videotapes, contact the Six Sigma Research Institute at:

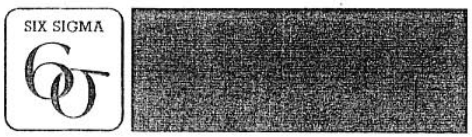
Phone: (708) 538-2397
Fax: (708) 538-3043

Six Sigma Research Institute

SIX SIGMA 6σ ®

VIDEOTAPES

Ⓜ MOTOROLA UNIVERSITY



The Six Sigma Research Institute was created by Motorola in 1990 to research and develop the methodologies and supporting tools necessary to facilitate the achievement of Six Sigma quality. Six Sigma is a statistical term adopted by Motorola to represent near-perfect quality. The Six Sigma Research Institute, an affiliate of Motorola University, has produced a series of instructional videotapes about the statistical tools and techniques needed to create robust product, process, and service designs to boost quality and performance. Called *The Vision of Six Sigma*, the series consists of three videotapes:

- **Part I—*Basic Six Sigma Concepts***

This videotape presents elementary concepts of probability and statistics. It explores, in terms of defects produced, what is meant by a Six Sigma level of quality.
(length: 18 minutes)

- **Part II—*Advanced Concepts of Six Sigma***

This videotape builds upon the principles presented in Part I. Robust design and the associated implications for profitability and customer satisfaction are explained. Additional information on breakthrough research (Chaos Theory) currently being conducted by the Institute is also presented. The video features opening remarks from Motorola's Chairman of the Board and CEO, George Fisher. Dr. Mikel Harry, director of the Six Sigma Research Institute, presents technical information.
(length: 56 minutes)

- **Part III—*A Practical Example of Robust Design***

Examples of actual statistical experiments, such as response surface modeling and associated contour plots are featured in this video. In addition, viewers examine how statistical tools are used to optimize a band pass filter circuit design, raising expected first time yield from 50 percent to 90 percent. Explanations are presented by Dr. Mikel Harry.
(length: 24 minutes)

Annual Black Belt Symposium

The primary purpose of the Annual Black Belt Symposium is communication: sharing ideas, knowledge, and the experience of what is working well and what is not. The annual symposium "primes" the creative pump.

By sharing success stories, the best ideas developed locally are shared globally throughout the corporation, resulting in a rapid expansion of practical knowledge. The conference inspires and motivates the audience to be their best, grow and learn at an accelerated rate, and take initiative.

Support for Black Belts

The Six Sigma Black Belt will have a variety of products and services, developed and supplied by the Six Sigma Research Institute (SSRI), to assist him or her in the achievement of business unit goals. These include:

- Black Box Simulator
- *Handbook of Six Sigma Methods*
- Instructional Design Shell
- *Six Sigma Encyclopedia of Applications*
- *Six Sigma Encyclopedia of Tools*
- SSRI Consulting Services
- Six Sigma Software
- Six Sigma Videotapes

For more information about the Black Belt Development Process, contact the Six Sigma Research Institute at:

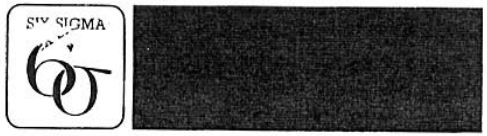
Phone: (708) 538-2397
Fax: (708) 538-3043

Six Sigma Research Institute

SIX SIGMA 6σ ®

BLACK BELT DEVELOPMENT PROCESS

Ⓜ MOTOROLA UNIVERSITY



Six Sigma Black Belt Program

Motorola's fundamental objective is the achievement of Total Customer Satisfaction. To support this goal, five interrelated key initiatives were defined. Of these initiatives, achievement of Six Sigma Quality is paramount. Reaching this level of virtual perfection, requires that the three primary sources of product variation—inadequate design margin, insufficient process control, and unstable or varying materials and components—be simultaneously attacked. To assist in facilitating this process, Motorola has established a network of experts proficient in the field of statistics. They are called Six Sigma Black Belts.

The Motorola Technical Institute (MTI) is a program being developed to serve as a vehicle for instituting a corporate infrastructure focused on Six Sigma excellence. Graduates of the MTI program would then be considered as candidates for Black Belt certification.

What is a Six Sigma Black Belt?

Black Belts serve, within their business units, as internal consultants for the appropriate application of Six Sigma problem solving methods. They train personnel in the field of statistics, provide consulting services, and take the leadership role in the use of statistics to reach the Six Sigma goal.

Each business unit has several Black Belts with varying backgrounds and areas of experience. They provide support to all areas of the business unit including design, manufacturing, materials, services, and administration.

Black Belt Certification

To become a Black Belt an individual must demonstrate a dedication to the achievement of Six Sigma quality, be recognized by the business unit's management as a leader in their functional discipline, and be skilled in analytical problem solving but not necessarily skilled in statistics. Although the majority of Black Belts come from the technical disciplines, there are a substantial number from the service and administrative functions.

Applications for Black Belt certification are screened by the Certification Committee to assess the candidate's existing skill level and determine areas requiring additional training and/or experience.

After acceptance by the committee, a mentor is assigned to the candidate and a Skills Development Plan is developed jointly with the candidate and the immediate supervisor. The candidate then enters an internship period during which successful application of Six Sigma tools must be demonstrated.