

**Systems Approach  
to  
Process Improvement  
Student Guide**

**Prepared by  
Naval Leader Training Unit  
Little Creek, Virginia and Coronado, California**

**Prepared for  
Chief of Naval Education and Training  
Pensacola, Florida**

**February, 1997**



## ACKNOWLEDGMENTS

The Systems Approach to Process Improvement course was initially developed as a joint venture between the Total Quality Leadership Office (TQLO), Washington, D.C. and the Navy Personnel Research and Development Center (NPRDC), San Diego, CA, under the sponsorship of the Total Quality Leadership Office. This course was originally designed and developed by Mr. Antonio Rodriguez (TQLO), and Dr. Samuel Landau (NPRDC), and Dr. Paula Konoske (NPRDC). Dr. Steve Dockstader provided additional guidance in the development of the original course.

The current edition of the Systems Approach to Process Improvement (SAPI) course was designed and developed by a team of instructors from the Naval Leadership Training Units at Little Creek, VA and Coronado, CA. Working from the frame of the original course, course managers MSGT Willard F. Vignoe and OSGS (SW) Rip Stauffer integrated input from students and instructors into this revision. Major Richard Mehaffey assisted in the development of the statistical exercises throughout the course. Ms. Laurie O'Leary (TQLO) provided technical review and assistance.

We especially wish to thank Dr. Donald Wheeler, consulting statistician and co-author of *Understanding Statistical Process Control*. Dr. Wheeler not only wrote our supplemental text but also taught us all how to use it. He was kind enough to offer editorial comments on some of the newer material and advice on presentation.

# Systems Approach to Process Improvement

## Course Structure

The course consists of the following modules:

Overview	
Module 1:	Understanding the Extended System
Module 2:	Data Collection Procedures
Module 3:	Data Characteristics and Variation
Module 4:	Assessing and Achieving Stability Using Averages Control Charts
Module 5:	Assessing and Achieving Stability Using Individuals Control Charts
Module 6:	Assessing Process Capability
Course Summary	

## Length of Instruction

These times are approximate and will vary with each class of students.

Overview	2 hours
Module 1	3 hours
Module 2	6 hours
Module 3	4 hours
Module 4	10 hours
Module 5	7 hours
Module 6	5 hours
Course Summary	3 hours

## Methods of Instruction

Lecture, videotapes, exercises, and discussions

## Videotapes

Wheeler, D. J., (1984). *A Japanese Control Chart*. Statistical Process Control, Inc. & SPC Press, Inc. (18 minutes).

Crawford-Mason, C. (Producer), & Dobyms, L. (Journalist). (1987-1989). *The Funnel Experiment*. [Videotape, The Deming Library Vol. IX]. Washington, D.C.: CC-M Productions (20 minutes).

## Required Readings

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## **DON TQL Glossary**

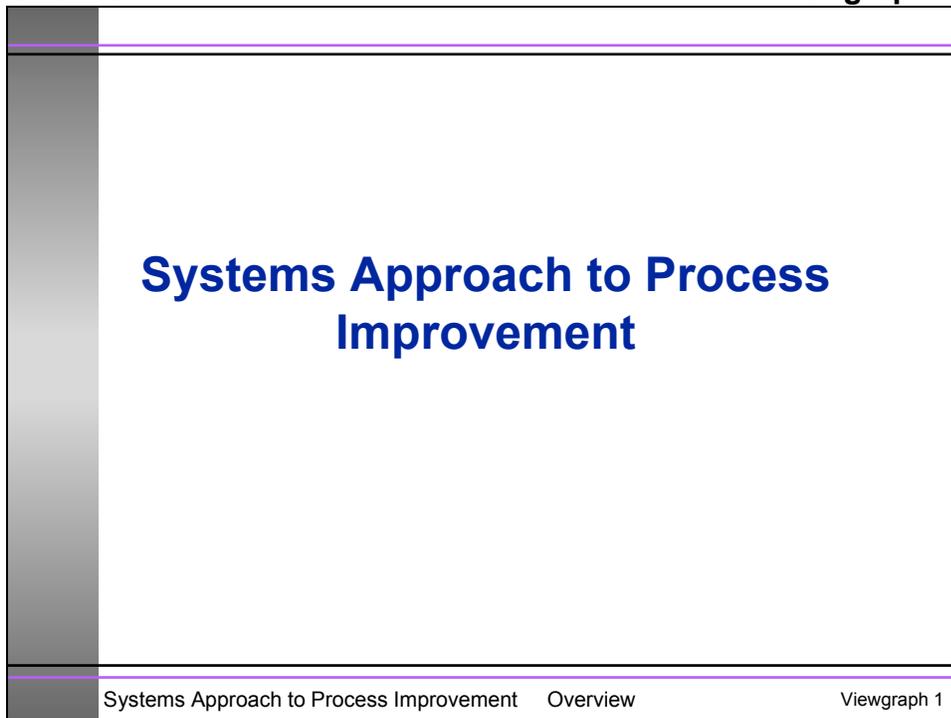
**Systems Approach**

**to**

**Process Improvement**

**Overview**





The viewgraph displays the title "Systems Approach to Process Improvement" in a large, bold, blue font, centered on a white background. The slide is framed by a thin black border. A vertical grey bar is visible on the left side of the slide. At the bottom of the slide, there is a footer containing the text "Systems Approach to Process Improvement Overview" on the left and "Viewgraph 1" on the right.

## Systems Approach to Process Improvement

Welcome! This is the *Systems Approach to Process Improvement* course. A systems approach model will be presented and discussed with the goal of enhancing your total quality leadership knowledge and skills.

Each participant is expected to have completed the *Fundamentals of Total Quality Leadership* course.

## **Introductions and Administration**

Now that we have had the opportunity to talk with one another and share our experience with TQL, we can talk about the classroom environment. You are encouraged to become an active participant in discussions, as well as share examples from your workplace.

It is extremely important that you attend all of the class sessions and keep up with the assigned readings. Read each module and the associated readings prior to the class session for that module.

You will be actively involved in the course. Most of the concepts and principles in this course are presented in lecture format, with exercises to reinforce the learning and provide practical application. Videotapes supplement one module. You will be asked to discuss the ideas presented. Much of the benefit from the course will come through your participation in these discussions. Feel free to ask questions about points that are not clear. Active participation in the course can make the ideas presented your own. This will make your future jobs a bit easier when it is time to apply TQL.

<h2>Course Objectives</h2>	
<ul style="list-style-type: none"><li>□ Prepare quality advisors to help an organization optimize the performance of the extended system<ul style="list-style-type: none"><li>④ Gain knowledge of the extended system</li><li>④ Select processes</li><li>④ Improve processes</li></ul></li><li>□ Prepare quality advisors to guide an organization in the activities required to improve processes<ul style="list-style-type: none"><li>④ What to do</li><li>④ When to do it</li><li>④ How to do it</li></ul></li></ul>	
Systems Approach to Process Improvement	Overview
	Viewgraph 2

### Course Objectives

The purpose of the *Systems Approach to Process Improvement* course is twofold.

The primary objective is to provide a quality advisor the knowledge and the skills that will help an organization optimize the performance of its extended system. This will be accomplished by identifying what needs to be done to gain knowledge of the extended system, how to select processes based on that knowledge, and how to improve processes.

The second objective is to prepare quality advisors to guide teams in organizations in the activities required to improve processes. This course will teach the quality advisor what to do, when to do it, and how to do it. The quality advisor will be able to teach, guide, and advise organizational teams (and individual leaders) in ways to optimize organizational performance.

<h2>Extended Systems View of Organizations</h2>	
<ul style="list-style-type: none"><li>□ <b>Extended System</b><ul style="list-style-type: none"><li>➤ Optimization of the system</li></ul></li><li>□ <b>Process Improvement</b><ul style="list-style-type: none"><li>➤ Customer focus</li><li>➤ Measurement</li><li>➤ Management and improvement of processes</li></ul></li></ul>	
Systems Approach to Process Improvement	Viewgraph 3

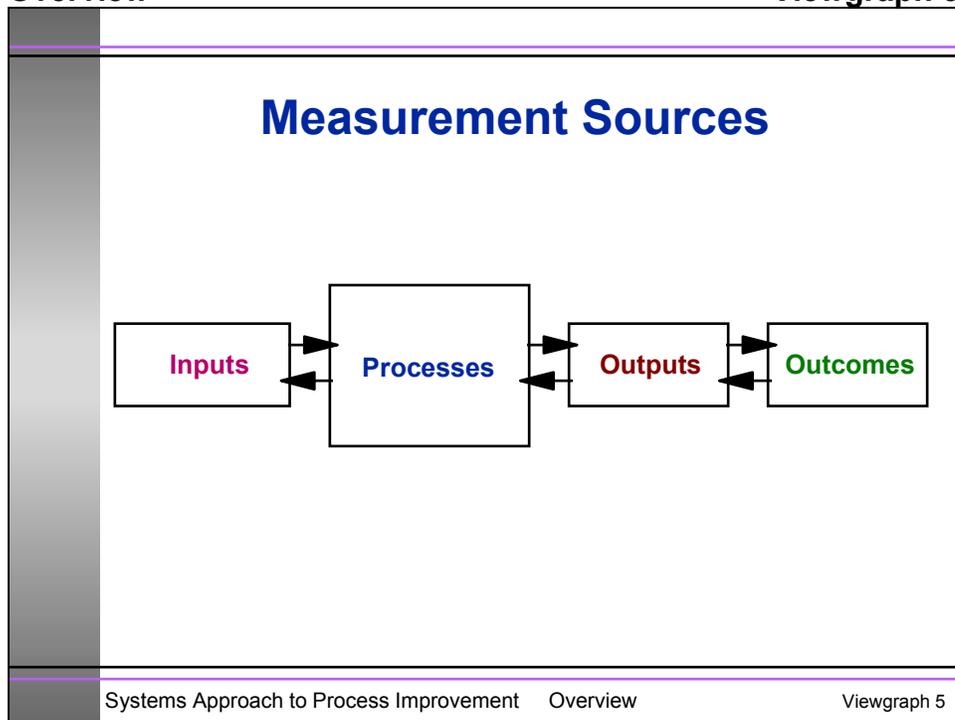
### Extended Systems View of Organizations

The title of this course reveals the orientation we believe is required to improve quality. Two factors are critical in leading or managing quality improvements: viewing the organization as a system and improving processes. If management decisions are not based on overall impact on the system, and there is no mechanism for measuring processes, any improvements will be temporary at best.

We will expose you to new paradigms to consider as you focus on what is required to implement improvements in your organization.

We will provide a roadmap for achieving organizational improvements in the areas of quality and productivity. This roadmap does not simply discuss the need to consider the organization as systems, subsystems, and processes, although it is a prerequisite for improvement. This roadmap is not simply a guide to using statistical tools, although you'll be able to use them. This roadmap will help you **integrate** your systems knowledge with the statistical tools to help optimize your organizational performance. This includes the following activities: identifying and prioritizing **stakeholders**, identifying **processes for improvement**, **planning** how to make improvements, **carrying out** your plans, and finally **evaluating** them.





### Measurement Sources

The inputs needed to make optimal decisions depend on the performance signals sent by the extended system. In order to accurately receive and interpret these signals, appropriate **measurement** systems must be in place. Traditionally, **outputs** have been the primary sources of measurement. While they are important, measurement of **outcomes** (stakeholder perceptions of quality), **processes** (interaction of factors required to produce a product or service), and **inputs** (supplier information) must also be considered if quality is to be improved and optimal results achieved. The *Systems Approach to Process Improvement* is a cycle that starts with (1) outcomes (identifying and addressing the requirements of relevant stakeholders, e.g., customers), moves to (2) the organizational outputs (products or services), that (3) are related to the processes that lead to that output, and to the (4) inputs (supplier related provisions).

Measurements for each of these sources can be obtained by using the basic graphic tools of statistical process control (SPC). Since each tool is used for a specific purpose, it is important to know when to use each one. Using a tool that is inappropriate for a particular context or set of data can lead to incorrect decisions: decisions that may be beneficial in the short term, but detrimental to the long-term goals of the organization. The construction and use of the seven basic graphic SPC tools are integrated within the systems context. **An important theme throughout this course is the concept that statistics and measurement are means to help you make decisions, rather than ends to be achieved.**

**Variation**

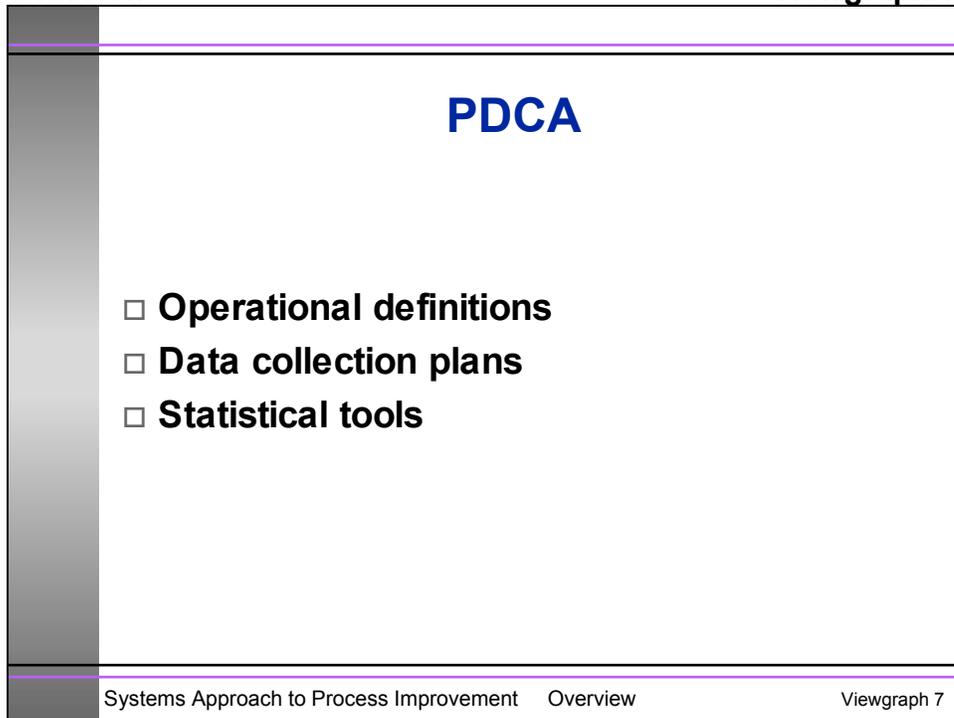
- Variation is to be expected**
- Need to learn when to act and when not to act**
- Achieve predictability**
- Meet requirements**

Systems Approach to Process Improvement   Overview   Viewgraph 6

## Variation

You've already learned about the concept of variation from the *Fundamentals of Total Quality Leadership* course. Leaders often take variation as a sign that immediate action must be taken to reduce or remove it. However, it is not always optimal to make a change in these circumstances. This course will provide you with the knowledge and skills to know when it is appropriate to take immediate action, when it is best to wait, and when it is best not to take any action at all.

A result of understanding variation is your ability to predict what will occur. Ways to achieve and maintain predictability (that is, stability of results) are presented in this course. Achieving process stability, coupled with identifying, clarifying, and meeting requirements, is used to establish long-term process improvements.



The viewgraph displays the title 'PDCA' in large blue font at the top center. Below it, a bulleted list contains three items: 'Operational definitions', 'Data collection plans', and 'Statistical tools'. The viewgraph has a grey vertical bar on the left and a footer at the bottom with the text 'Systems Approach to Process Improvement Overview Viewgraph 7'.

## PDCA

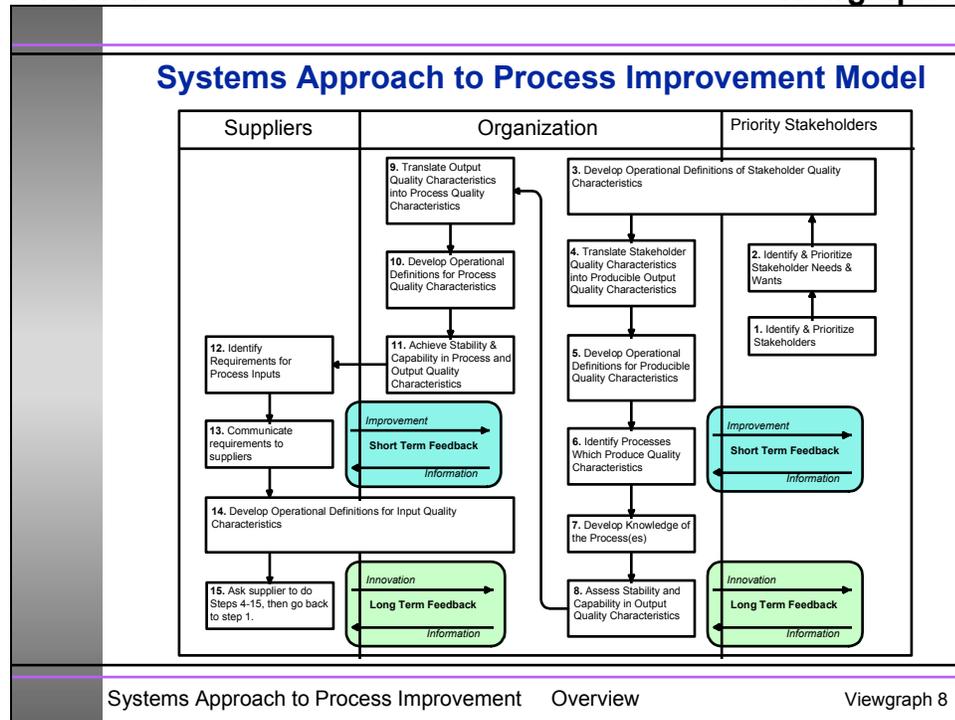
- **Operational definitions**
- **Data collection plans**
- **Statistical tools**

Systems Approach to Process Improvement Overview Viewgraph 7

## PDCA

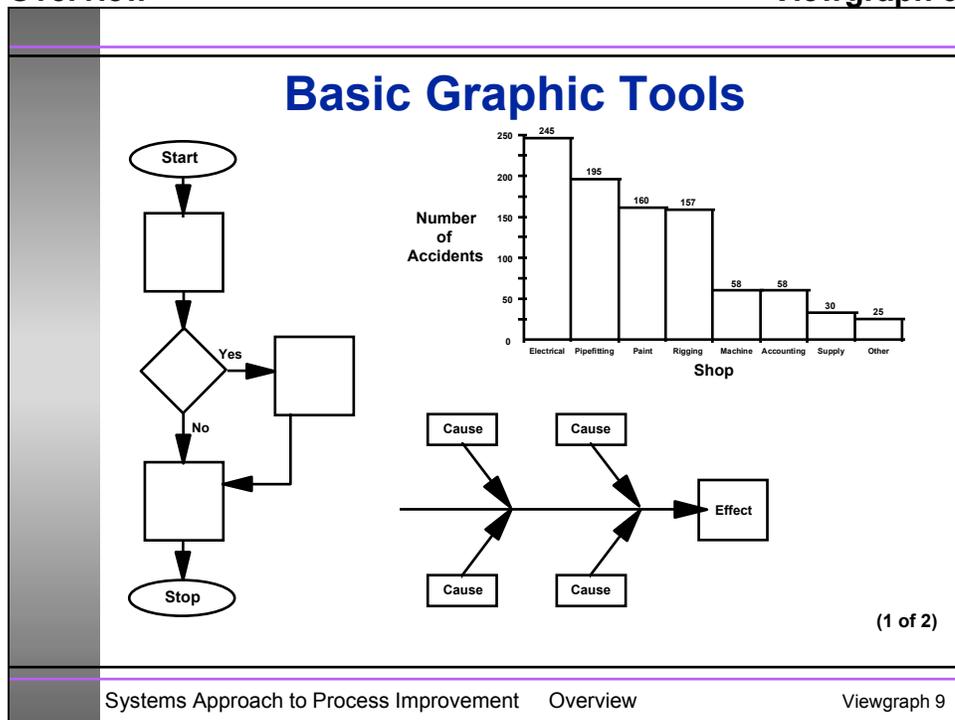
An important reason for developing and using measurement systems is the need for a gauge to tell you how well your system is performing. But how do you know what to measure? When do you measure it? How frequently do you measure it? How much information should you gather? And, how do you know if there has been an improvement? Clearly, a procedure is needed to systematically and consistently answer these questions. Such answers can be obtained by following the Plan-Do-Check-Act (PDCA) cycle.

The PDCA cycle is a model for learning. It is a systematic way to determine an organization's needs, how best to fulfill those needs, and to determine the extent to which those needs have been satisfied. PDCA is discussed in relation to the need for developing **operational definitions**, planning for **data collection**, and identifying how best to use the specific **statistical tools**.



## Systems Approach to Process Improvement Model

The Systems Approach to Process Improvement model integrates the extended systems orientation and the scientific structure found in the PDCA to identify the specific **steps** that will assist an organization in optimizing their performance. The model provides a sequential set of activities that begins with how to identify and prioritize stakeholders (e.g., consumers), how to interpret their requirements and needs into quality organizational results, and how to deal most effectively and efficiently with suppliers. These activities, along with relevant examples and exercises, are discussed in detail in this course. The application of the basic graphic tools is integrated within this framework. Implementing this model will provide a helpful guide to process improvement.



### Basic Graphic Tools (1 of 2)

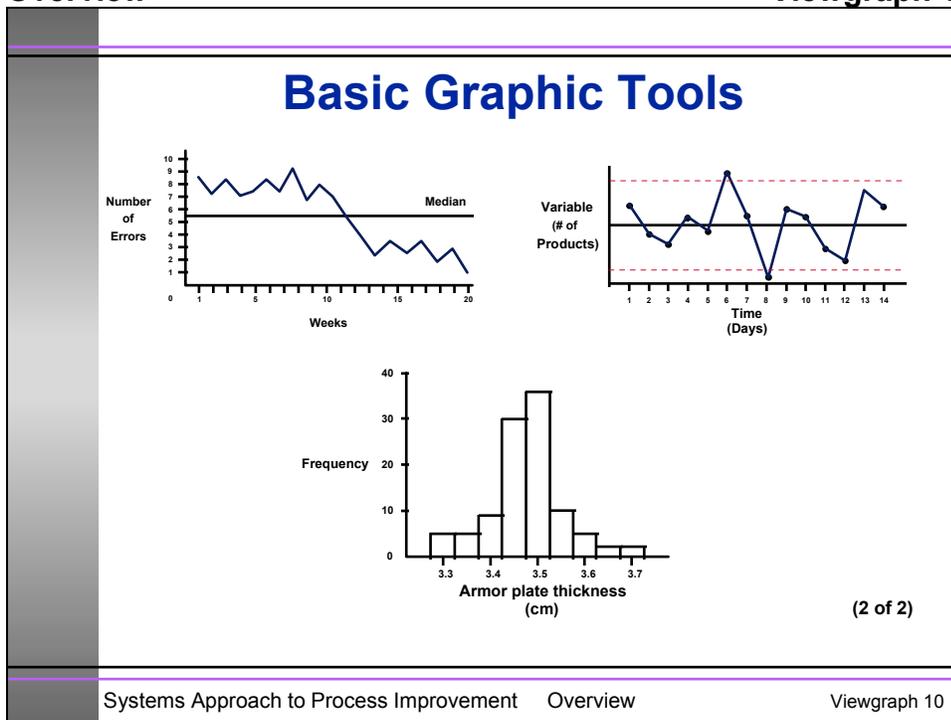
The seven basic tools are flow charts, cause-and-effect diagrams, Pareto charts, run charts, control charts, histograms, and scatter diagrams. These tools may be used in all phases of process improvement efforts. The specific tool that is used depends on the question(s) you are trying to answer and the goals you are trying to achieve.

You should have learned the first three tools in earlier DON TQL courses.

**Flow chart:** A tool used to depict the sequence of steps and decisions in a process.

**Cause-and-effect diagram:** A tool used to organize potential causes of quality into general categories to identify possible relationships between factors.

**Pareto Chart:** A bar chart used to order or prioritize data by type, category, or other classification.



### Basic Graphical Quality Control Tools (2 of 2)

**Run chart:** A line chart of data plotted over time. It is used to study variation of quality characteristics over time.

**Control chart:** A statistical tool used to distinguish variation due to special causes from those due to common causes. We use control charts to assess and help achieve stability.

**Histogram:** A bar chart that shows the location and distribution of data over a range of values. We will use histograms to study capability in a process.

<h2>Course Structure</h2>	
<ul style="list-style-type: none"><li>□ Overview</li><li>□ Module 1: Understanding the Extended System</li><li>□ Module 2: Data Collection Procedures</li><li>□ Module 3: Data Characteristics and Variation</li><li>□ Module 4: Assessing and Achieving Stability Using Averages Control Charts</li><li>□ Module 5: Assessing and Achieving Stability Using Individuals Control Charts</li><li>□ Module 6: Assessing Process Capability</li><li>□ Course Summary</li></ul>	
Systems Approach to Process Improvement	Overview
	Viewgraph 11

### Course Structure

The course consists of six modules, this overview, and a summary.

In Module 1, you will view your organization and its stakeholders as part of an extended system. The foundation and the basics of the Systems Approach to Process Improvement model are presented. You will be able to recognize both the three major phases and all the specific steps of the model. You will also be able to recognize the importance of process stability and capability of the system as a whole.

In Module 2, you will learn how to collect data from the extended system. You will be taught how to develop operational definitions and to formulate your own data collection plans through the application of the PDCA cycle.

In Module 3, you will learn various statistical concepts and procedures that you will need for later modules.

In Module 4, you will learn to use control charts of subgroup averages to assess stability in a process. Use of data and statistical thinking concepts will be explored further.

In Module 5, you will learn to use individual data points in control charts to assess stability in processes where there is no rational basis for subgrouping. A

technique for adjusting the aim of a process using an individuals chart is discussed and practiced.

In Module 6, you will learn to assess capability using histograms and other techniques. The concept of the Taguchi Loss Function is demonstrated and discussed.

<h2>Course Results</h2>	
<ul style="list-style-type: none"><li>□ <b>Depict your organization's extended system and measurement sources</b></li><li>□ <b>Demonstrate how the PDCA can be used as a framework for acquiring knowledge and gathering data</b></li><li>□ <b>Use knowledge of variation as a basis for action</b></li><li>□ <b>Apply the Systems Approach to Process Improvement Model to your organization's extended system</b></li><li>□ <b>Construct and apply basic graphic tools</b></li></ul>	
Systems Approach to Process Improvement	Overview
	Viewgraph 12

### Course Results

You will leave this course with the knowledge and skills needed to teach, guide, and advise organizational teams to optimize their organizational performance. You will be able to help your organization implement a systems approach to process improvement and be able to select and use the appropriate graphic tools. Specifically, you will be able to assist in the following:

Depict your organization's extended system and measurement sources.

Demonstrate how the PDCA can be used as a framework for acquiring knowledge and gathering data.

Use knowledge of variation as a basis for action.

Apply the Systems Approach to Process Improvement Model to your organization's extended system.

Construct and apply basic graphic tools.