NCAT

Georgia Institute Of Technology

National Center For Advanced Technologies

Texas Instruments

WORK BOOK

for

Video Series

on

Integrated Product And Process Development

Sponsored by the

Acquisition Reform Office, ASN (RD&A)
Department Of the Navy

Overall Perspective

NCAT IPPD Video Series

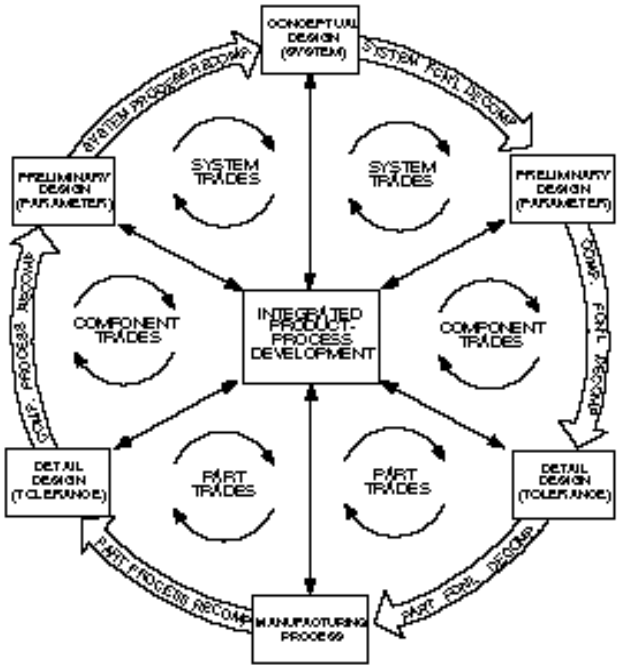
Overall Perspective

Integrated Product/Process Development (IPPD), along with the use of Integrated Product Teams (IPTs), are seen as key enablers for everything from acquisition reform to assuring a focus on affordability in Science and Technology (S&T) program management. IPPD is being implemented in the commercial sector as part of the ongoing Quality revolution to produce world-class competitive products. The Defense Manufacturing Council (DMC) has proposed "An Integrated Strategy for Cost Reduction" to provide Affordable and Supportable Defense Systems. IPPD is seen as a key for implementing this Strategy through providing Affordable Product and Process Technology and Lean Weapons Systems Development, Production and Support. IPPD was defined in 1993 in a National Center for Advanced Technologies (NCAT) industry white paper, prepared by the IPPD Working Group as "a management methodology that incorporates a systematic approach to the early integration and concurrent application of all the disciplines that play a part throughout a system's life cycle." A proposed advanced development IPPD process was also included in the NCAT white paper which provided entrance criteria and exit criteria for an advanced technology demonstration An IPPD management approach, consisting of an IPPD Team, IPPD Process (Methodology) and IPPD Tools.

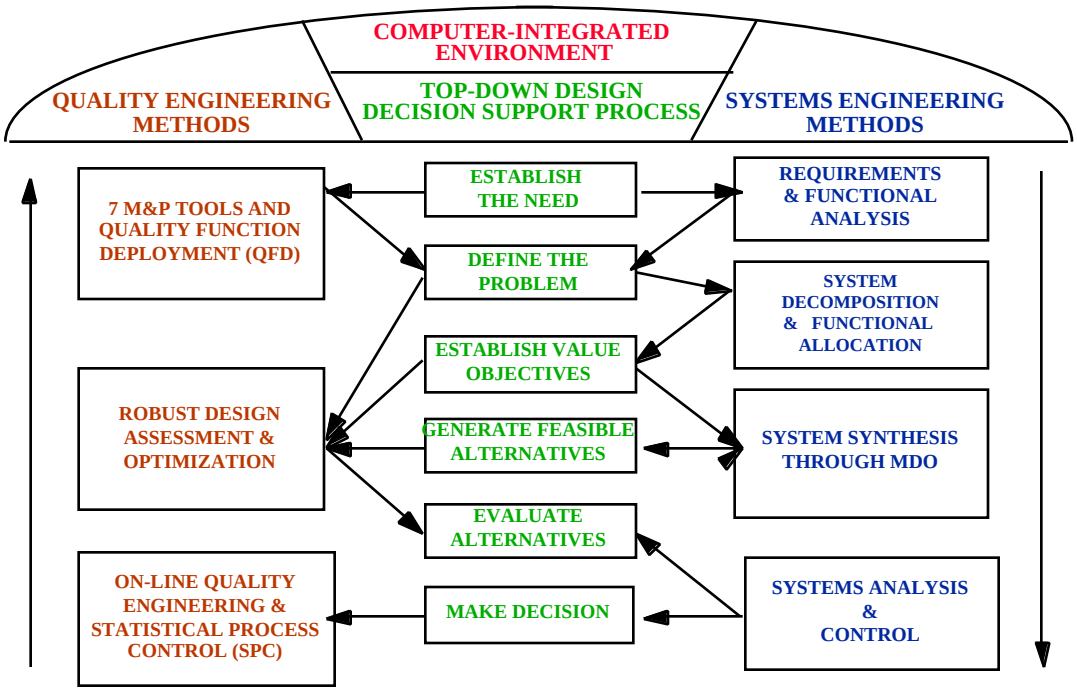
Working with NCAT and industry, Georgia Tech, in its Aerospace Systems Design Laboratory (ASDL) and Systems Realization Laboratory (SRL), has developed a generic IPPD Methodology that is used for education, research and training. Faculty and researchers from these laboratories will be the Georgia Tech presenters at this Workshop. This IPPD Methodology consists of the integration of four key elements: Systems Engineering Methods and Tools, Quality Engineering Methods and Tools, a Top-Down Design Decision Support Process, and a Computer Integrated Environment. This IPPD Methodology provides the means for conducting parallel process/product (cost/performance) design trades at various levels (system, component, part). System Design for Affordability through IPPD is the current thrust at Georgia Tech, using this Methodology.

The series is organized around this generic IPPD Methodology, using the sub-elements of the Top-Down Design Decision Support Process to illustrate how various methods and tools from Quality Engineering and Systems Engineering are utilized. The Seven Management and Planning Tools, in conjunction with Quality Function Deployment (QFD), are utilized to translate the established need (customer requirements) into a defined problem (design requirements). One of the most effective Quality Engineering methods is Robust Design Assessment and Optimization. Two different, but closely related approaches will be presented. One is based on Robust Design Simulation (RDS) where technology targets and upper and lower specification limits are determined using a combination of Design of Experiments (DOE), Taguchi PDOM, and Response Surface Methodology (RSM). The second will be a Six Sigma approach, where process variations are reduced and controlled. The presentation on the Six Sigma approach and an exercise using Six Sigma measures will be provided by an instructor from Texas Instruments, Inc. In addition, several case studies will be presented by industry and government program managers, providing an insight into implementation techniques and problems. These lessons learned span the IPPD methods and tools that are presented in the first eight modules.

While IPPD in general and the generic IPPD Methodology can be exercised by IPTs using manual methods there are considerable advantages for using automated tools. These advantages include cycle time reduction and distributed (across entities) design and development. Distributed design is considered essential in today's competitive and resource constrained environment. The rapid development of information-based technologies, along with virtual/rapid prototyping, are providing a better computer integrated environment for distributed design and development. Presentations on emerging techniques in these areas, along with the utilization of activity-based and process-based costing methods, will also be included.



IPPD as Integrating Function During Decomposition and Recomposition



The Generic Methodology For IPPD

Video Series
on

Integrated Product and Process Development

Sponsored by the

Acquisition Reform Office, ASN (RD&A)

Overview

This Video Series introduces a generic methodology on how to use the Integrated Product and Process Development (IPPD) management process and provides tool application exercises. Current case studies will provide real-world implementation examples. The objective of the series is to: (1) show participants how the IPPD process can produce affordable systems that satisfy the customer's need in less time, and (2) provide knowledge of and experience in using tools that support the IPPD process. Upon completion of these videos and the workbook exercises, each participant should understand the fundamentals of implementing an IPPD program using integrated product teams, problem definition and evaluation methods, activity based process tools, and robust design methods for variation reduction during design.

Introduction

Integrated Product and Process Development is a management methodology that incorporates a systematic approach to the early integration and concurrent application of all the disciplines that play a crucial part throughout the life cycle of a system. This process seeks to use multi-disciplinary teams to optimize the design, manufacture and support of a system through the application of quality and system engineering tools and utilizing industry best practices. In May 1995, Secretary of Defense Perry directed the implementation of IPPD throughout the acquisition process. A DoD Guide to IPPD was drafted in January of 1996 and various departments of the DOD have written IPPD requirements into contracts and RFPs. Industry and academia have been developing IPPD tools and practicing Concurrent Engineering (CE) methods since 1990 in order to reduce cycle time and improve quality. The life cycle cost has proven to decrease steadily with more emphasis on quality through customer focus and robust design. Georgia Tech has been developing and teaching Concurrent Engineering and IPPD tools as part of design since 1990, and NCAT has been leading the use of IPPD for Affordability through workshops and white papers. NCAT and Georgia Tech, together with Texas Instruments expertise in Six Sigma Methods, are able to combine industry and academic experience to present lessons learned and characterize the barriers to effective implementation of IPPD.

Implementation

This video series presently consist of 12 modules, with plans to add several more each year. The first module presents the leaders of DoD explaining why IPPD is important, and why each participant of the U.S. acquisition team should understand the techniques of IPPD. The second module is an explanation of what is to be gained by Implementing an IPPD methodology, and also introduces a generic IPPD methodology for design and development. Each of the subsequent modules deals with a specific method or tools for IPPD, and these tools are introduced in the methodology. There are presently three case studies as part of the series, each presents the IPPD Methods used during the program, and the lessons learned while applying IPPD. This series is specifically tailored to the Department of Navy to assist in the dissemination of IPPD methods and tools for use by project managers and engineers within the Navy Acquisition Community. Specific Modules are:

- **Why IPPD is Important**
- **Introduction to an IPPD Methodology**

- **Defining The Problem: Seven Management & Planning Tools**
- **Quality Function Deployment (QFD)**
- **Robust Design Methods**
- **Six Sigma Quality Process**
- **Teaming: Building A Learning Organization**
- **Creating an IPPD Computing Infrastructure**
- **Case Study: Next Generation Soldier**
- **Case Study: New Attack Submarine**
- **Earned Value and Activity Based Costing**
- **Case Study: Low Cost IFOG**

Presentations, team exercises and case studies are included in the video materials. Both industry and academic representatives, who are experts in the particular topic, will be presenting in the series.

Participants will receive all presentation material (on paper and on disk when feasible), copy of any reference papers, and a workbook in a form suitable for copying. Workshop presentation material may be re-used throughout the DOD acquisition community.