A RESOURCE CONSUMPTION MODEL (RCM) FOR PROCESS DESIGN

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Presentation Overview

- RCM Overview
- RCM Methodology
- RCM Application Example
Goal: Develop a Comprehensive Methodology

- Evaluate process design alternatives
- Cost, time, and utilization metrics
- Volume-based calculations
- Capture economy of scale
- Help evaluate manufacturing strategies
- Contain greater detail to assist analyst
Existing Methodologies

- Engineering Economics
- Cost Accounting and Estimating
- Break-even Analysis
- Design For Manufacture
- Computer Aided Process Planning
- Expert Systems
RCM Methodology

Process Design Problem

Alternative 1
- Resource 1
- Resource 2
- Resource 3
- ... Resource k

Alternative 2

Alternative j

RCM Calculations

Cost
- Resource Cost
- Salvage Value
- Repeat Cost
- Piece Life
- Quantity Delay

Time
- Time Life
- Time Consumption
- Time Delay

System
- Group ID
- Overlap Percent
- Availability
- Batch or Unit

Quantity Constraints
- Time Constraints
- System Constraints

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RCM Methodology Attributes

- Resource Consumption
- Time/Cost/Utilization
- Discrete Calculations
- Visual results
- CIM
Methodology Features

- **Resource parameters**
- **Common Structure**
- **System Effects**
  - Cycle time calculations
  - Availability
- **Repeat Cost Functions**
- **Cost Delay**
- **Computer Model**
Strategies

- Low Cost
- Fast Response
- Flexibility/Agility
- Resource Utilization
Management needs

- Profits
- Control costs
- Risks
- Long-term decisions
- Understanding (cost per unit)
Example - Robotic Welding

- 3 Alternatives: Single, Tandem, Manual
- Cost, time, & utilization comparison
Average Part Cost($) vs Production Volume

Proj: Should the tandem or single torch robotic system be purchased?, for Selected Alternatives

- Tandem Torch
- Single Torch
- Manual Welding
- Single Torch Op2
- Tandem Torch Op2
Total Time (hrs) vs Production Volume
Proj: Should the tandem or single torch robotic system be purchased? for Selected Alternatives

Graph: Total Time Comparison of Alternatives

Total Time (hrs) vs Production Volume
Tandem Torch
Single Torch
Manual Welding

Total Time (hrs)
Production Volume
Graph: Avg. Cost Composition for Tandem - High Setup

Average Part Cost ($) vs Production Volume

Proj = P3, Selected Alt = Tandem Torch Op2

Average Part Cost ($)

Production Volume

BRS  BPS  BWG  BWW  BLW  BLS  Tan1

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Average Part Cost($) vs Production Volume

Proj= P3, Alt= Tand, Selected Res= TWGL

Quantity Constrained
Time Constrained
System Constrained

Average Part Cost($) vs Production Volume

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Average Part Cost($) vs Production Volume
Proj= P3, Alt= Tand, Selected Res= TWW

Average Part Cost($) vs Production Volume
Quantity Constrained
Time Constrained
System Constrained

Production Volume

Average Part Cost($)
Graph: Utilization for Robot System

Utilization vs Production Volume
Proj= P3, Alt= Tand, Selected Res= TRS

Utilization (%) vs Production Volume

- Quantity Constrained
- Time Constrained
- System Constrained
Conclusions

- Includes many relevant factors
- Represents System Dynamics
- Flexible
- Timely Implementation
- Incorporates Additional Capabilities
Conclusions (continued)

- **Limitations**
  - Deterministic approach
  - Computationally intensive
  - Single product
  - Quality trade-offs
  - Other parameter relationships