VAVE Applied in Electronics Contract Manufacturing Services

By:
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Question Period
Introduction

Your Host - Pierre Marquis, Project Manager, VAVE

- Sanmina-SCI Canada since 1995
- Eng Manager
- Quality/Training Manager
- Quality/Store Manager
- Global Account NPI Manager 2001
- Project Manager since 2002
- 22 years in telecom mfg, electronics & PCB fabrication
  - Nortel, Bell Canada, Circo Craft

- MBA (1999)
- B.Sc. Industrial Eng. (1985)
- VE training Feb. 1999
- VAVE Session Facilitator
- Six Sigma Black Belt (2005)
- Based in Montreal
- Member of CSVA

www.scav-csva.org

SOCIÉTÉ CANADIENNE DE L’ANALYSE DE LA VALEUR
CANADIAN SOCIETY OF VALUE ANALYSIS
We focus on delivering the highest-level quality, technology and service to our customers.

- 26 years of operation
- $10+ billion in annualized revenue
- 80+ plants in over 20 countries
- 13M ft.2 of manufacturing capacity
- 48,000 employees
- Market Focused Organization
- Total manufacturing solution
Sanmina-SCI Corporate Overview

Total Solution for Our Customers

Component Manufacturing
- pcb fabrication
- pcb assembly
- backplanes
- cables
- memory modular solutions
- Plastic injection
- precision machining
- enclosures

Systems Design and Manufacturing

Target End Markets
- Communications
- Industrial & Semiconductor
- Personal & Business Computing
- Defense & Aerospace Systems
- Computing & Storage
- Medical Systems
- Multimedia & Consumer
- Automotive

World-class Infrastructure Support Services: Supply Chain Management & Global Oracle ERP
Sanmina-SCI in Canada
- Diverse solution
- Gateway to global services

Ottawa, ON
- PCB Assembly and Test / NPI Center
- System integration & test
- AS9100B Certified

Montreal, QC
- PCB Assembly and Test
- System integration & test

Toronto, ON
- Enclosures
- System integration & test

Calgary, AB
- Design center
Sanmina-SCI Corporate Overview

End-to-End Design Engineering Services

A Complete End-to-End Solution

Mechanical / Thermal Design

Optical Design

Test Development

EMC/EMI Engineering

Reliability Testing HALT / HASS

Product Integrity / Compliance

Signal Integrity

Circuit Design

DFx Services
NPI and VAVE Definitions

• NPI
  • Involves new Form, Fit & Function Product
  • One or many PCBAs
  • Involves EMS DFx activities
    ▪ DFM
    ▪ DFA
    ▪ DFT
    ▪ DFD
    ▪ DFSS
    ▪ RoHS
  • May include enclosure (indoor or outdoor)
  • Solicits Supply Chain Planning
  • Includes Alpha & Beta Product Development Phases

• VAVE
  • Value Analysis Value Engineering
  • A methodology aimed at optimizing the value of a product or a process, existing or under development.
  • It ensures maximum user satisfaction at minimal cost.
DEFINITION OF VALUE

VALUE = \frac{SATISFACTION OF NEEDS}{COST}
VALUE OF A PRODUCT

usage functions
esteem functions
safety
reliability
maintenance
availability
comfort
development cost
design cost
manufacturing cost
operation cost
maintenance cost
disposal cost
Industrial Sector NPI Case Study

Safety Node (Industrial controller for semiconductor’s mfg)
NPI Case Study - Industrial

Workshop Opportunity Discovery

- DIN rail mounted relays
- Costly Device-Net cable interconnect
- DIN rail modem mount
- Panel mount hard wired circuit breaker & Ethernet port
- PS retention bracket
- High cost dual phase forced convection cooled Power Supply (PS)

Existing In-House Customer Originated Design
VE Packaging Objectives

- Simplify assembly process – provide better access for component mounting, wiring and metal part fabrication
- Eliminate Power Supply retainer bracket
- Change sheet metal to RoHS compliant pre-plate CRS
- Select lower cost single phase, convection cooled Power Supply
- Eliminate panel mounted and hard wired components
- Eliminate need for DIN rails and fasteners for Modem and Relay attachment
- Eliminate hard cabled Device-Net interconnect
VE Mech Packaging Result

- Open frame assembly access
- Functional testable subassembly on single chassis element
- Qualified lower cost natural convection cooled Power Supply
- Collapse multiple sheet metal piece-parts into single net shapes
- Eliminated 23 mechanical BOM line items
- Passed validation and compliance testing during first round!
**NPI Case Study - Industrial**

**Workshop Opportunity Discovery - Electrical**

- Logic and Interconnect PCBA’s
- Relays Termination Cables Connectors
- Ethernet Port & 4 LED’s
- Euro Round Turck Connectors
- RJ45 D-Sub Tyco
- Circuit Breaker Thermal Fuse
- DeviceNet Buss EtherNet System
- Ethernet Port Relocate
VE Electronics & Interconnect Objectives:

- Cost Reduce Two PCBA’s
- Simplify BOM / Upgrade Component Technology
- RoHS Conversion
- CE Compliance
- Improve Weight
- Power Supply Must Be F47 Compliant
- HALT Testing Acceptance
VE Electronics Results

- One PCBA System
- Eliminate Cables
- Clean-up OBS/EOL
- RoHS Compliant
- Full DFT
- Automated Assembly
- Simplify BOM
- Reduce Components
- SW Seamless
- Logic Redesign Circuits

- Integration Assembly Ease
- Compliant Power Supply
- Met Space Constraints
- Improved Wiring
- High Reliability
- Lower Maintenance
- Multi Platform Usage

- HALT Yield Zero Defects
- Passed Thermal Analysis
- AVL Qualified/Certified
- FRU Satisfied
- Improved Weight
- CE/EMC/Semi F47

<table>
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<th>Before VAVE Unit Cost</th>
<th>VAVE Target Unit Cost</th>
<th>Actual Unit Cost</th>
<th>GM</th>
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<td>$4,994 (DCR 25%)</td>
<td>$4,476 (DCR 32%)</td>
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Payback Period Less Than One Business Quarter Manufacturing
Benefits of VE

- Increased understanding of client’s need and their relative importance
- Reduced cost
- More efficient team
The multidisciplinary team

Is composed of a representative of all the disciplines involved in the subject being studied
VAVE Process Applied to NPI

Building a team

VAVE for a Product at NPI Stage
- Accounting / Cost Prime
- Component Eng
- Design Engineers (hard. soft. electrical)
- Industrial Eng.
- Marketing / Sales
- Product / Quality Eng.
- Purchasing
- Test Eng.
- Moderator
The VAVE Job Plan: 7 phases

**STEP**
- Organization
- Information exchange
- Function and cost analysis
- Creativity
- Evaluation
- Development and Presentation
- Implementation and follow-up

**WHEN vs SESSION**
- Before
- Before
- During
- During
- During
- After
- After
### Step 5 - Evaluation phase

#### SCORE MATRIX

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<tr>
<th>Difficulty</th>
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<td>High</td>
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NPI Case Study – Image Processing System

- Joint SANM/Customer VAVE Session
  - MAIN PROBLEMS
    - Thermal issues with 1st proto
    - Actual cost is over target by 50%
    - Annual volume 1300 (yr 2)
  - SOLUTIONS from VAVE
    - SANM proposed thermal analysis
    - AVL Subs identified: $800k / yr CR
    - Use vacuum forming on cover: $200k / yr CR
    - PCBA re-design: 80% CR Potential (or $10M/yr)
  - Potential Annual Savings: $11M (Payback Period < Two Months)
Map and Characterize the Product’s Value Path Into Sanmina-SCI Technology: Opportunities Evaluated

- Integration Of Optical Circuit Pack Main/Child/Mezzanine Cards Into Single 11x17 PCB
- Integration Of Optical Laser Transmit & Receive Daughter Cards Into Single 9x3.5 PCB
- Alternate AVL Optical Components
- Elimination Of Connectors
- Remove Delay Component Lines, Replace With Etch
- Substitute AVL Low Cost Parts (Oscillators)
- Substitute Power Bricks For Reduced Cost
- Replacement Of Obsolete/EOL Components
- Dramatically Improve Fiber Management
- Reduce In-Process And Field Failures With 100% DFT

Before
Re-design Case Study – Optical Circuit Pack

**Result:**

- Integrated seven PCBAs into three
- Substantially improved thermal performance
- Provided base platform for product family reuse
- Six month elapsed time: concept – engineering - NPI to volume release

Total Redesign Manufacture Cost Savings Exceeded 30%, per add/ drop pair! Profit Margin Measured At Sales Increased By 18% Per Add / 22% Per Drop
• Joint Sanmina-SCI / Telecom Customer VAVE Session
• Protos Completed & Approved within 6 Months
  • Affected 15 parts on a Internet Switch Assy
    • Introduced Two New Memory IC AVL: 42% CR
    • Eliminated Three Temperature Sensors: 60% CR
    • Eliminated 4 unused connectors (over 15): 27% CR
    • Introduced a new Heat Sink AVL: 65% CR
    • Re-designed ship box packaging: 15% CR + Product Quality Improved
• NREs: $20K
• Annual Savings Realized: $1.75M (Payback < One Month)
SANMINA-SCI Proposal on 1U Chassis Packaging re-design

**ACTUAL DESIGN**
Actual packaging consisting of:
- 1x outer box, RSC 200BC, kraft, printed 1 color
- 3x anti-static polyethylene foam end caps inserts

**NEW DESIGN**
Proposal packaging consisting of:
- 1x outer box, FOL 275C, kraft, printed 1 color
- 1x die-cut corrugated, 275BC, kraft, insert
- 1 ESD bag (not shown on picture)

**PRICES** (based on annual usage of 25k, 2000 per production – FOB Guad)

**TOTAL**
- $7.40/kit

**TOTAL**
- $5.19/kit (-30%)

**SHIPPING BOX SIZE**
- Actual: 20 1/8 x 4 7/8 x 19 ¾ (1.12 cu.ft)
- New: 18 ¾ x 2 7/8 x 19 ½ (0.59 cu.ft.) (-47% volume)

**OTHER ADVANTAGES**
- Less warehousing space if shipped flat
- Reduced logistics costs for Customer
OVERVIEW of VAVE Process (26 wk)

- Select VAVE candidates & Define scope;  
  - Week 1-2
- Establish Team Members (Customer & SANM);  
  - Week 1-2
- Prepare & distribute preliminary information  
  - Week 3
  - Costed BOMs, AVLs, product flow chart, labor content
- Conduct VAVE session (one or two days);  
  - Week 4
  - Establish cost by function, brainstorm on CR ideas
- Produce VAVE report for follow-up
- Follow-up on CR ideas - weekly conf. Calls;  
  - Week 5-11
- Write business case & Approve in SANM;  
  - Week 12
- Present business case to customer for approval;  
  - Week 13-14
  - Obtain P.O. for NREs (if applicable)
- Produce FPEs & Perform tests (ICT, FCT, PI, etc);  
  - Week 15-23
- Implement design documentation changes  
  - Week 24-26
Conduct VAVE Session (1 day)

- Introduction & Session Goal by animator;
- Presentation of PCBA (or enclosure) functions by customer designer;
- Presentation of mfg flow, labor times & quality issues by product eng;
- Presentation of major cost components by cost prime;
- Discussion on functions of major components & their worth, with customer designer;
- Brainstorm on CR ideas, capture of ideas by animator;
- Screening of ideas captured by team (score matrix);
- Do an action plan, including delegation of responsibilities;
  - Use of SANM, Excel forms developed for VAVE sessions
- Establish a schedule for follow-up (e.g. regular conf calls).
CONCLUSION

- VAVE allows SANM’s customers to increase their client’s satisfaction, while reducing cost
- VAVE at NPI stage ensures best ROI
- VAVE is indispensable in our global and competitive business environment
QUESTIONS ?
MERCI !
THANK YOU !

REFERENCES
Source: Nguyen-Parrot
Lucie Parrot, ing. CVS
Techniques of Value Analysis and Engineering (3rd edition)
By Lawrence D. Miles