VAVE Applied in Electronics Contract Manufacturing Services

By:
Pierre Marquis, Project Manager, VAVE

Toronto CSVA Conference

October 28th, 2008
Agenda

- Introduction
- Sanmina-SCI Corporate & Canada Overview
- NPI and VAVE Definitions
- VAVE Concept
- VAVE Process Applied to NPI
- NPI VAVE Case Study – Image Processing System
- NPI VAVE Case Study – Battery Pack
- Re-design Case Study – Optical Circuit Card
- VAVE Case Study – Ethernet Switch M/B
- NPI Case Study in Packaging
- Conducting the VAVE Session
- Question Period
- Back-up slides: Supervisory Data Access Point Terminal
  - NEBS III Compliant HDSL Shelf
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
- 23 Years in Telecom Mfg, Electronics & PCB Fab
- Nortel, Bell Canada, Circo Craft, Toptech

- 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
We focus on delivering the highest-level quality, technology and service to our customers.

- 27 years of operation
- $8 billion in annualized revenue
- 80+ plants in over 19 countries & 5 continents
- 13M ft.2 of manufacturing capacity
- 40,000 employees
- Market Focused Organization
- Total manufacturing solution
Sanmina-SCI Corporate Overview

Total Solution for Our Customers

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
- Enclosure Design & Manufacturing
- System integration & test

Calgary, AB
- Design center
Sanmina-SCI Corporate Overview

End-to-End Design Engineering Services

Mechanical / Thermal Design. Enclosure “Should cost” with Boothroyd-Dewhurst

Signal Integrity

Circuit Design

DFx & VAVE Services

A Complete End-to-End Solution

Optical Design

Test Development

EMC/EMI Engineering

Reliability Testing HALT / HASS

Product Integrity / Compliance
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, REACH & WEEE
  - 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

\[
\text{VALUE} = \frac{\text{SATISFACTION OF NEEDS}}{\text{COST}}
\]
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
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
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
- During
- After
### Step 5 - Evaluation phase

#### SCORE MATRIX

<table>
<thead>
<tr>
<th>Difficulty</th>
<th>Benefits</th>
<th>Score</th>
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<tr>
<td>Low</td>
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<td>High</td>
<td>Low</td>
<td>1</td>
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<tr>
<td>High</td>
<td>High</td>
<td>3</td>
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</table>
Joint SANM/Customer VAVE Session

MAIN PROBLEMS / FACTS
- 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)
NPI Case Study – Battery Pack

JOINT SANM/OEM CUSTOMER VAVE SESSION (Jan 2008)

BEFORE (12 parts)
- Three AA Batteries
- Six Clips
- Three Shrink Tubes
- Five Minutes Assy Time

AFTER (2 parts)
- One Battery Pack
- One SMT Connector
- One Minute Assy

SAVINGS
- 59%
- Consumer Product: Will Generate Annual Savings > $1M
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)
NPI Case Study in Packaging

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**
- ACTUAL DESIGN: $7.40/kit
- NEW DESIGN: $5.19/kit (-30%)

**Shipping Box Size**
- ACTUAL DESIGN: 20 1/8 x 4 7/8 x 19 3/4 in (1.12 cu.ft)
- NEW DESIGN: 18 1/4 x 2 7/8 x 19 1/2 in (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 Design & NPI stages 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
NPI Case Studies

Supervisory Data Access Point Terminal and NEBS III Compliant HDSL
## Supervisory Data Access Point Terminal Case Study

<table>
<thead>
<tr>
<th>DCR IDEA</th>
<th>Risk</th>
<th>Mitigation</th>
<th>Change HW</th>
<th>Change SW</th>
<th>PCB Spin</th>
<th>Value</th>
<th>$ Unit Est. CR</th>
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<tr>
<td>Housing Redesign</td>
<td>Low</td>
<td>Model &amp; Prototype</td>
<td>Yes – I/O Plate</td>
<td>NA</td>
<td>NA</td>
<td>5 - 8%</td>
<td>1 - 2</td>
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<td></td>
<td></td>
<td></td>
<td>Yes – Minor Tool</td>
<td></td>
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<tr>
<td>Packaging</td>
<td>Low</td>
<td>Model &amp; Prototype</td>
<td>Yes – Box/Inserts</td>
<td>No</td>
<td>NA</td>
<td>10 - 20%</td>
<td>1 - 2</td>
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<tr>
<td>Power Supply External Brick</td>
<td>Low-Med</td>
<td>Supply Chain</td>
<td>Yes – AVL BOM</td>
<td>No</td>
<td>NA</td>
<td>5 - 10%</td>
<td>1 - 2</td>
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<tr>
<td>Prox Reader PCBA</td>
<td>Low-Med</td>
<td>Design DFx &amp; Prototype</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>25 - 30%</td>
<td>12 - 15</td>
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<td>Display Assembly</td>
<td>Low</td>
<td>Supply Chain</td>
<td>Yes – Minor</td>
<td>No</td>
<td>No</td>
<td>10 - 15%</td>
<td>4 - 6</td>
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<tr>
<td>32 MEG SDRAMM</td>
<td>Low-Med</td>
<td>Design DFx &amp; Prototype</td>
<td>Yes – Minor</td>
<td>No</td>
<td>Yes</td>
<td>40 - 60%</td>
<td>5 - 8</td>
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<tr>
<td>BOM AVL Suppliers</td>
<td>Low</td>
<td>Component Certification Quality Testing</td>
<td>No – Crosses Yes - Substitutes</td>
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<td>Yes</td>
<td>5 – 10%</td>
<td>7 - 13</td>
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<td>Retarget FPGA</td>
<td>Med</td>
<td>Component Engineering &amp; Certification Testing</td>
<td>Yes – Substitutes</td>
<td>No</td>
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<td>5 – 10%</td>
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<td>SODIMM</td>
<td>Low-Med</td>
<td>Redesign Based On BOM Rev</td>
<td>Yes</td>
<td>No – FW Possible</td>
<td>Yes</td>
<td>25 – 35 %</td>
<td>6 - 8</td>
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### Annual Cost Reduction

$1.8 M - $2.8 M Range

Based On EAU = 40K

### Unit Cost Reduction

$45 - $70 Range (15-25%)

ROI = One Business Quarter
NEBS III Compliant HDSL Case Study

Telecom Customer Issues
- Sub-standard Thermal Performance
- High Cost
- Reliability

Solution: Shelf Construction
- Three major structural elements
- Unstressed backplane
- Precision fit and alignment

Solution: Shelf Construction
- Minimal mechanical fasteners
- Mating attachment features avoids shear stress failure and eliminates gasketing
- Common LH/RH parts
- Formex Plastic sheets
Fully integrated NEBS III Compliant HDSL Shelf

- Sheetmetal enclosure (SANM Calgary Design, includes Thermal)
- High density Midplane – no cables required (SANM Salem Design)
- PCB/PCBA
- Cooling module
- Dual high current PIMs
- Material CR of 40%, Labor CR of 7%