

Relative Cost for Backplanes and Blades

John D'Ambrosia
Tyco Electronics

john.dambrosia
@tycoelectronics.com

Jimmy Sheffield
Tyco Electronics

jimmy.sheffield
@tycoelectronics.com

Joel Goergen
Force10 Networks

joel@force10networks.com

Goals

- Establish a baseline stackup for line card and backplane for costing purposes
- Explore relative cost impact with different options on cost of board only
 - Counterboring
 - Use material extremes
 - Use smaller diameter holes
- Have quoted by different board shops globally
- Material extremes chosen initially
 - Nelco 4000-6 (base)
 - Rogers 4350

Does Not Include -

- Component costs
 - Chips
 - Thermal management
 - Connectors
- Board assembly costs
- Rework costs
- Impact on shipping packaging costs
- Impact on mechanical enclosure costs caused by brittleness or softness of board materials
- Materials qualification costs

General Description of PWB Houses

- House A - high volume multi-layer line cards (Europe)
- House B – low/mid volume, focus on military & special technology products (Monster boards) (US)
- House C – mid volume large backplanes (US)
- House D – large volume line cards and backplanes (Asia)
- House E – large volume line cards / backplanes (US)
- House F – large volume line cards / backplanes (Asia)
- 3 houses are Tyco 3 houses are not

Considering the Stackup

“The longest traces in a backplane must be distributed throughout the entire stackup. Selective use of materials on certain layers will not provide enough routing channels for these tracks. This issue grows as you move from a central switching architecture to a mesh architecture. “

Robert Jardon

Jardon Engineering

Director of Technology

FYI – Robert did all the routing studies for PICMG ATCA

Line Card Summary

- General Description
 - Size: 280mm x 322.25mm (11.024" x 12.687")
 - Thickness: 2.4mm +/- 0.2mm (0.094" +/- 0.008")
 - No. Holes: ~10,000, Min Hole Size: 0.018" finished
 - No blind / buried vias
 - Impedance Control: 100 Ohm differential +/- 10%
 - Layers 18
 - Quote quantities: 10, 100, 1000, 5000, 25000
- Board 1A
 - 4000-6
 - All costing based to Board1A costing
- Board 1B
 - Same as Board 1A, except 3 levels of counterboring added.
- Board 1C
 - Same as Board 1B, except Rogers 4350 used for signal layers instead of 4000-6
- Board 1D
 - Same as Board 1A, except Min Hole Size: 0.0135" finished

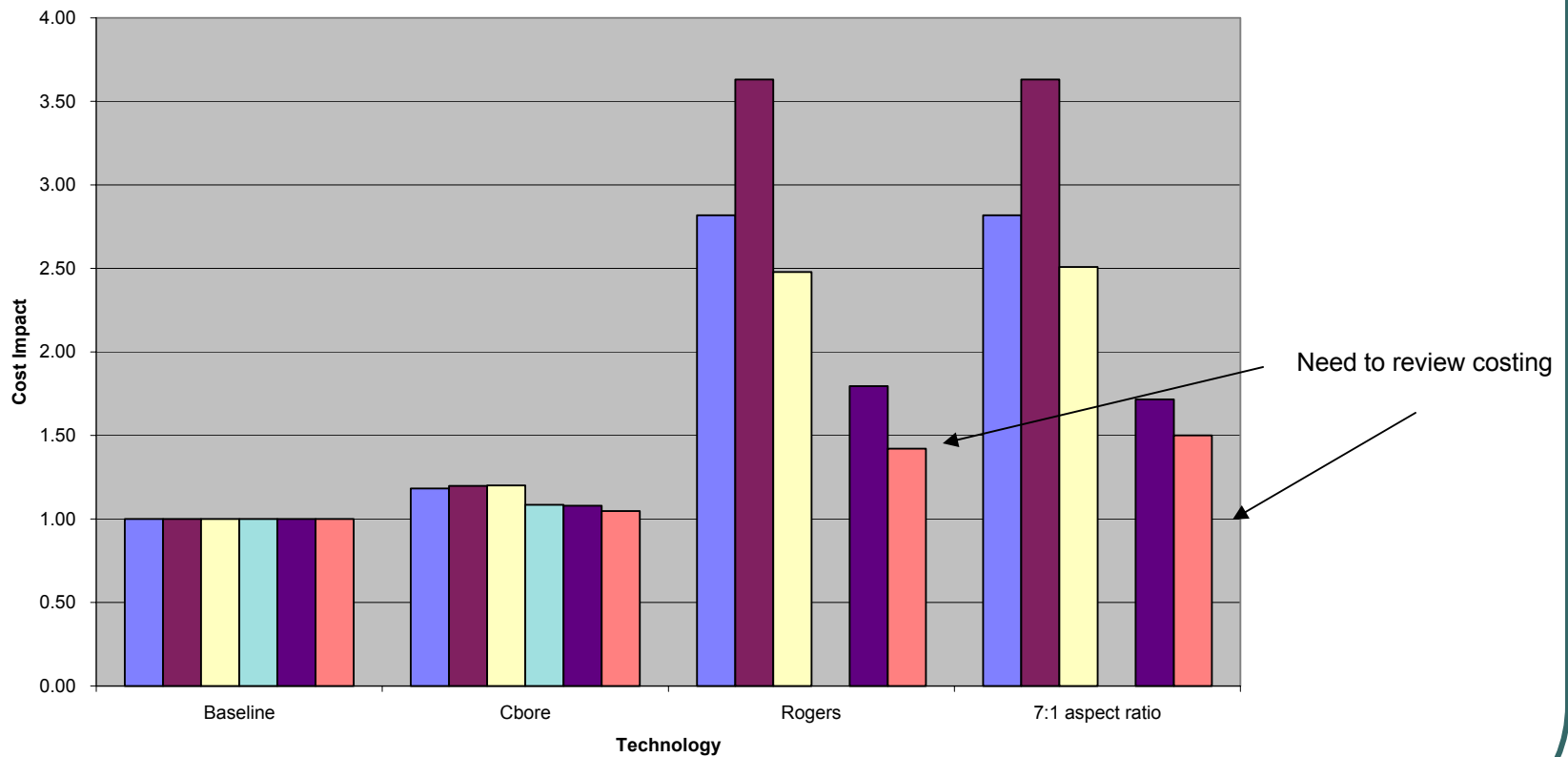
Backplane Summary

- General Characteristics
 - Size: 430mm x 216mm (16.929" x 8.504")
 - Thickness: 5.59mm +/- 0.56mm (0.220" +/- 0.022")
 - Min Hole Size: 0.022" finished (press-fit), No. of Holes: ~6,500
 - Impedance Control: 100 Ohm differential +/- 10%
 - Layers: 30
 - Quote quantities: 10, 100, 1000, 5000, 25000
- Board 2A
 - Based on Nelco 4000-6
 - All costing based to Board 2A costing
- Board 2B
 - Same as Board 2A, except 3 levels of counterboring added.
- Board 2C
 - Same as Board 2B, except Rogers 4350 used for signal layers instead of 4000-6
- Board 2D
 - Same as Board 2C, except Min Hole Size: 0.0135" finished (high-aspect ratio)

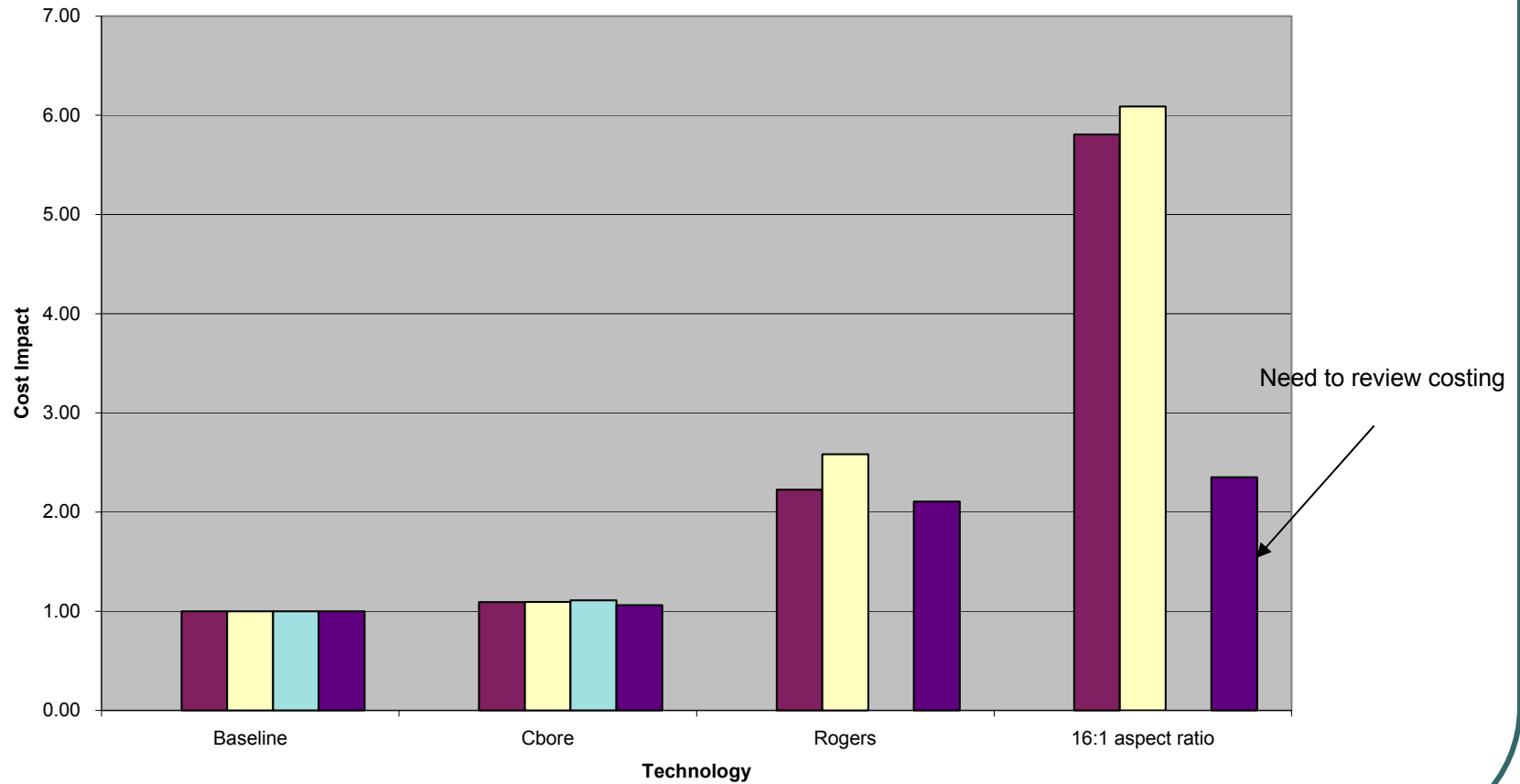
Quoting Summary

- 6 different board houses have responded to date
 - 4 US Based
 - 1 EMEA
 - 1 Asia
- Some line card configurations were no-quoted
- Some backplane configurations were no-quoted
- Reasons vendors didn't quote
 - Board thickness
 - Rogers material availability

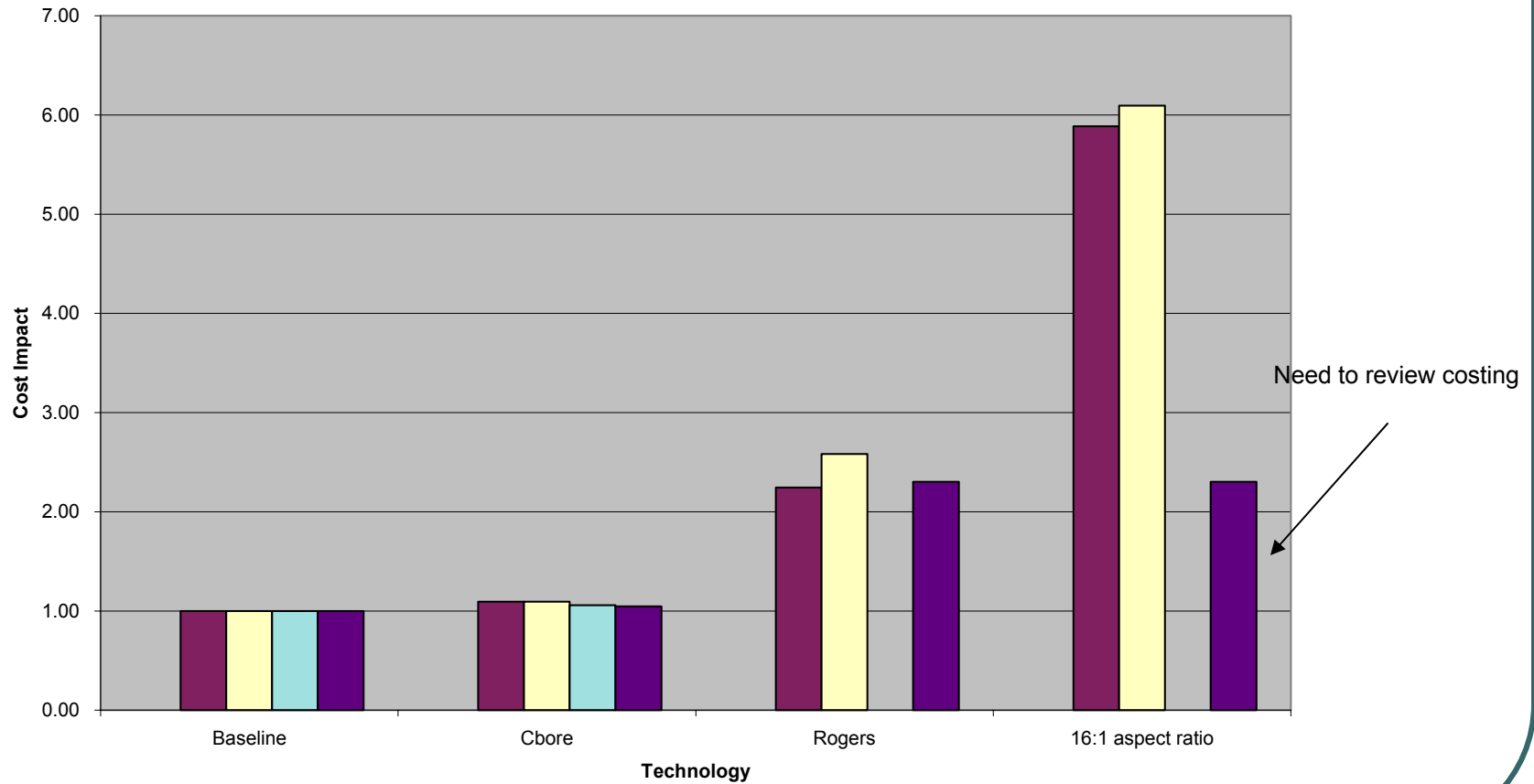
Line Card Quote (25K) Summary



Backplane Quote (1K) Summary

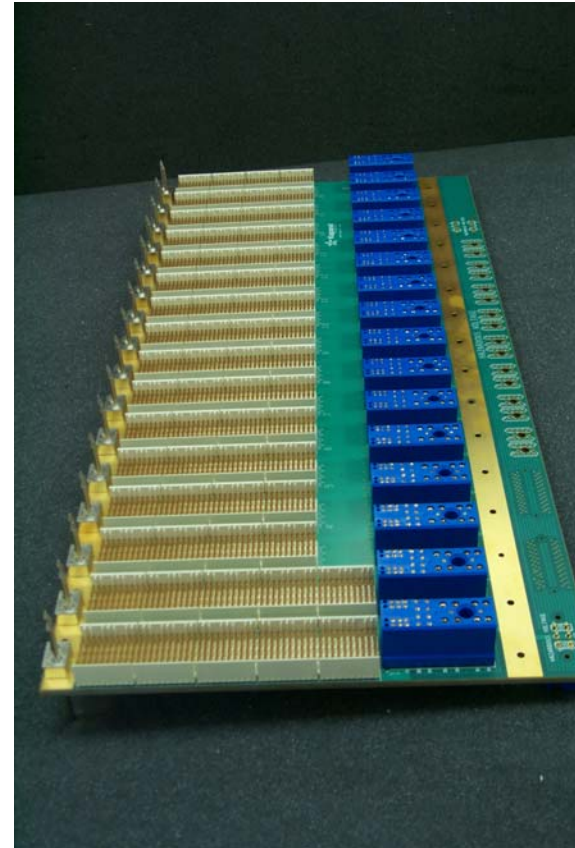


Backplane Quote (25K) Summary



Relative Cost Related to Implementation

- Tyco Electronics HM-Zd QuadRoute Implementation
 - 4.75 mil wide traces
 - Routes 2 pair in-between signal columns
 - 20 layers board with 8 signal layers, 3.175mm
 - Same routing density as 36 layer design
 - Reduces stub effect
 - Approximate 5:1 aspect ratio
- Cost Comparison
 - 4000-13 – Material – 2x over 4000-6
 - Board Cost - Estimate 30% cost savings over 36 layer 4000-6 design
 - Typical panel size
 - Typical production quantity
- Kaparel
 - Full Mesh ATCA backplane using QuadRoute technique
 - 18 layers



Summary on High Volume Board Costing

- Line Cards
 - Adding Counterboring – minor cost adder
 - Adding Rogers 4350 – major cost adder
 - 2.5 – 3.5x cost quoted
 - Reduced # of vendors quoted
 - Adding Reduced via size(7:1) – minor cost adder
- Backplanes
 - Adding Counterboring – minor cost adder
 - Adding Rogers 4350 – major cost adder
 - 2.25 – 2.5x cost quoted
 - Reduced # of vendors quoted
 - Adding reduced via size (16:1) – major cost adder
 - Significant cost adder – approximately 6x cost quoted
 - Implementation can make a difference
 - Need to consider material and processing costs
- Need to review costing from some houses