



The World Has Changed.

Has Your In-Circuit Test Strategy
Changed with It?

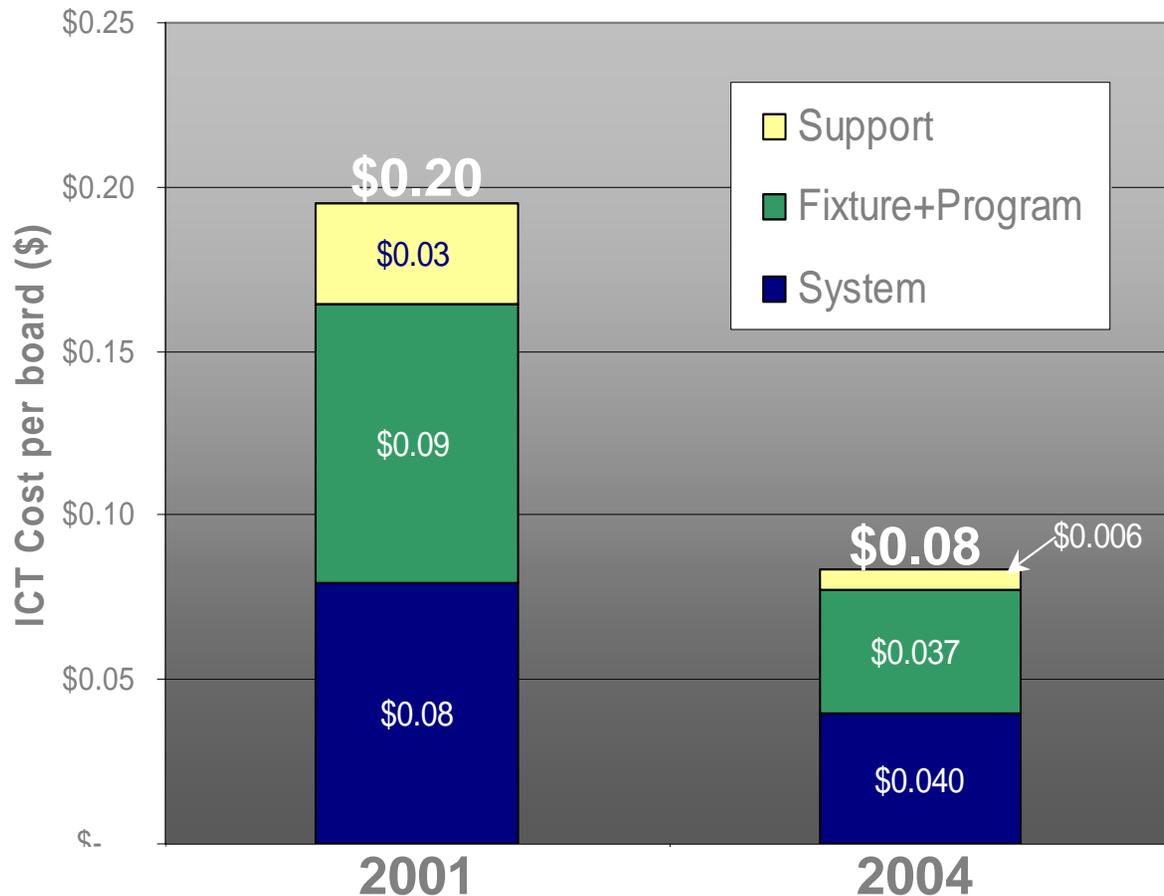
Affordable Manufacturing Test Solutions

Ask yourself a few tough questions about your current board test reality

- Is overall in-circuit effectiveness declining even though your testers are supposed to handle increasingly complex boards?
- Are you trying to implement increasingly complicated boards using fewer test engineering resources?
- Do you have too many in-circuit testers but not enough vendor support?
- Do fixture and programming costs look like they're careening out of control?
- Does your tester have complex digital pin electronics that you rarely have the time or resources to use?
- Are you examining emerging test and inspection technologies like Boundary Scan, AOI or AXI, but can't find the budget to fund them?

...If you answered 'yes' to one or more of these questions, it's time for some new thinking about test strategy.

One OEM who asked these questions has saved more than 60% in testing cost in just three years.



Testers in Use	
2001	2004
20 - A3X7X	5 - A3X7X
11 - Z18XX	35 - CheckSum

Production volume increased 20% during this period.

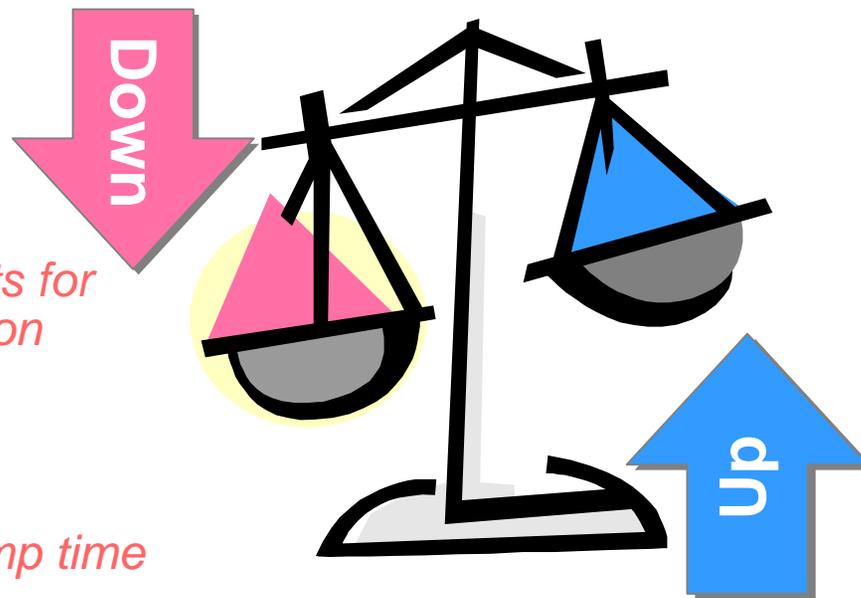
A large OEM reduced ICT cost per board by 60% in just three years by replacing traditional in-circuit testers with CheckSum Analyst systems.



How? By recognizing that the 'testing truths' of just a few years ago don't work as well anymore

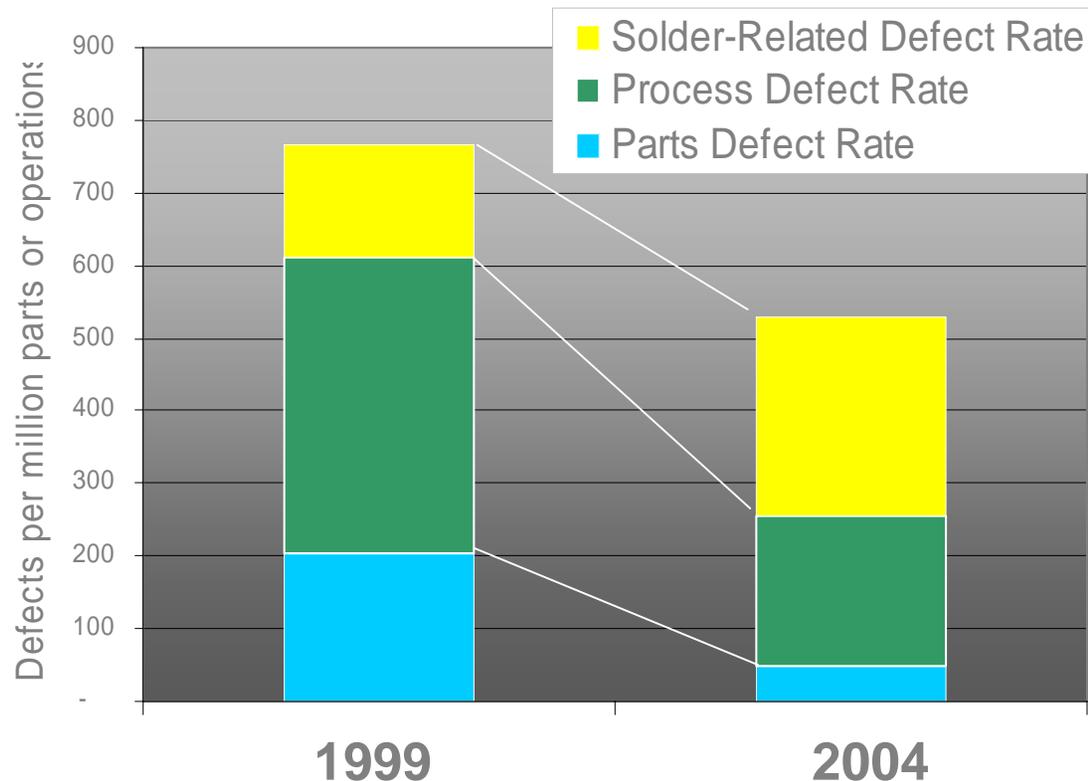
The balance of issues affecting the circuit board test world has changed a lot since 1999:

- *Capital budgets for test & inspection*
- *In-house test engineering resources*
- *Production ramp time*
- *ATE vendor support*



- *Overall board & parts (ppm) quality*
- *Manufacturing yields*
- *Pressure on mfg. cost*
- *Assembly beat rate*
- *Use of automated imaging technology*
- *Circuit density*
- *Digital complexity*
- *Mixed signal/ SOC*
- *Device speed*
- *Fixture & program cost*

The fault spectrum has shifted

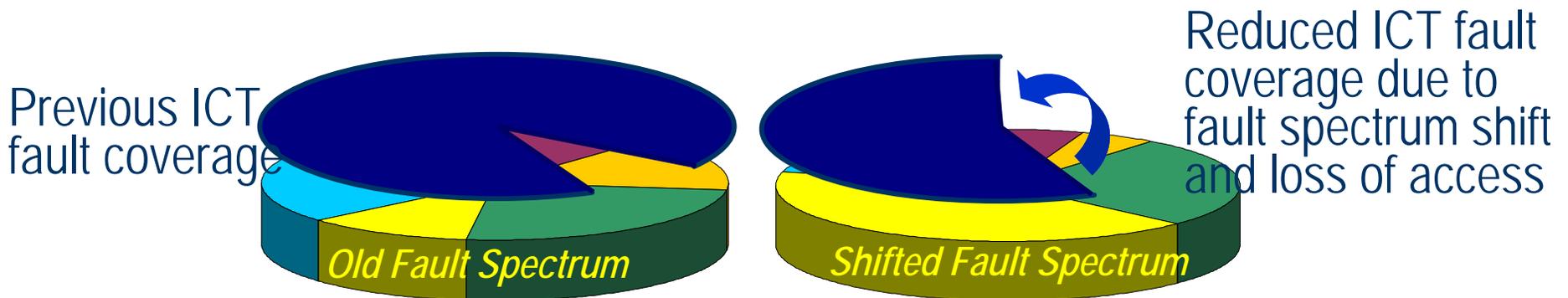


What's changed

- Solder defect rate has increased as SMT opens predominate over through hole shorts.
- Solder defects are now mainly quality-related that are well addressed by Automated Imaging.
- SMT process defect rate is lower than through-hole rate.
- Overall parts defect rate has decreased dramatically, especially for digital ICs.

As defect rates have decreased, assembly yields have increased and the distribution of fault types has shifted.

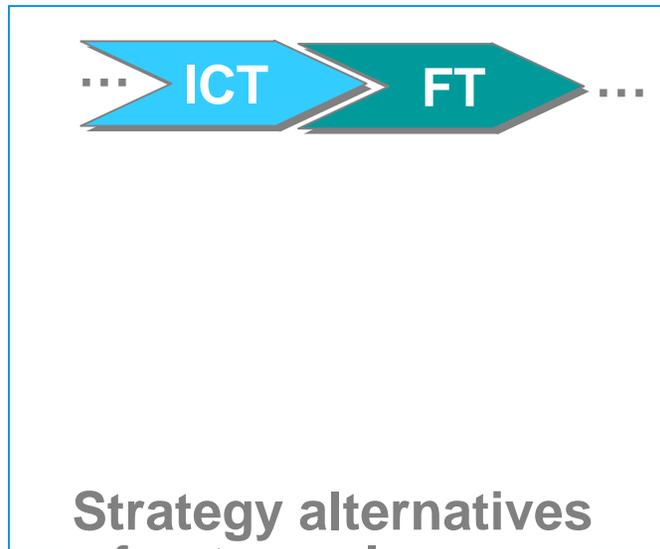
In-circuit test has become less effective, driving the search for alternatives



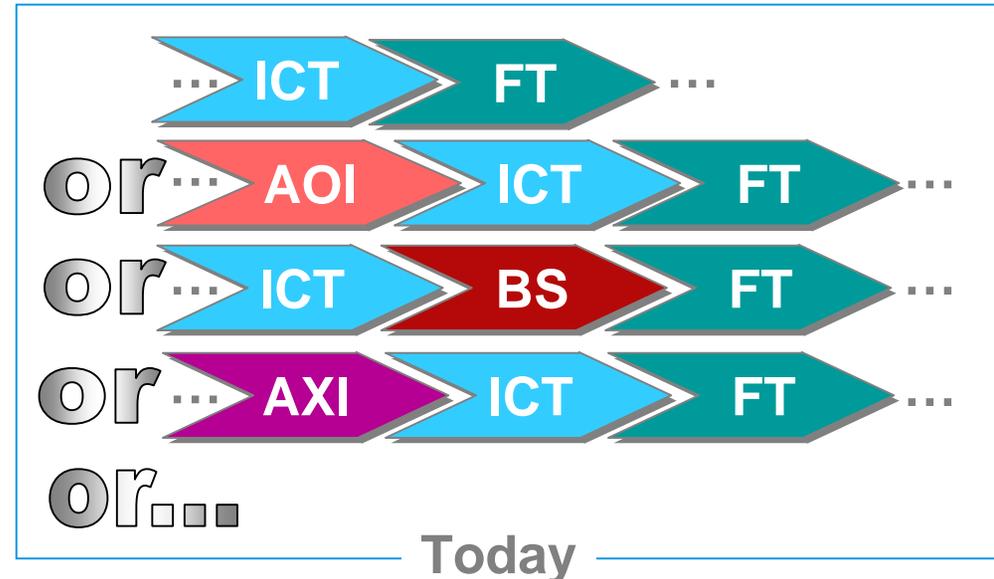
- Fewer parts failures and the shift from shorts to opens as the predominant solder defect have shifted the fault spectrum away from ICT's strengths.
- Increasing device & board speeds prevent placing test pads on boards, resulting in 'loss of access' (LOA) for in-circuit bed-of-nails fixtures.
- Complex devices make traditional in-circuit 'backdrive' testing expensive and impractical.
- New package types such as BGAs further increase loss-of-access.

Nevertheless, ICT remains the most cost-effective means to capture parts, process and solder defects on boards.

Alternative test approaches & budgetary pressures demand reevaluating the overall test strategy

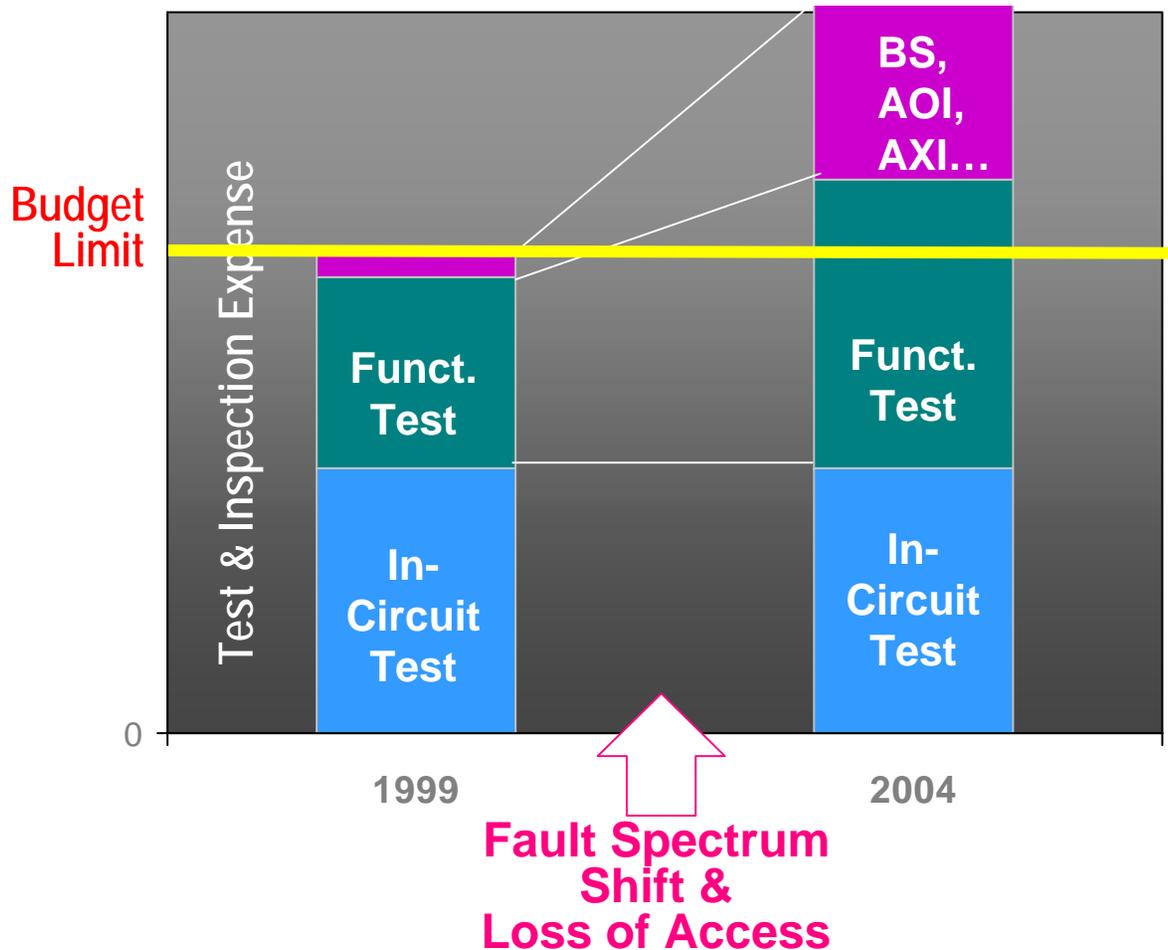


Strategy alternatives of not very long ago



- Test strategy complexity grows geometrically as more test and inspection alternatives become available.
- The key to test strategy design is knowing & matching the board's test requirements to the most effective means to meet those requirements.

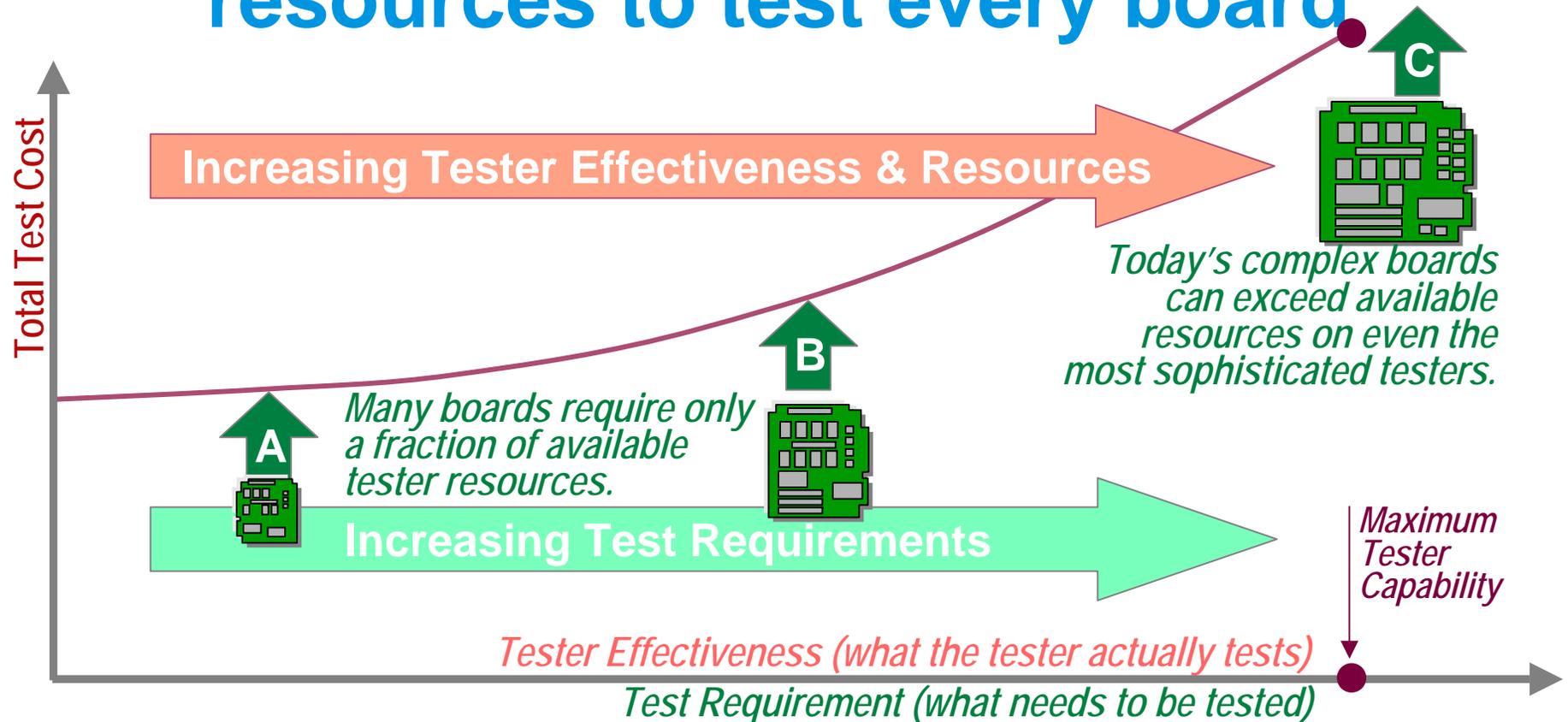
But the expense of compensating for reduced ICT effectiveness 'busts the budget'



The Budget Dilemma

- The fault spectrum shift and loss of access have reduced ICT effectiveness.
- Driving the search for test & inspection alternatives such as Boundary Scan, AOI, AXI.
- And greater board complexity has increased functional test cost.
- But even if the T&I budget has remained flat, the expense of adding alternatives will exceed available budget.

The traditional ICT 'Default' strategy: use a tester with maximum available resources to test every board

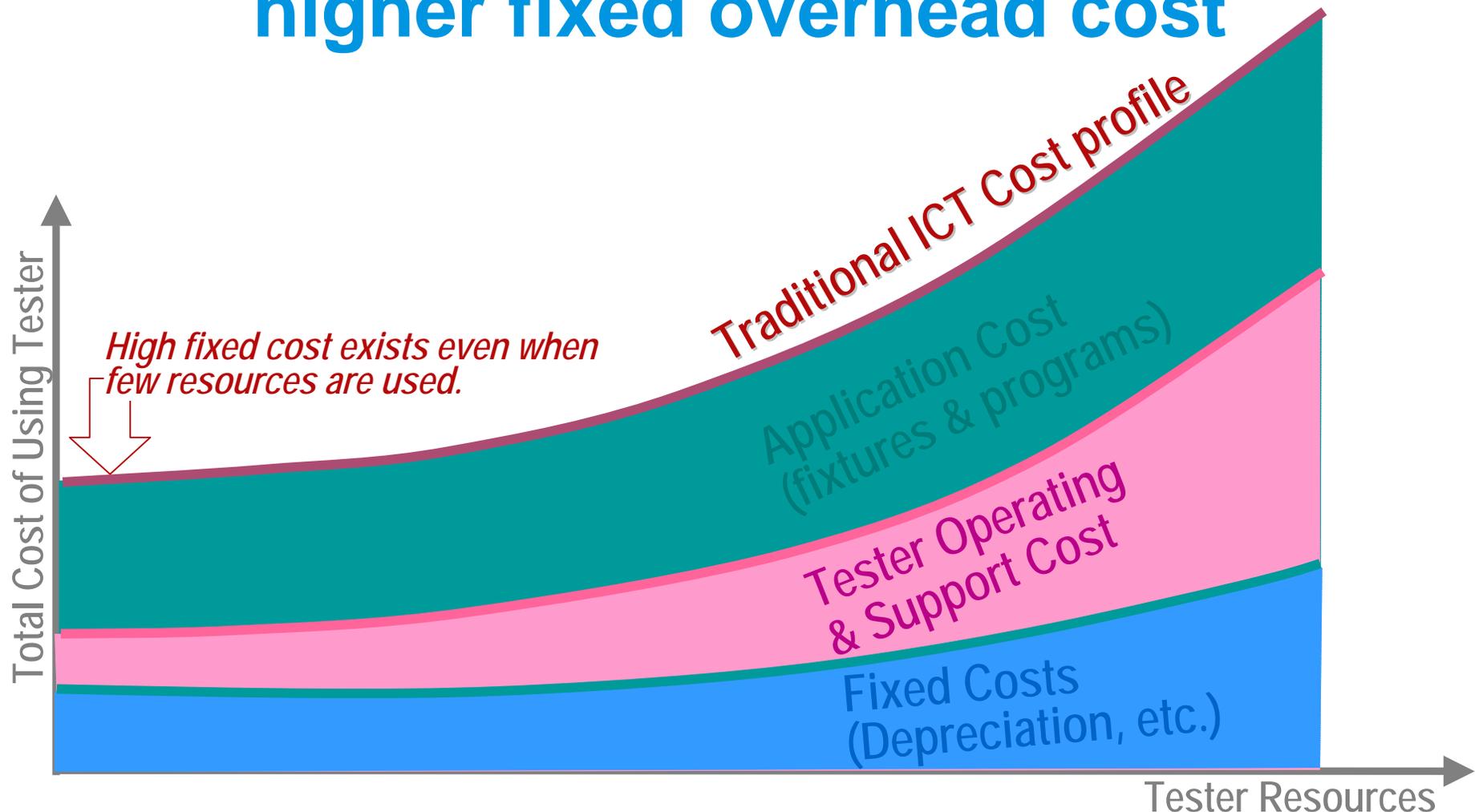


Typical Default Test Strategy rationale:

- “No matter what’s on the board, the tester will be able to handle it.”
- “Just using one tester simplifies test development and test strategy.”

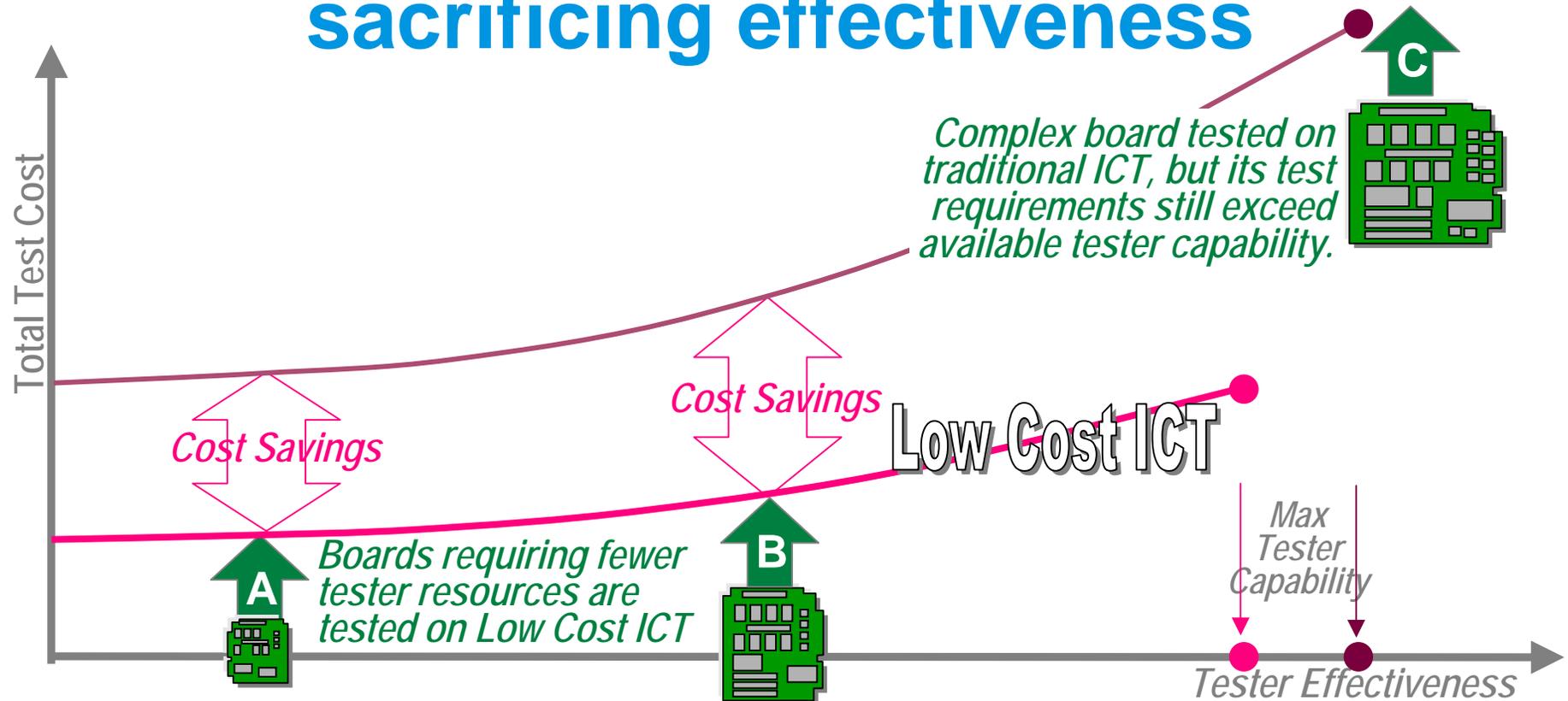
But the Default Test Strategy always incurs higher costs.

Why? More tester resources means increased system complexity and higher fixed overhead cost



Complexity and cost increase hand-in-hand...

Low Cost ICT uses a platform that reduces overhead cost without sacrificing effectiveness



Low Cost ICT foregoes the complexity and cost of tester elements that the shifted fault spectrum has made effectively surplus.

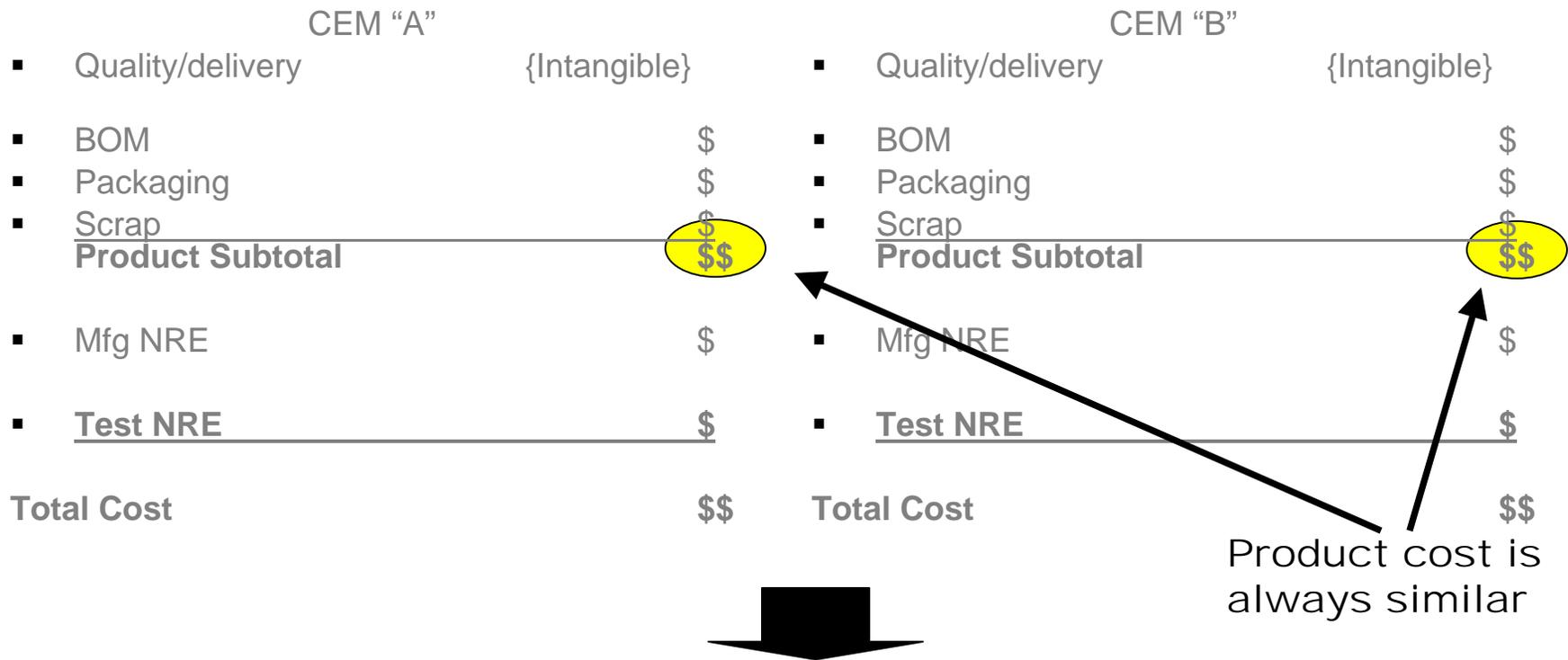
- More reliable, more complex digital parts eliminate the requirement for high cost—and increasingly less effective—digital backdrive.
- Fewer defective analog parts mean reliable solid state switching can replace failure-prone reed relays with virtually no impact on test coverage.

Reasons test managers resist the Low Cost test strategy

1. Fixed cost is “free.”
 - “The testers we’re using are already on the books; they may even be written off.”
2. Variable cost is “almost free.”
 - “I can use the same support and applications infrastructure I’ve developed over the years.”
 - “No training costs for new equipment.”
3. I’ve already got four different brands of in-circuit testers, my manager wants to standardize and now you want me to add *another* one?
4. Fixture and program cost is NRE and is paid for by the customer.
 - “I don’t save any money by buying a less expensive fixture or program.”

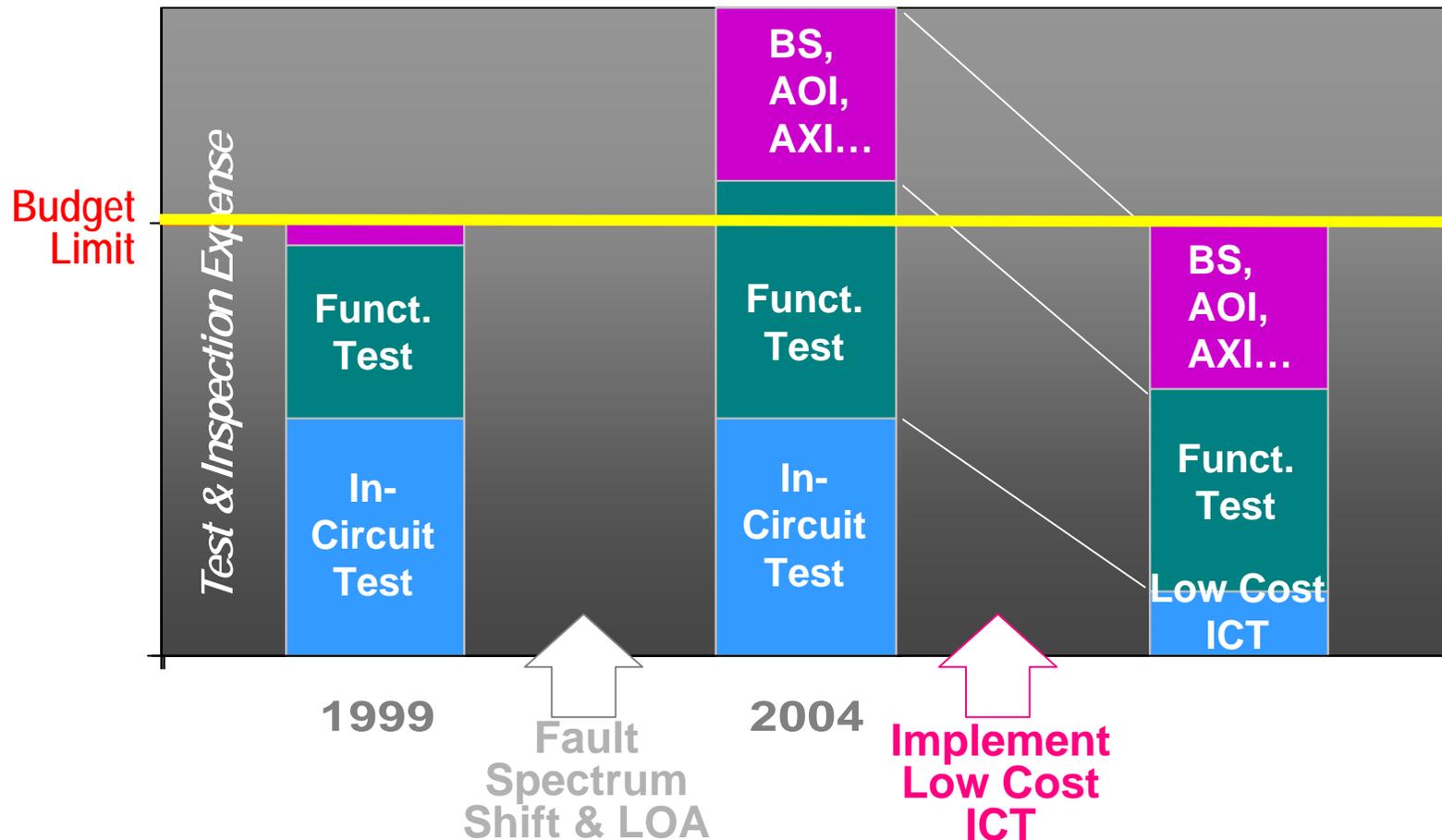
But there’s a compelling reason to change...

How Does an OEM Choose a CEM?

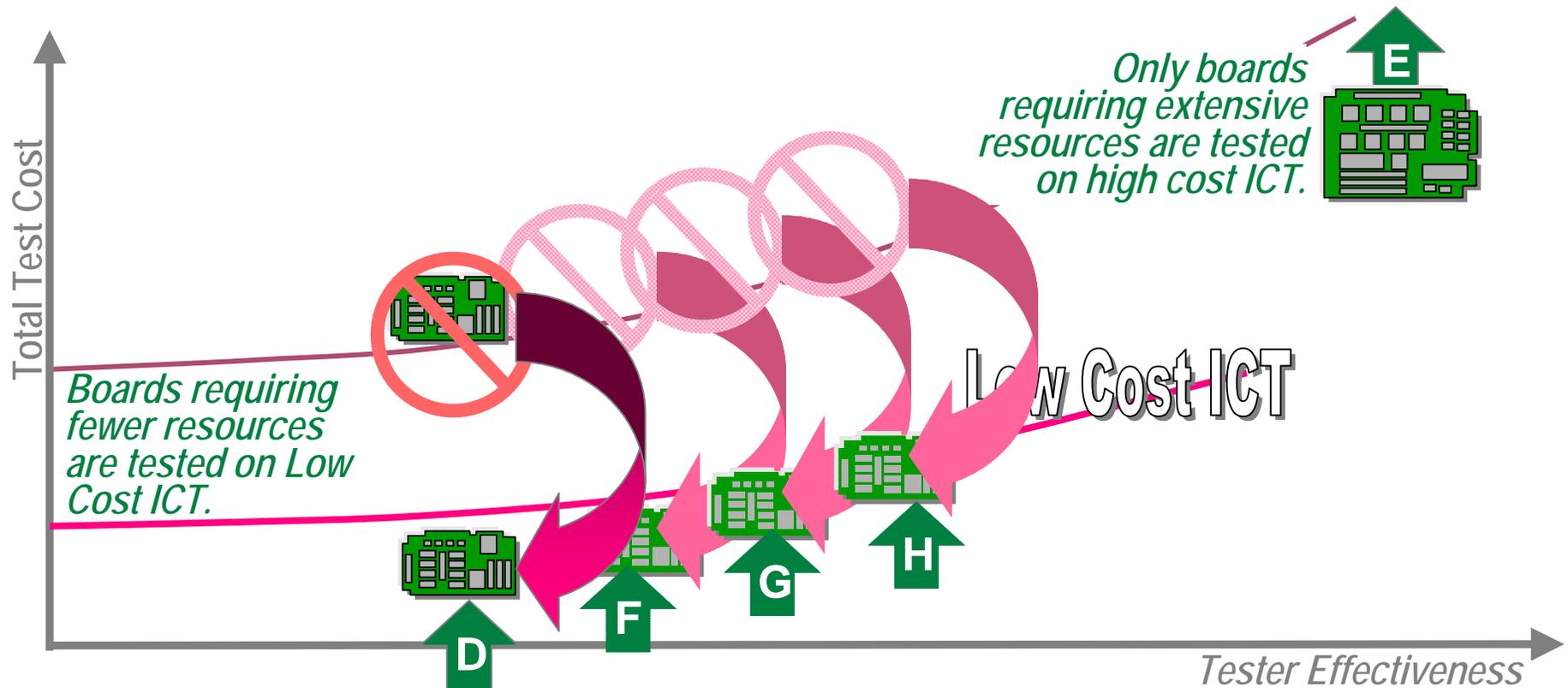


**CEMs have few opportunities to differentiate on cost.
 Test NRE can be reduced by >50% with the Low-Cost ICT strategy.**

Low Cost ICT creates tangible savings, freeing up budget for alternatives and functional test

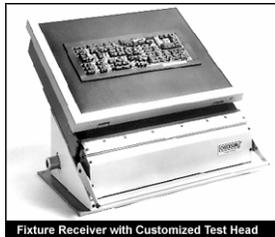


The strategic lesson: Minimize ICT cost by managing a tester resource portfolio

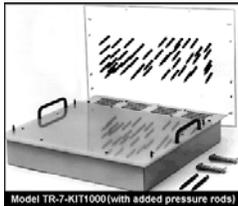


- Portfolio savings are generated only when assets have significantly different cost structures and technological characteristics
- Use traditional high cost ICT only for boards ('E') that require its more complex resources and justify the higher cost structure
- New "default strategy:" Implement on Low Cost ICT whenever feasible.

CheckSum products & services maximize the benefits and savings of Low-Cost ICT



Economical fixture solutions



Cost-effective, scalable tester platforms



Knowledgeable,
experienced
“Solutions on Call”
staff



What does 'Low Cost' really mean?



Analyst *ems*

- Low cost ICT
- TestJet Technology*
- Optional ISP capability
- 800 points for less than \$50K!



Analyst *ils*

- Low cost in-line ICT & functional test
- Up to 2000 points / 10" x 13.4"
- 800 points for less than \$100K!



Analyst *ft*

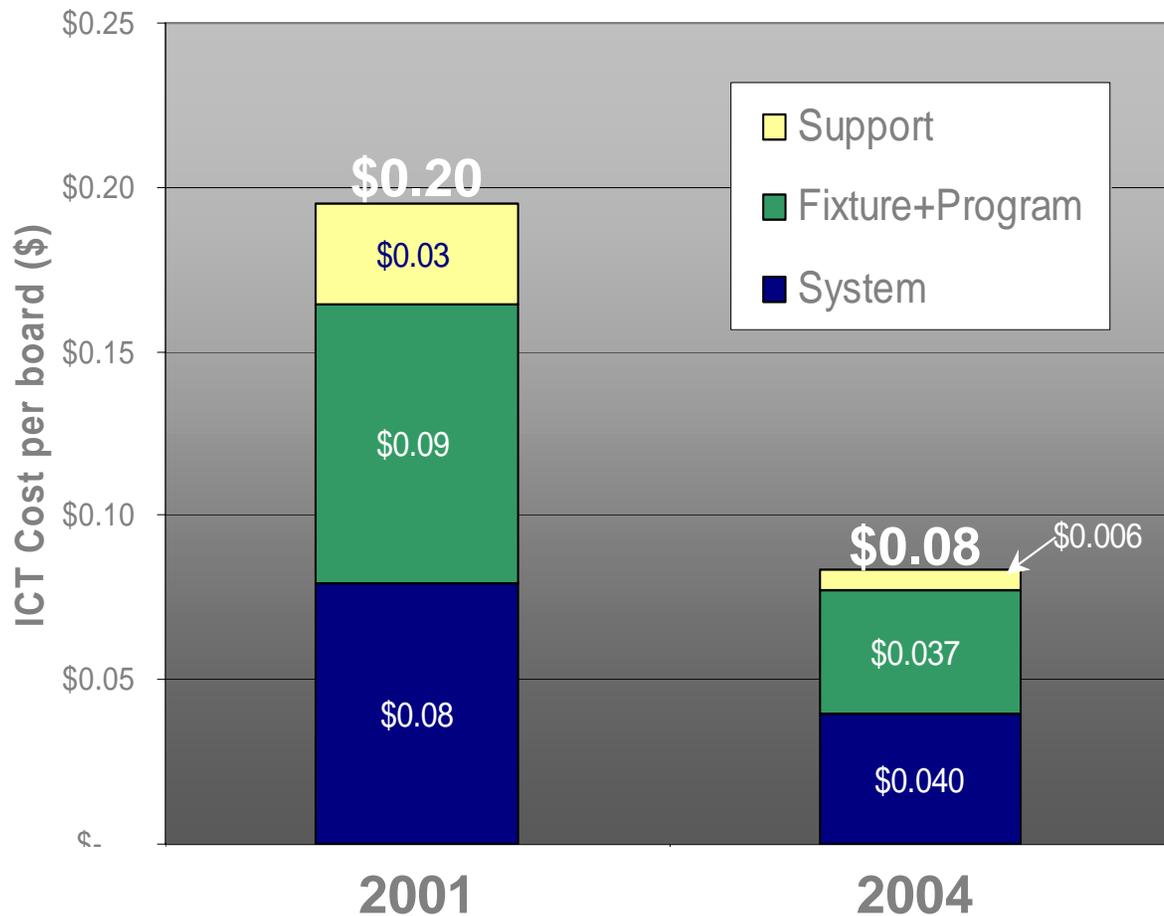
- Low cost ICT & functional test
- Supports external P.S. & Instruments
- 400 points for less than \$40K!

*TestJet Technology is protected under U.S. Patent No 5,124,660 & 5,254,953

CheckSum is the reliable full service vendor, delivering solutions to hundreds of manufacturers worldwide

- An American ATE company committed exclusively to electrical board test for OEMs and Electronics Manufacturing Service providers.
- More than 2,000 systems installed worldwide.
- CheckSum is the only board test company to have grown continuously through the recent electronics downturn.
- As North America's only full service board test vendor, CheckSum reduces support and applications cost
 - CheckSum's engineer-to-engineer technical support, affordable "fast-turn" turnkey fixturing and programming services complete the cost effectiveness equation.
 - Our **Solutions on Call** philosophy delivers capabilities such as on-board ISP programming and Boundary Scan when and where they're needed.
- CheckSum systems provide the low cost test capability that's needed for today's fault spectrum
 - CheckSum's low-cost Analyst series in-circuit testers are the ideal compliment to AOI and AXI.
 - Straightforward system architecture and easy-to-use interface reduce system complexity and cost.

Using the portfolio strategy that includes Low Cost ICT is how this OEM captured real savings



Lessons Learned

- A 'tests everything' tester is always more expensive—even for boards that use only a fraction of its resources.
- In order to capture low cost ICT savings, you must use a tester that has a completely different cost structure: tester, fixtures, programming, support.
- Use the traditional high cost tester only when its resources are clearly required.
- Do it one project at a time.

The Analyst systems paid for themselves after just 3 fixture/program sets and the savings in one annual service contract.