Decreasing Repair Cost and Improving Probe Card Life A Case Study

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Problem Statement

- Cantilever card usage is increasing
  - Repair costs are increasing
  - More repair volume
  - More difficult repairs
    - Tighter pitch
    - Higher pin counts
    - More levels of probes
- Operator training is more difficult
- Cost of inventory is higher
- Cost of down time in wafer sort is higher

Program Goals

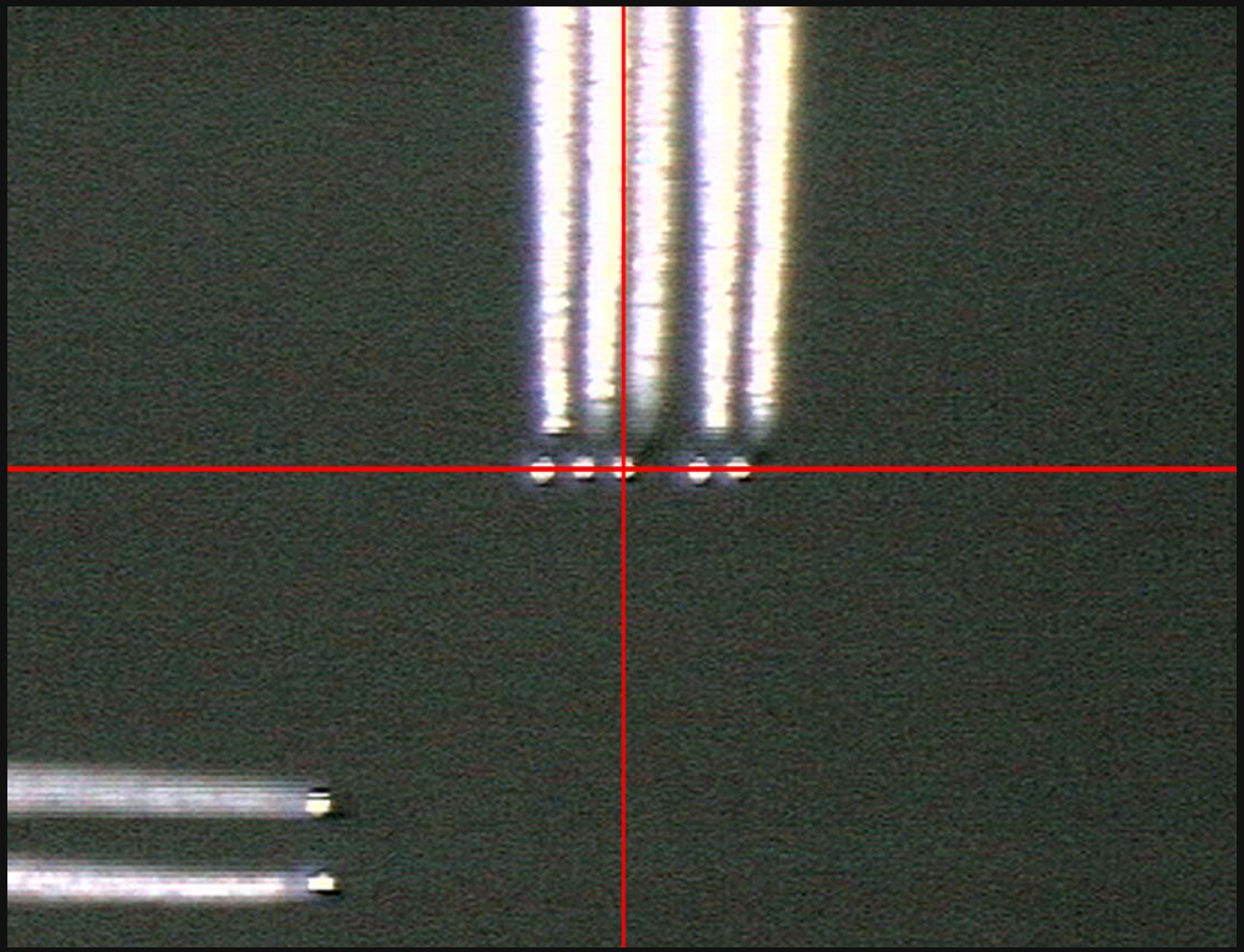
- Lower card repair costs
  - Decrease repair times
  - Decrease training times
- Reduce card inventory
- Improve ergonomics
- No degradation of repeatability
- No negative safety issues
- If possible, increased probe card life

Approach to the Solution

- Install ProbeTracker™ option on existing Probilt PB3500 Probe Card Analyzers
  - Software controlled microscope
  - Crosshair positioned to proper probe location
  - True reference for tips up repair
  - Correct probe uniquely identified
    - No need to “count probes” to find repair point

ProbeTracker™ option on PB6500

Positioning Crosshair



Program Concerns

- Will ergonomics really improve?
- Pinch points and safety concerns
- Will repeatability of system be adversely affected by weight of ProbeTracker™?
- Will the through-put time (TPT) really be reduced?
  - Setup time required
  - Probe repair time reduction
- Will probe card life increase significantly?

Qualification Plan

- Ergonomics Study
  - Wrist assessment
  - Microscope positioning
    - Manual mode vs automated mode
- Safety Evaluation
  - Pinch points
  - Motion

Qualification Plan (2)

- Repeatability Study
  - GR&R – Standard repeatability study
  - P/T $\leq$ 0.15 success criteria
- Throughput Study
  - Time study comparison
  - Economic analysis of results

Standard Microscope Ergonomics

ProbeTracker™ Ergonomics

Ergonomics Study Results

- Tech spends approx. 2 hrs on system
  - Standard Microscope
    - 5 min break every 15 min
    - 2 hrs 40 min required for 2 hrs productive time
- Improved ergonomics
  - No strain on shoulder & wrist
    - No extended reach required
    - No wrist movement to adjust microscope
    - No lost time

Safety Evaluation Results

- Passed all safety requirements
  - No pinch points
  - Movements are slow enough for cautionary moves

Repeatability Study DOE

- 10 consecutive runs of typical card
- Correction factor: 0.9730
- # of standard deviations: 6
- Parameters Tested
  - Alignment (X, Y)
  - Leakage
  - Planarity

Repeatability Study Results

Parameter	UCL-LCL	P/T (Avg)
Leakage	10	0.02
Alignment X	18	0.14
Alignment Y	18	0.14
Planarity	18	0.14

Throughput Analysis DOE

- Side by side comparison
  - PB3500 #1 with standard microscope
  - PB3500 #2 with ProbeTracker™ option
- Record repair time & # probes repaired
  - Calculate repair time per probe
  - Include multiple operators (5)
  - Study results over extended time

PB3500 #1 – Standard Microscope

Operator	Repair Time	Probes Repaired	Minutes per Probe
1	219	27	8.11
2	51	19	2.68
3	69	14	4.93
4	93	6	15.50
5	36	16	2.25

Probe Card Mfg: Test/Repair (SWTW 2004)

	Card Mfg A	Card Mfg B	Card Mfg C	Card Mfg D
Card Size	300 probes	300 probes	500 probes	1000 probes
% Prb's Repair	10-30%	10-20%	10-20%	10-20%
Test & Repair Time	3-4 hrs	4 hrs	8 hrs	12-16 hrs
Avg Repair Time/Prb.	4.7 min	5.3 min	6.4 min	5.6 min

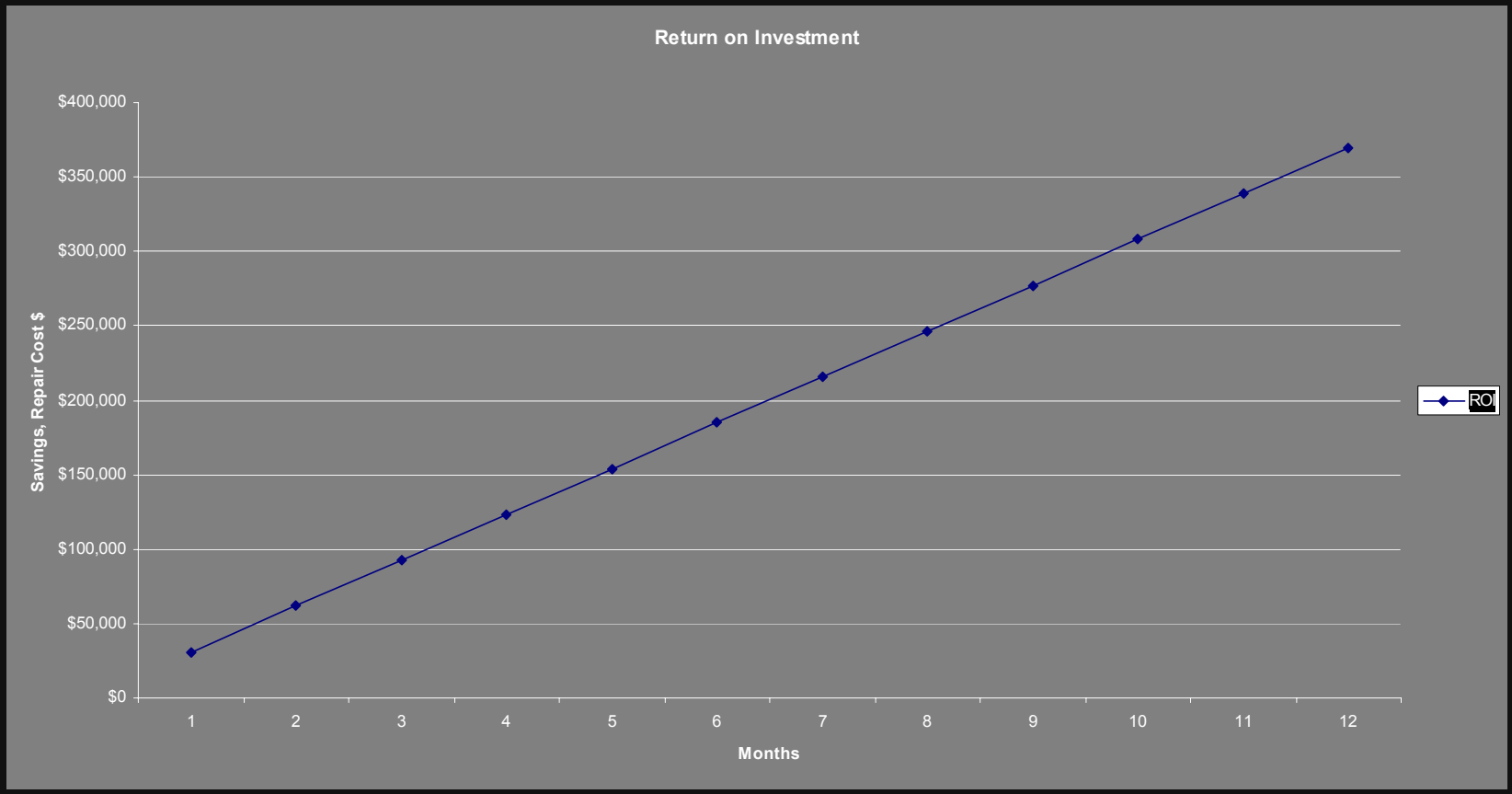
PB3500 #2 - ProbeTracker™

Operator	Repair Time	Probes Repaired	Minutes per Probe
1	137	49	2.80
2	137	50	2.74
3	21	16	1.31
4	19	4	4.75
5	6	16	0.38

Repair Cost Comparison

Parameter	PB #1, W/O ProbeTracker™	PB #2, With ProbeTracker™
Cost = $75/hr	$1.25/min	$1.25/min
Time/Probe	5.7 min	2.37 min
Cost/Probe	$7.13	$2.96
Avg Reps/Card	27	27
Rep. Cost/Card	$192.51	$79.92
Cards Rep/mo	152	152
Cost/mo-2 shft	$52,671	$21,866

Return on Investment



Future Studies and Trends

- Confirm increase in probe card life
- Implement/train in other repair centers
- New systems using same technique
  - Tips up repair station
  - Tips up analyzer/repair station

PB1200 Tips-Up Repair Station