

# CMP Outsource Solutions: Fueling Customer Success

July 2009



CMP

**entrepix** Our Expertise  
Our Services  
Your Success

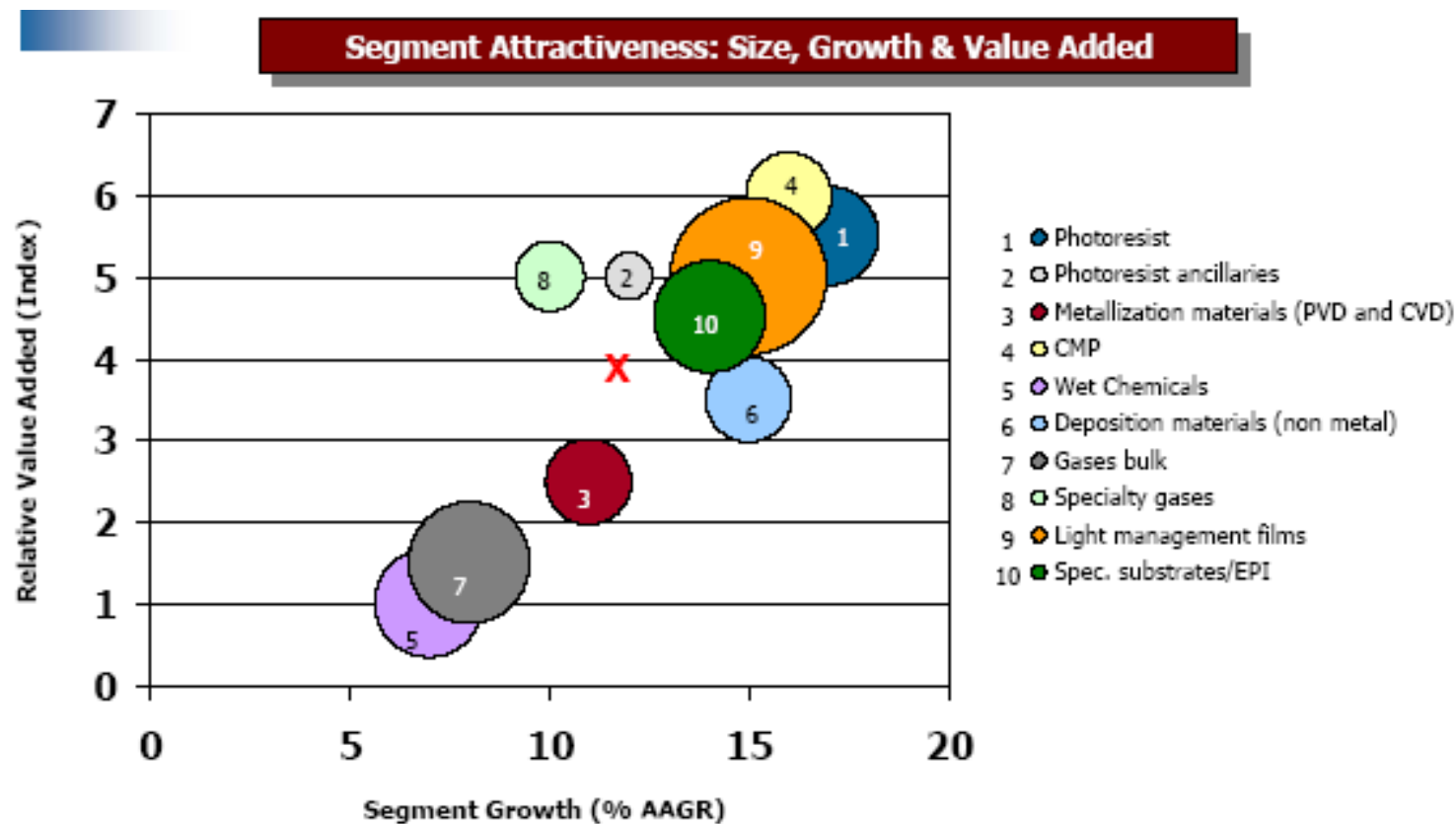
**entrepix**  
YOUR CMP PARTNER

# Outline



- CMP Evolution
- Development Approach – STORM
- Applications and Examples
- History of Partnership
- Market Opportunities
- Services
- Conclusion

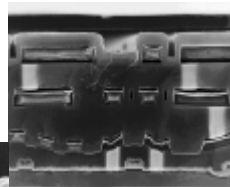
# CMP Critical to IDM Value Chain





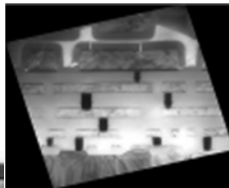
## CMP Evolution

Process, Applications, Equipment, & Consumables Evolve

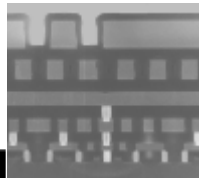


500 nm  
ILD planarization, W plugs w etch back

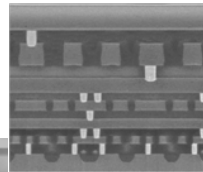
1000 nm  
Two Al Metal layers, BPSG



350 nm  
Four Al metal layers, W polish, PSG



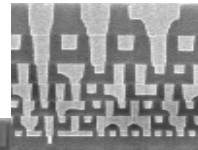
250 nm  
STI, Five Al metal layers, SiOF



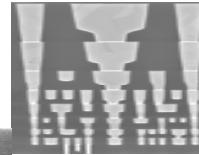
180 nm  
STI, 6 Al Metal layers



130 nm  
3-6 Cu Layers, PMD, W, STI



90 nm  
3-9 Cu Layers, PMD, W, STI  
OrganoSilicate Glass (OSG)



65 nm  
4-11 Cu Layers  
PMD, W, STI, OSG

## CMP Applications

*Oxide Polish*

*Pre-metal Dielectric*

*Inter-level Dielectric*

*STI Polish*

*Poly Polish*

*Tungsten Polish*

*Copper Polish*

*Barrier Polish*

*High k Gate*

Source: Courtesy of Ken Cadien  
Former Intel fellow

# CMP's Complexity Continues to Evolve



1995 - Qty ≤ 2

CMOS

Glass (oxide)

Tungsten

2001 - Qty ≤ 5

CMOS

Glass (oxide)

Tungsten

Copper

Shallow Trench

Polysilicon

2009 - Qty ≥ 36

CMOS

Glass (oxide)

Tungsten

Copper

Shallow Trench

Polysilicon

Low k

Cap Ultra Low k

Metal Gates

Gate Insulators

High k Dielectrics

Ir & Pt Electrodes

Magnetics

New Apps

Doped Oxides

Nitrides

NiFe & NiFeCo

Noble Metals

Al & Stainless

Polymers

Ultra Thin Wafers

Direct Wafer Bond

Through Si Vias

3-D Packaging

MEMS

Nanodevices

Integrated Optics

Substrate/Epi

GaAs

GaN

InP

CdTe & HgCdTe

Ge and SiGe

SiC

Diamond & DLC

Si & Reclaim

SOI

Quartz

Titanium

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36+ highly complex puzzles

CMP JIGSAW PUZZLE



**CMP Requires Dedicated Expertise** ⇒

entrepix  
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vs.

**Cap-Ex + Op-Ex + Tech Risk...**

entrepix  
Our Expertise  
Our Services  
Your Success

SVTC

# Why Outsource CMP?



## Growing need

- Industry and economic dynamics are accelerating outsourced services
  - Increasing Costs of R&D
  - Preserve capital
  - Headcount reductions reduce resource bandwidth
- Increased need for ability to rapidly & cost-effectively commercialize technologies

## Response & Benefits

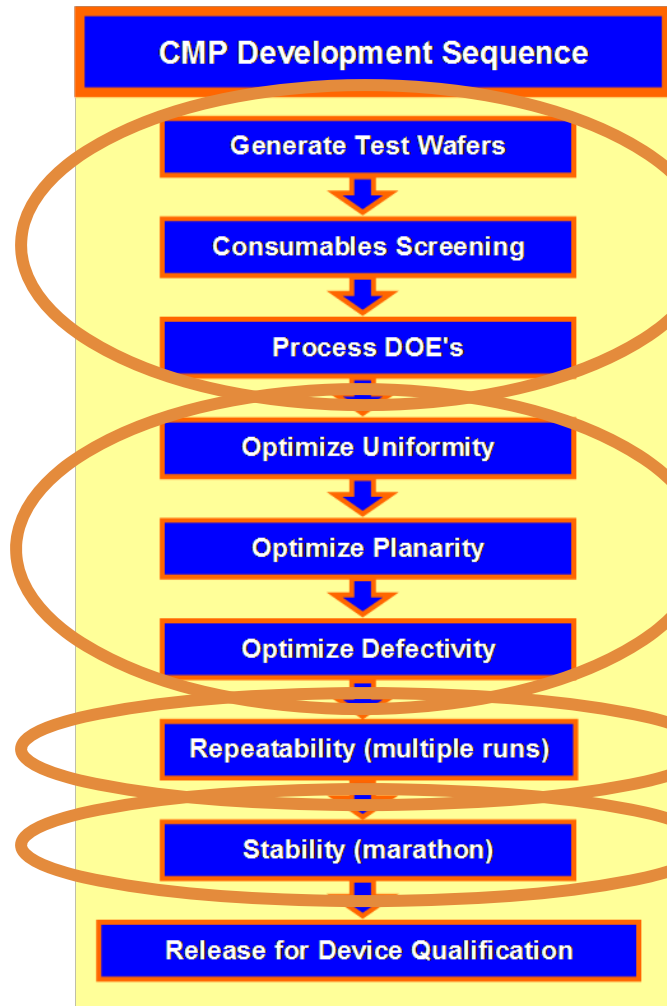
- Best in class CMP technical staff to support technology development
- Independent 3<sup>rd</sup> party data generation for IDM evaluations
- Faster time to market for new products
- Flexibility to experiment with new materials and products
- IP Secure environment

## Proven model

- 550+ CMP foundry customers globally, across virtually all semiconductor technologies



# CMP Development: Proven Approach



- Project **Screening Tests** criteria for each  
Test wafer availability and quality often impact timeline, validity of results, etc.
- Initial process DOE's generally focus on removing surface quality **Optimization**
- Optimization stages can be interchanged or executed in parallel
- Planarity, height, dishing, erosion, roughness, etc. depending on the material and intended application **Repeatability**
- Failure at any stage usually means backing up at least one stage to try again **Marathon**

# CMOS Customer Example



- Project launched to develop a planarized integration for an existing facility running mostly 0.5um and larger devices which did not require CMP.
- Integration included 2 levels of oxide CMP (PMD and ILD) and 2 levels of tungsten CMP (contact and via1).
- Initial estimate was roughly 24 months to purchase, install, and qualify CMP equipment plus develop the integration and be ready for production ramp.
- By leveraging an outsource CMP provider, integration work was started almost immediately and executed in parallel with the equipment lead time.

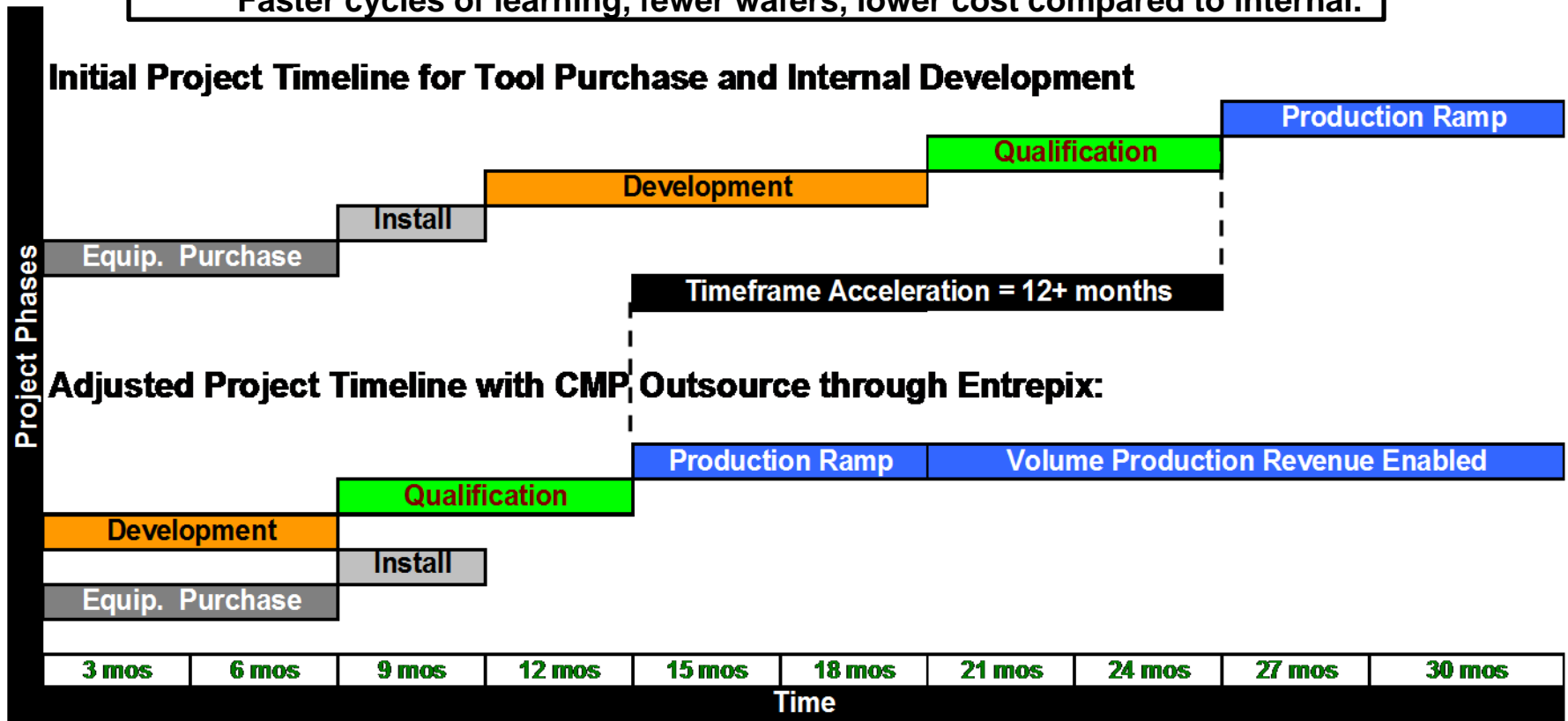


# CMOS Example: Timeline Comparison



## Key aspects of predicted time savings:

Development could begin as soon as test wafers were ready.  
Equipment purchase, lead time, and installation in parallel.  
Faster cycles of learning, fewer wafers, lower cost compared to internal.



# CMP Outsource History



**2002-03**

- Entrepix launches CMP Outsource Services
  - Engineering & Technology Development (ETD)
  - Characterize, optimize, materials, process & integration
- SVTC becomes subsidiary of Cypress

**2004-05**

- ISO9001:2000 certification
- Multiple IDM qualify and ramp production outsource

**2006-07**

- SVTC and ETPX initiate collaboration on 200mm services
- SVTC acquired by OakHill & Tallwood as independent R&D Services Co.
  - Novel materials
  - Analytical services

**2008-09**

- SVTC and ETPX partner on 300mm services
- SVTC acquires ATDF R&D Services Co. from SEMATECH
  - Combined strength of both organizations
  - Increase value add to customers



## Background

SVTC will outsource to Entrepix all 300 mm chemical mechanical polishing (CMP) development and production services for customers who use the Tool Access Program (TAP) at the SVTC fab in Austin, Texas. Services include:

- Experimental planning and support
- Full engineering project oversight and execution
- Data analysis, interpretation, and reporting
- Pilot production activities

Partnership provides CMP consumable suppliers and device makers with a cost effective solution to drive process optimization and technology advancement.

# Combination of Strengths



- State of the art manufacturing facility with 300mm CMP tools
- Global supplier of test wafers to materials and device manufactures
- 24x7 operations & maintenance support
- Access to diverse materials and processes
- Leading edge Analytical Services



- CMP Fastforward™ provides largest portfolio of CMP processes and materials knowledge
- World class engineering and operations experience
- Comprehensive equipment and processing service portfolio
- Flexible, long term customized solutions to meet customer needs

Customers save on capital costs and time by using state-of-the-art CMP tools and processes for development efforts.

# Continued Shift Towards Outsourcing

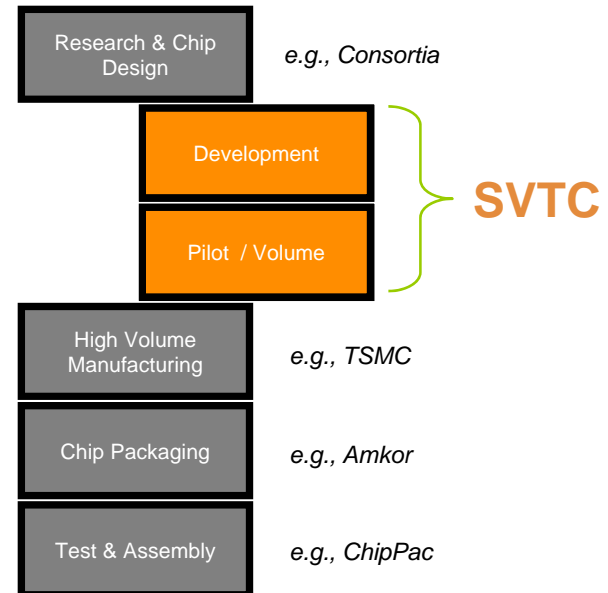


Decade long shift from Vertical to Horizontal Integration  
accelerating in today's economic condition

## Vertical Structure - Past



## Horizontal Structure – Future



# New Market Opportunities



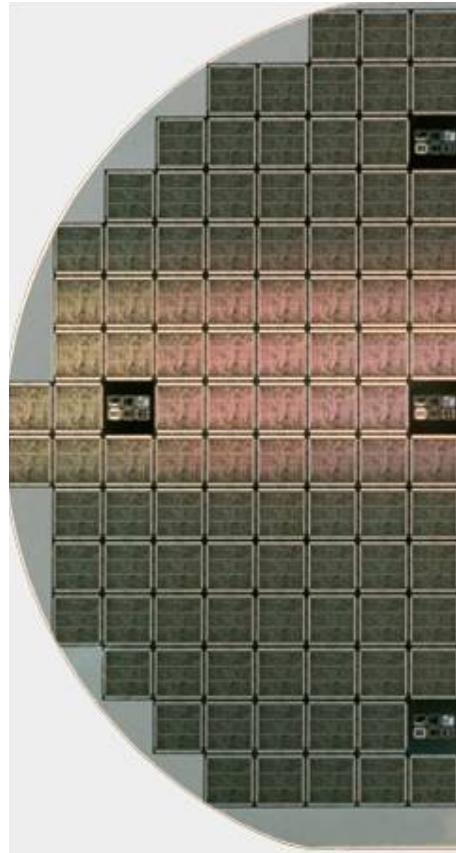
Start-ups

Fabless

IDMs

Foundries

Equipment & Materials



Novel memory

Novel transistors

MEMS/MOEMS

High Voltage

Image sensors

Bio Tech

Photovoltaic



# CMP Tool Access Program with Entrepix



Tool Access supports the development efforts of the CMP equipment and material suppliers.

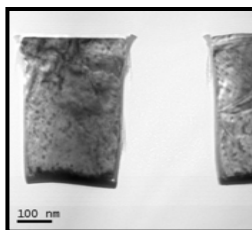
## Customer Benefits

- IP protected access to 200mm and 300mm CMP tools
- All resources in one location; engineering, wafers, metrology, consumables, failure analysis, electrical test
- Baseline ready for your comparison
- Process your customers' wafers for comparison
- Customers save on capital costs by using our state-of-the-art processing tools and engineering support for development efforts.

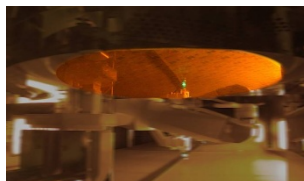
# Tool Access Program



**Engineering**



**Process  
Characterization**



**Metrology**



**Applied Materials Reflexion**



**Test Wafers**



**Advanced  
Test Reticles**

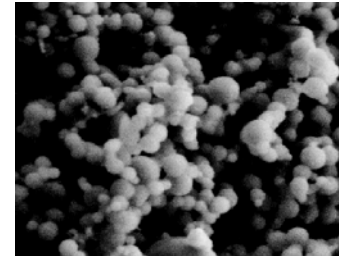
# CMP Tool Access to Qualify



PADS



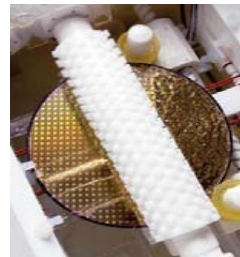
SLURRIES



ABRASIVES



CONDITIONING  
DISCS

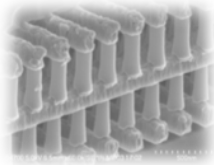


BRUSHES & CLEAN  
CHEMISTRIES

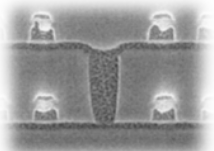


COMPONENTS

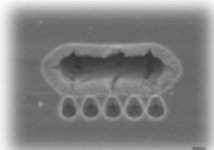
# Analytical Services



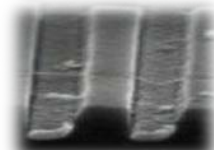
—○ AFM



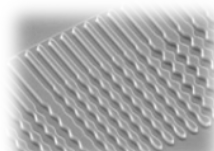
—○ Auger



—○ Dual Beam



—○ Focused Ion Beam



—○ SEM



—○ TEM



—○ SIMS



—○ VPD / ICP-MS

Powerful, in-house suite of  
leading-edge Analytical Services

On-site wafer and package level  
Sample Prep Services

Fast turn around times at  
competitive prices

# Conclusions



- Growth of CMP will continue
- Efficient research and development is needed to keep up with the short product life cycles
- CMP process development involves a sequence of stages (STORM) to efficiently reach milestones
- Partnerships will continue to provide more value add to customers
- Proper utilization of CMP outsourcing enables
  - Accelerate timelines
  - Preserve capital
  - Reduce cost and risk



SVTC Booth #5447 North Hall

Entrepix Booth #2227 South Hall