Transfer-Printing for microLED Displays
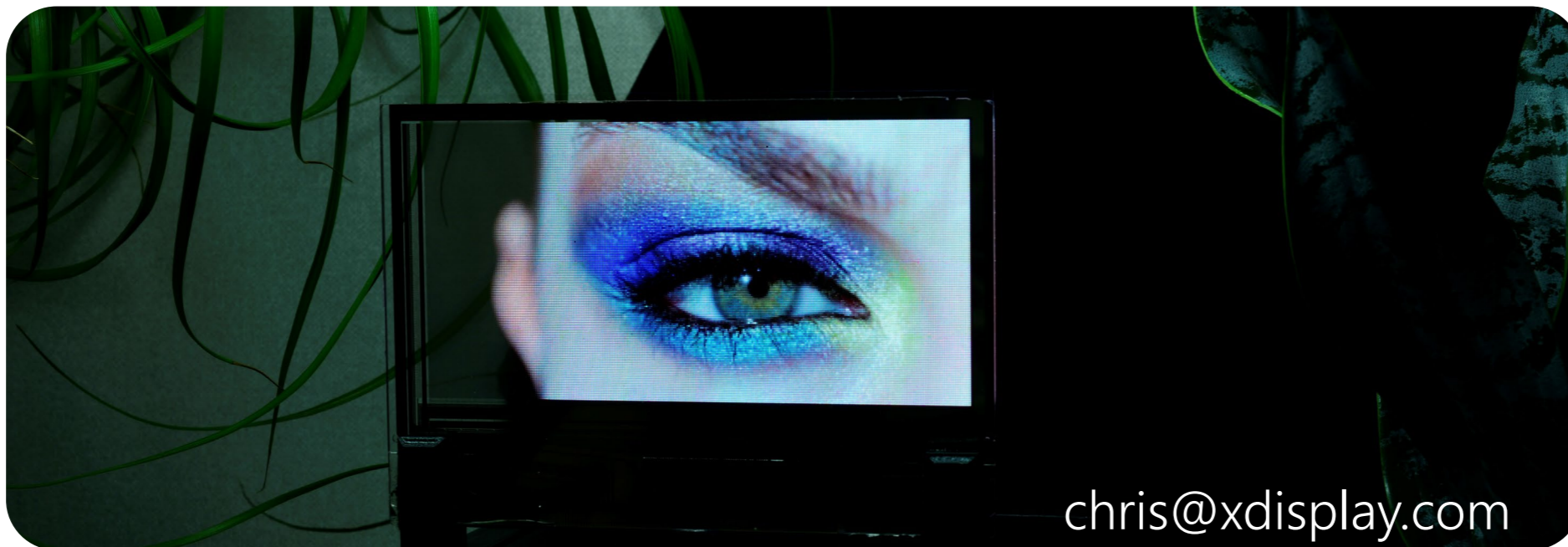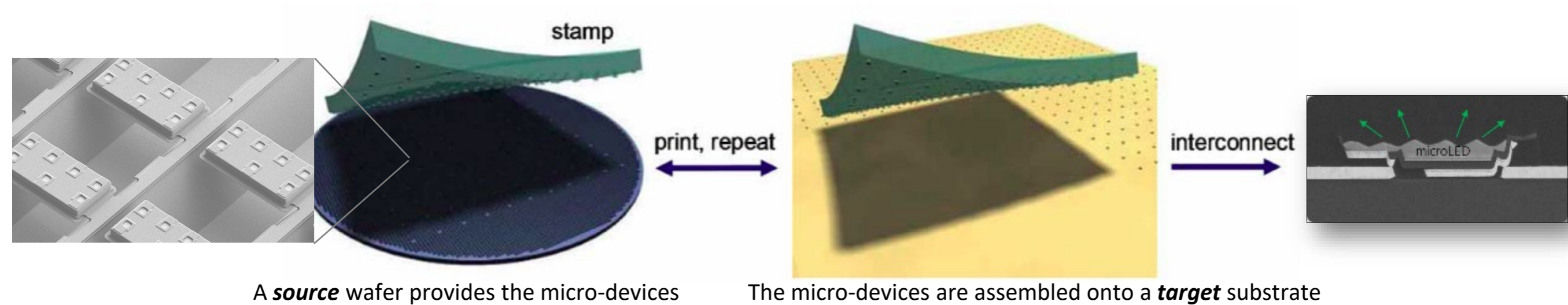
Chris Bower, CTO and co-founder
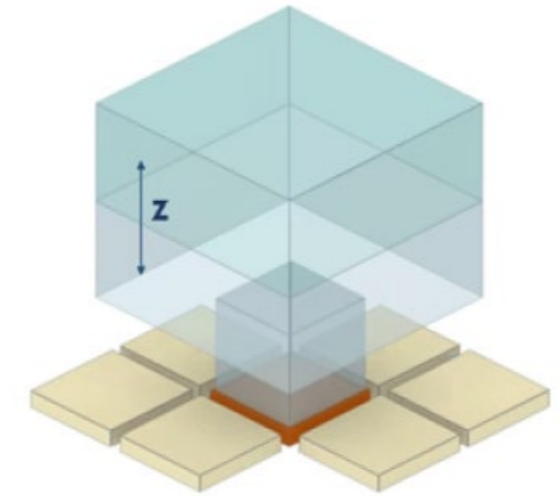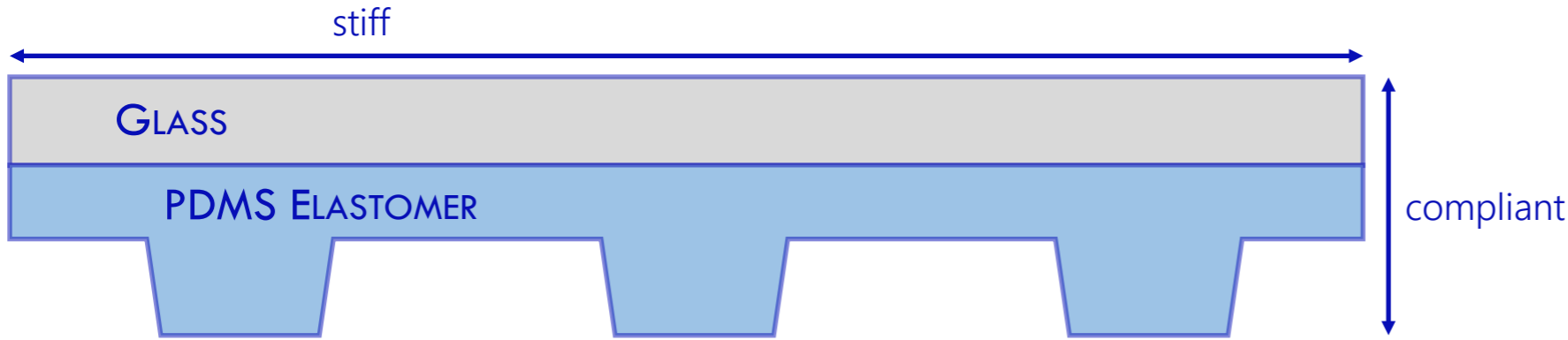
X Display Company (XDC)

chris@xdisplay.com

1. Form undercut, tethered microdevices (microLEDs, microICs, etc.)
2. Massively parallel transfer to the target substrate with a patterned elastomer stamp
3. Form interconnections to complete functional systems

A **source** wafer provides the micro-devices   The micro-devices are assembled onto a **target** substrate

stiff

GLASS

PDMS ELASTOMER

compliant

z

Elastomer stamp performs mass transfer by selectively retrieving an array of devices by van der Waals' adhesion and transferring the array to a display substrate (e.g. glass or plastic).
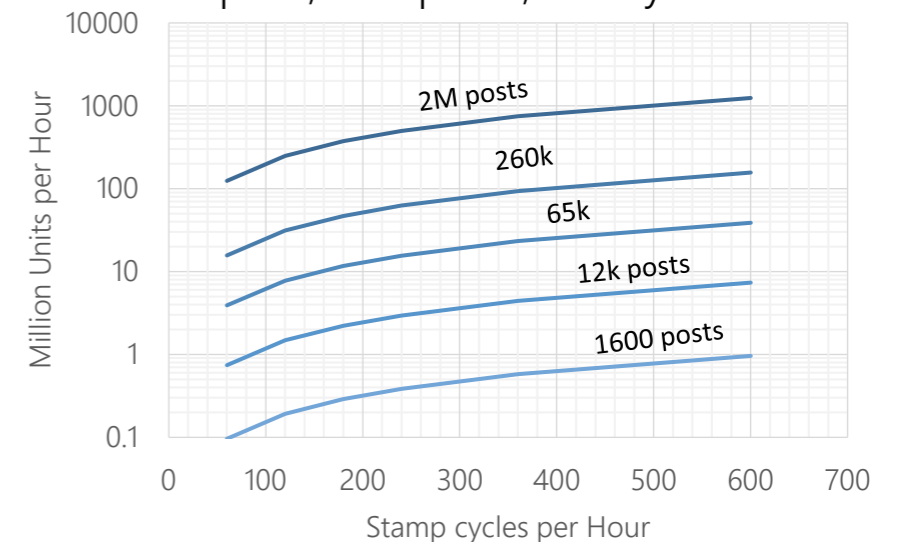
4 9s (99.99%) yield proven in R&D lab. Expect 6 9s or higher in production.

STAMP CHARACTERISTICS:

- compliant in z-direction
- short-range, rate-tunable adhesion

} Key enablers for yield and throughput

- transparent
- low-cost
- mechanically tough

Throughput (UPH) determined by array pitch, stamp size, and cycle time.

Million Units per Hour

2M posts
260k
65k
12k posts
1600 posts

Stamp cycles per Hour

Looking through the stamp:
Retrieve ICs with stamp, print to display, loop video.

Transfer
print tool:
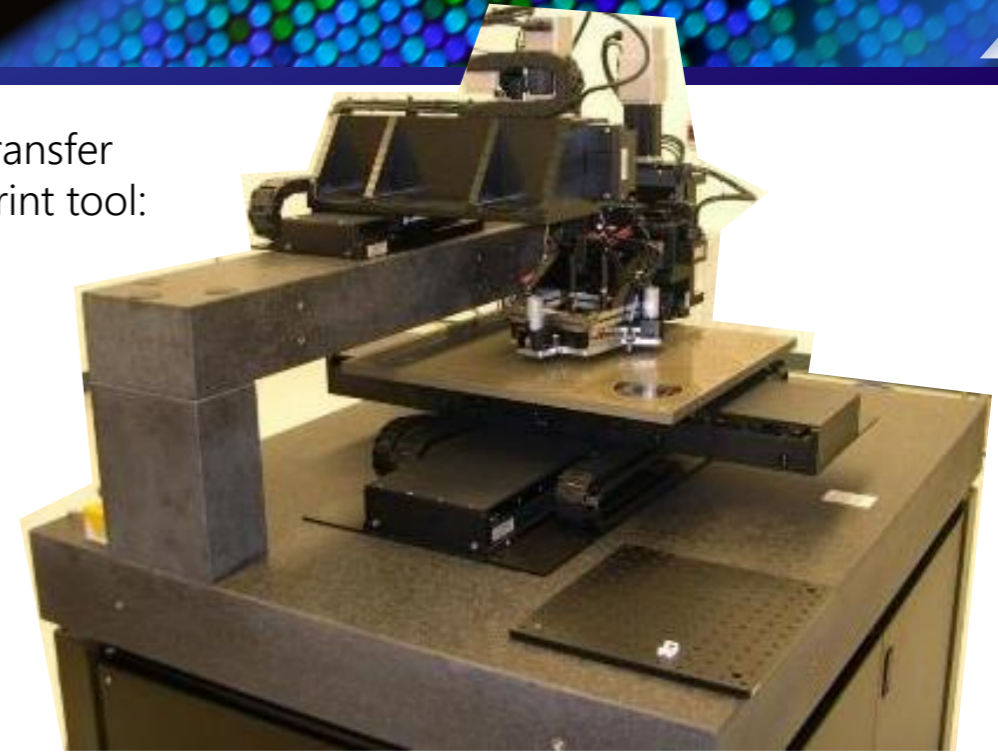
This video shows 20 second cycle time.

Note orientational control (7 contact pads on IC).

Mechanical array alignment can define the rate of deterministic mass-transfer micro-assembly.

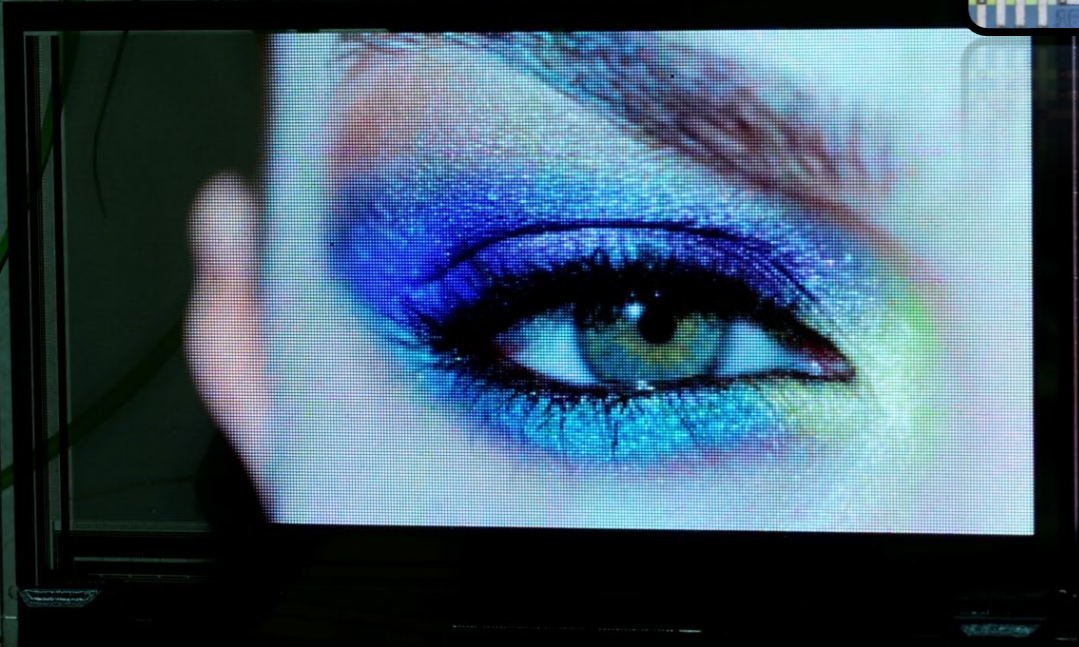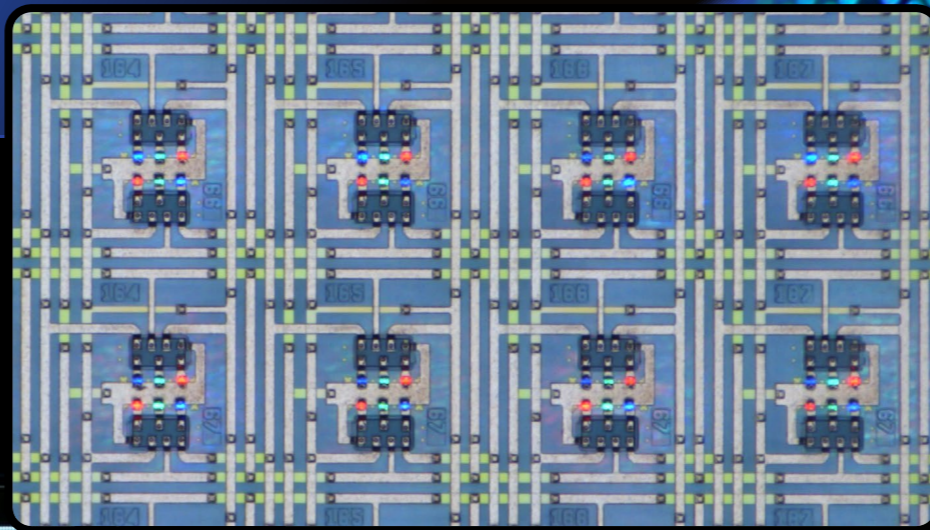Transfer forces act only for a few seconds of the cycle (very fast).

Looking through the stamp:
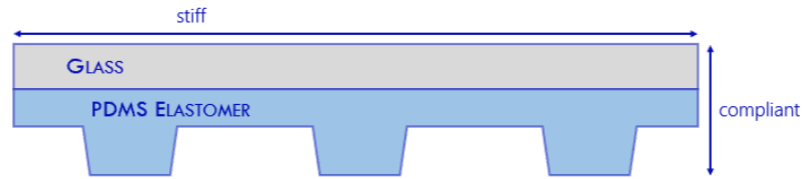Retrieve ICs with stamp, print to display, loop video.

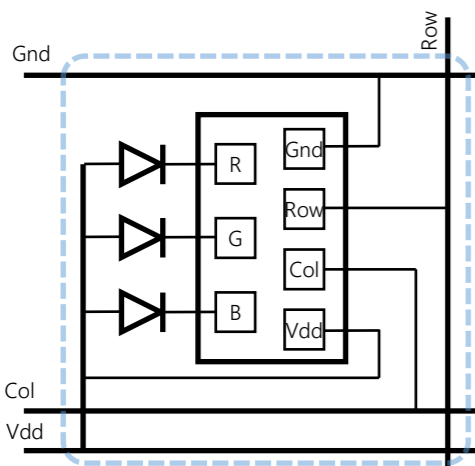Transfer-printer with automated substrate handling
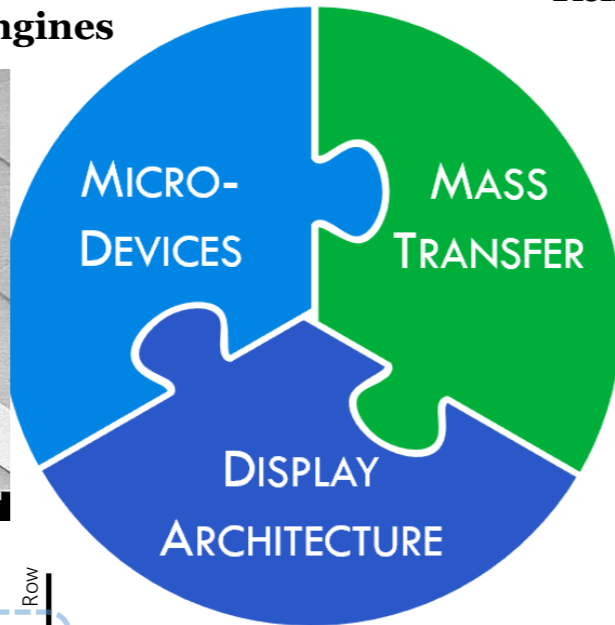
5.1" 70ppi UltraMatrix™ Display

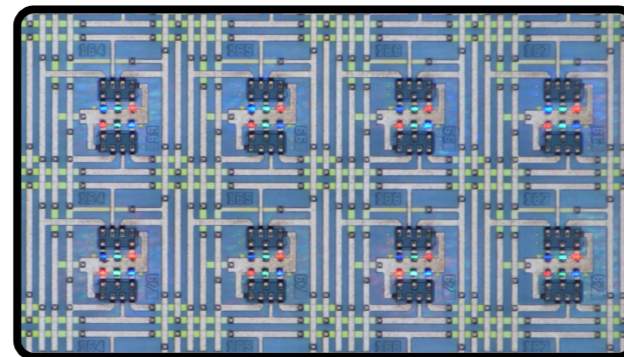14-bit PWM, 2 bit current select
60 frames per second
> 3,000 nits

How can we help?

R&D Equipment & Stamps

stiff

GLASS

PDMS ELASTOMER

compliant

microICs, microICs and PixelEngines

Micross 14.1mm x900   50.0um

MICRO-DEVICES

MASS TRANSFER

DISPLAY ARCHITECTURE

XCeleprint

Intellectual Property

Gnd

Row

R

G

B

Gnd

Row

Col

Vdd

Col

Vdd

display

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