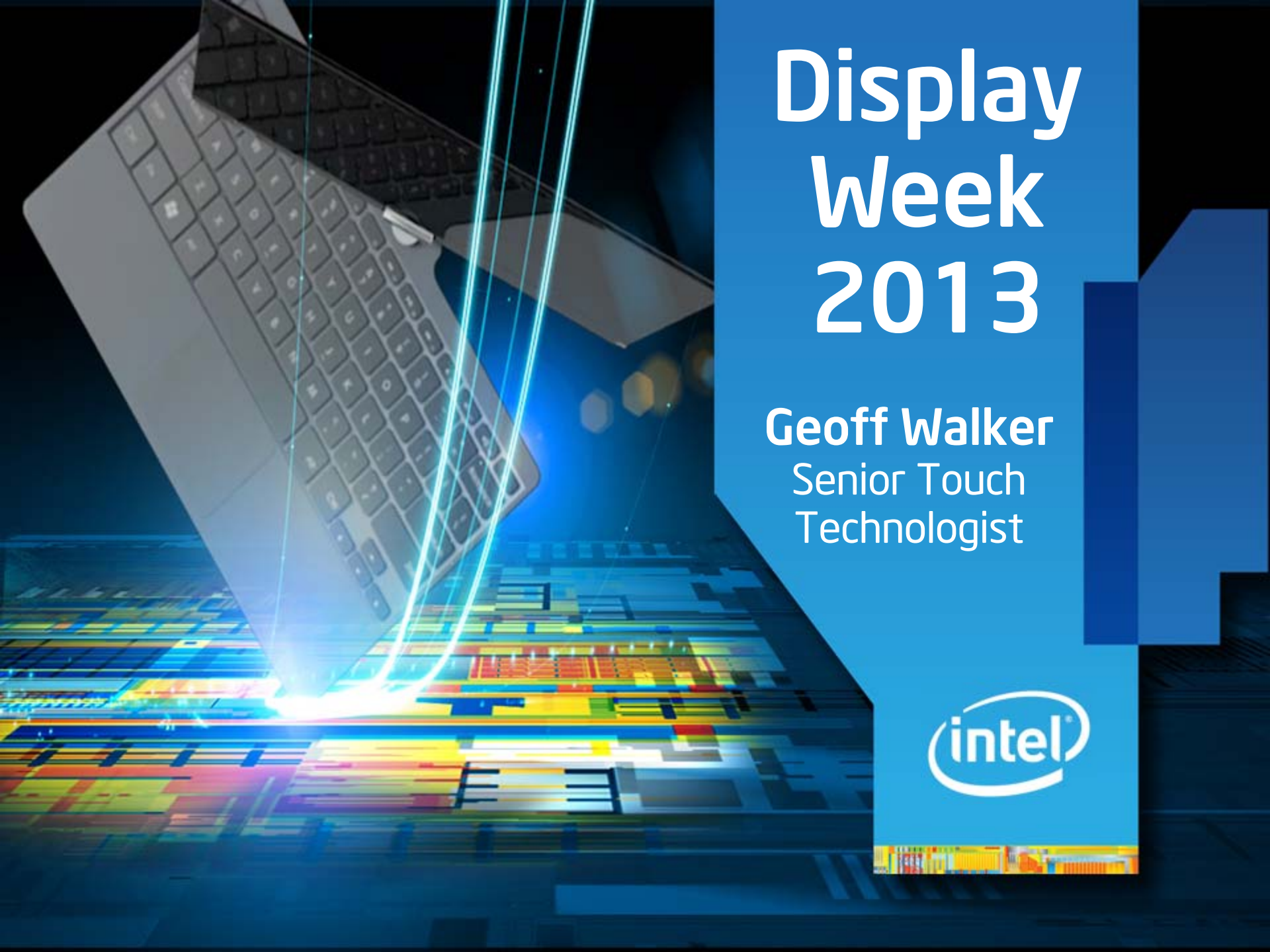


Display Week 2013

Geoff Walker
Senior Touch Technologist

intel

What You Missed (In Touch) In Vancouver

***File Download*:** www.walkermobile.com/SID_2013_Touch.pdf

Topics

- **Statistics** [1]
- **Most Interesting New Product** [2]
- **Related Product and Demonstration** [3]
- **Embedded Touch** [12]
- **Touch-Module Makers** [7]
- **Touch-Display Makers** [2]
- **Something Unusual** [2]
- **Summary of Observations** [1]

Statistics

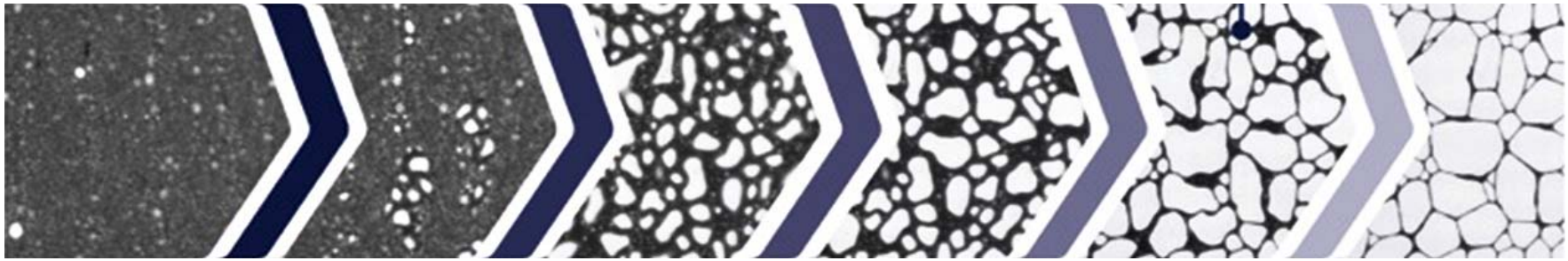
- **35% of booths were touch-related (63 of 182)**

Product	Exhibitors	Product	Exhibitors
Modules	15	Bonding	2
Enhancements	8	Glass processing	2
Adhesives	6	Market research	2
Metal & CNT films	5	EMR digitizer	1
Touch displays	5	Haptics	1
Controllers	3	Laser patterning	1
Embedded touch	3	Multi-touch self-capacitive	1
Glass	3	Pressure-sensing tiles	1
Integration	3	Passive styli	1

  - 14 of 15 touch-module suppliers were showing p-cap; Fujitsu (resistive-only) was the sole exception
  - 8 of 15 also showed resistive
  - Only one even mentioned SAW or surface-capacitive (etc.)

Most Interesting New Product…1

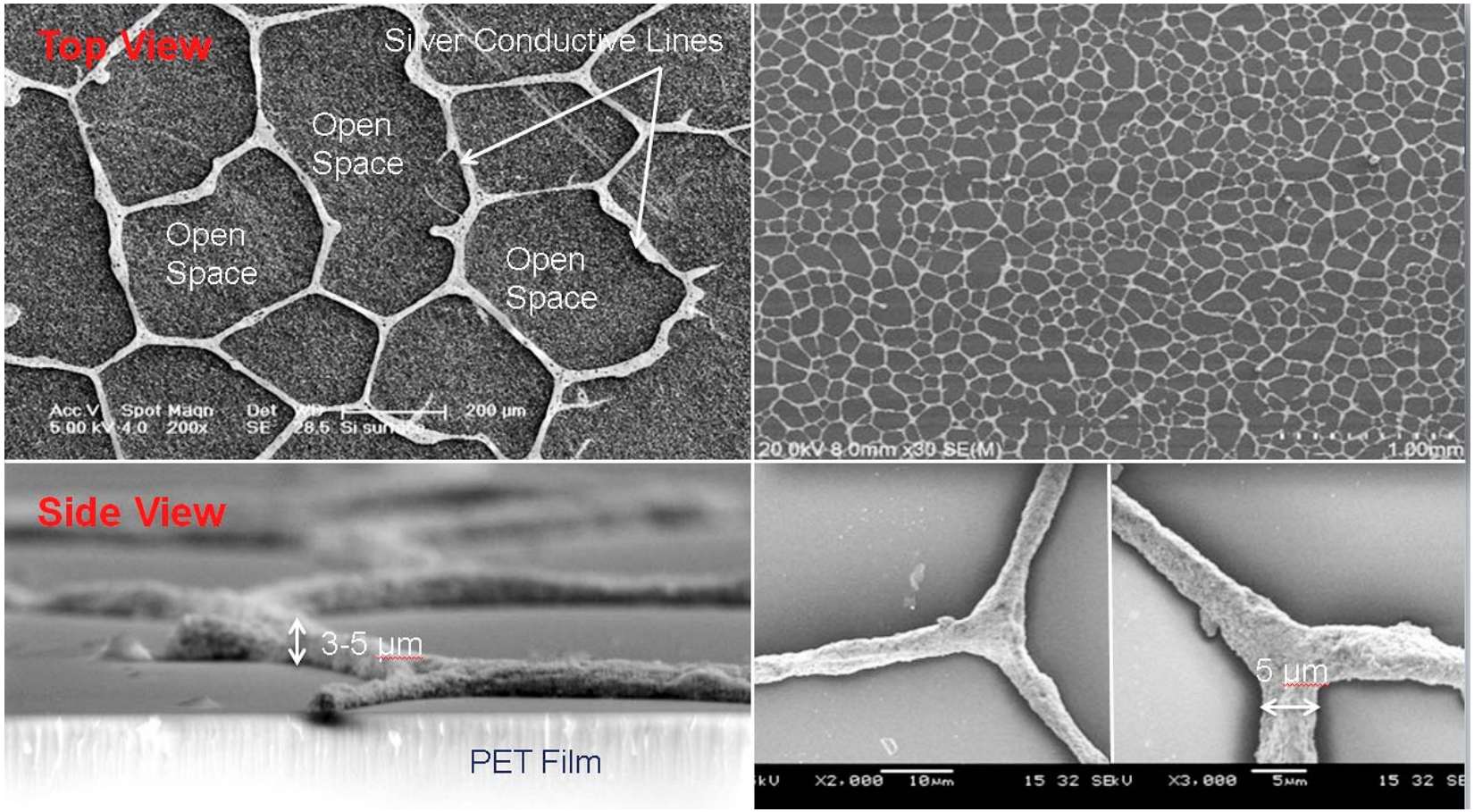
- **Cima NanoTech**
  - "Self-assembling" silver mesh
  - Starts with an opaque liquid coated on film with standard equipment
  - 30 seconds later it dries into a random-pattern silver mesh
  - Should be competitive with current metal-mesh films



Drying sequence (photos by Cima NanoTech)

Most Interesting New Product…2

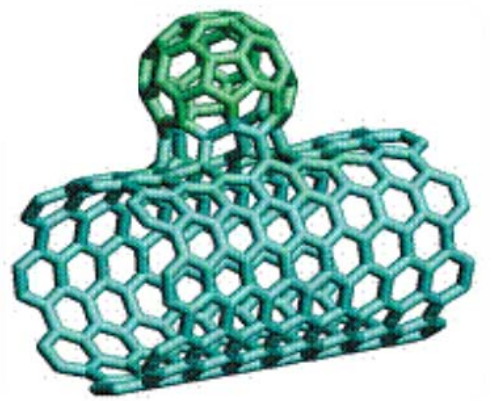
- **Cima NanoTech continued…**

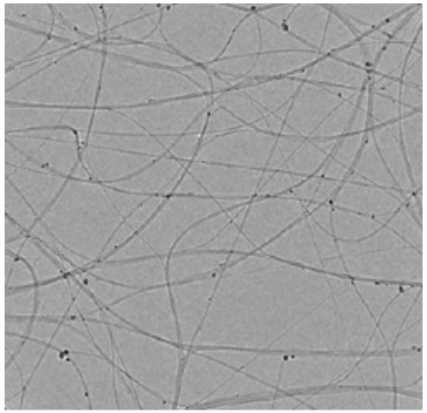


(Photos by Cima NanoTech)

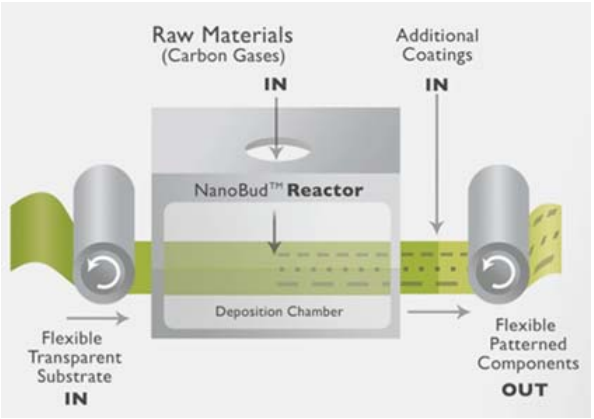
Related Product: CNTs

- **Carbon NanoBuds™ by Canatu (Finland)**
  - "NanoBud" = nanotubes + buckyballs (fullereens)
  - Probably the best current bet on CNTs, with high-volume production in 2014
    - Better optical performance than silver nanowires
      - Very low reflectivity and lower haze
    - Dry patterning, which allows printing electrodes and connections simultaneously (like metal mesh)
    - More flexible (bend radius 0.5 mm!)





(Artwork by Canatu)



Related Demonstration…1

- **Samsung Display showed a 23-inch "metal wired touch" monitor with a plastic cover-glass**
  - PMMA + OCA + film sensor
  - Could be copper metal-mesh or silver nanowires
  - Plastic cover-glass was very nice (anti-glare, good feeling, 5H hardness)
  - Touch performance (rated at 10 touches) was very poor
    - I don't get it… why show something with such bad performance??
    - Better performance has been shown by others

Photo by Author

Related Demonstration…2

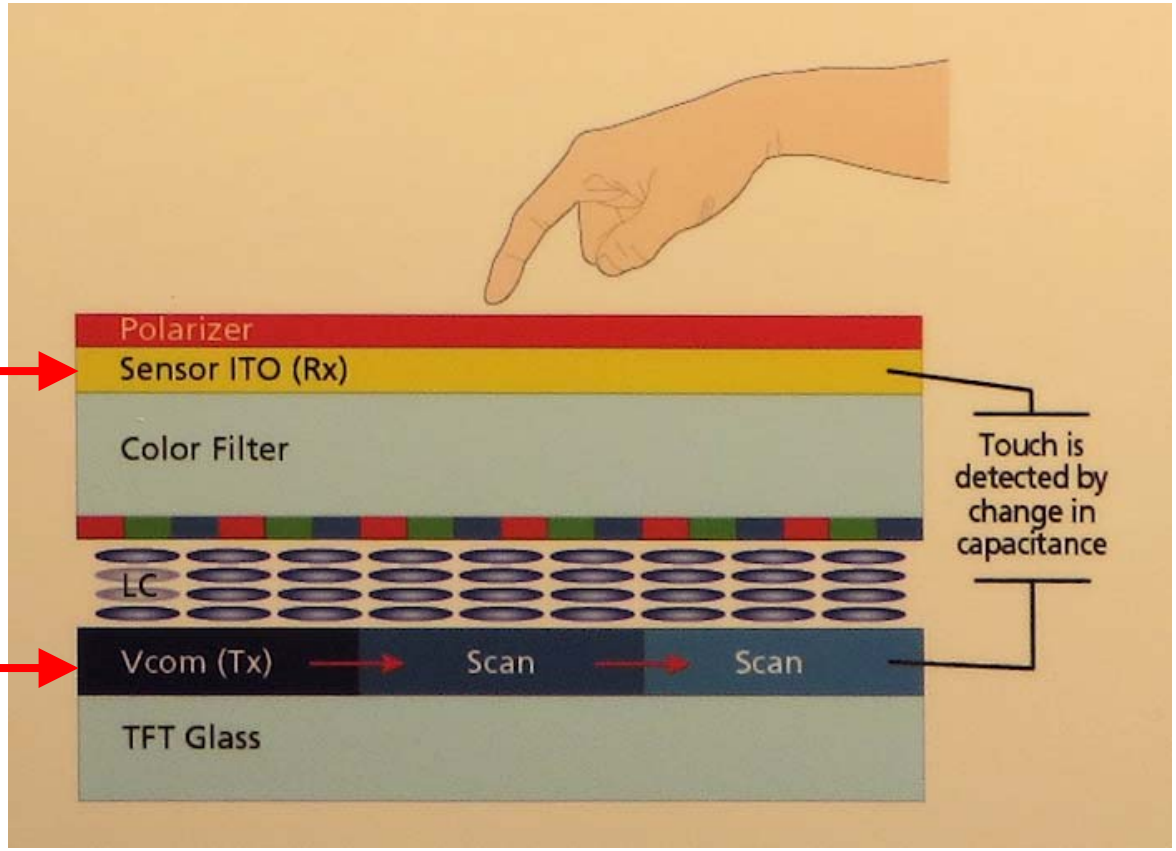
Photo by Author

Embedded Touch: JDI…1

- **Japan Display Inc. (JDI) was pushing "Pixel Eyes" (their hybrid in-cell/on-cell touch) very heavily**

The IPS anti-static ITO layer is segmented into receive electrodes

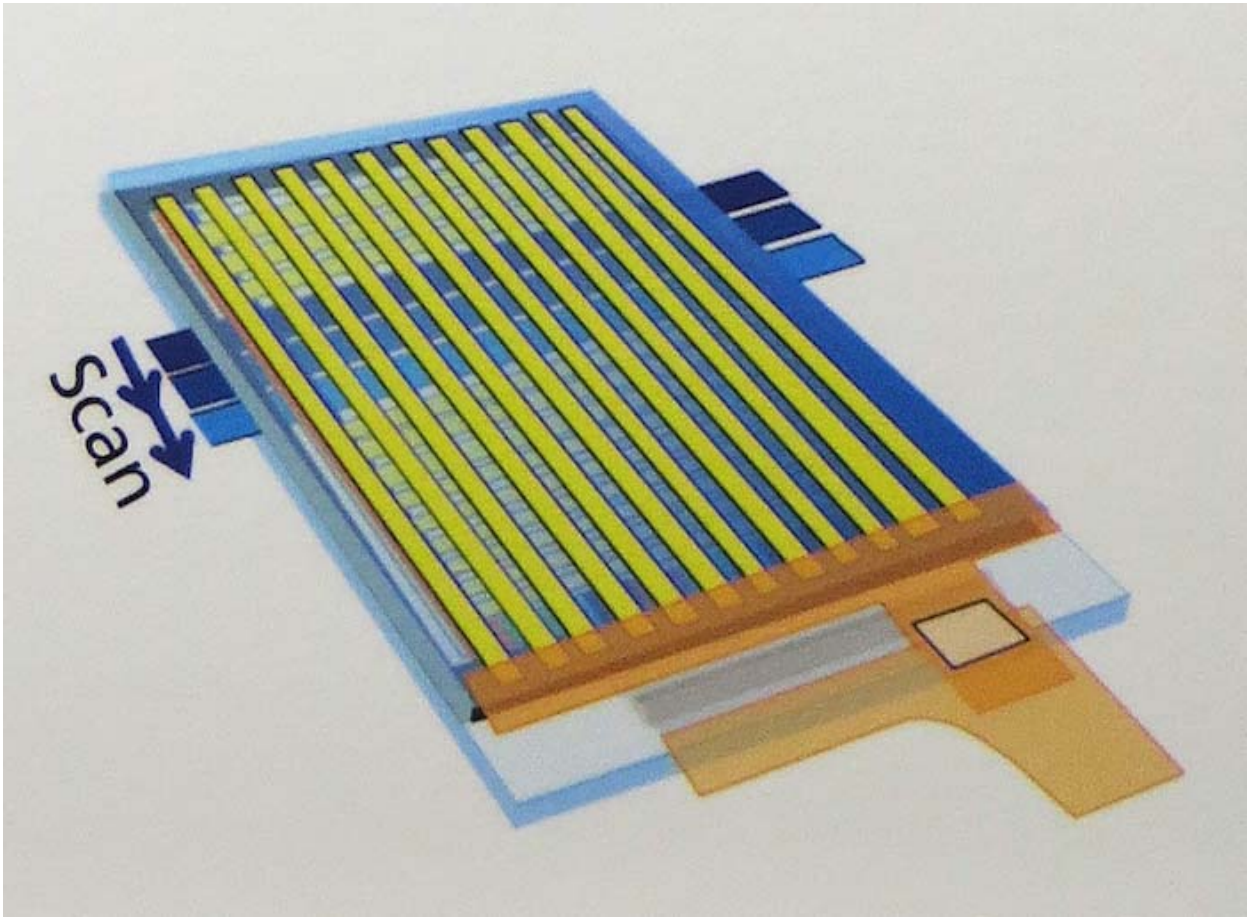
Groups of Vcom electrodes are combined to form transmit electrodes



Drawing by JDI

Embedded Touch: JDI…2

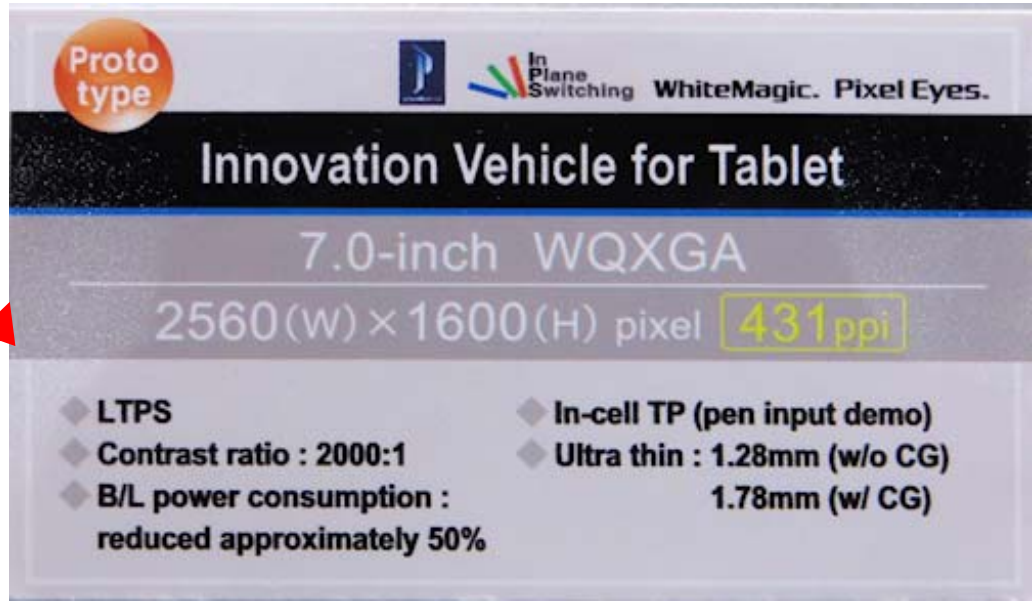
- Another view of Pixel Eyes hybrid in-cell/on-cell



Drawing by JDI

Embedded Touch: JDI…3

- **JDI showed a 7-inch pen-only Pixel Eyes demo**
  - The passive pen worked quite well but finger-touch sometimes also worked although it wasn't supposed to



Embedded Touch: JDI…4

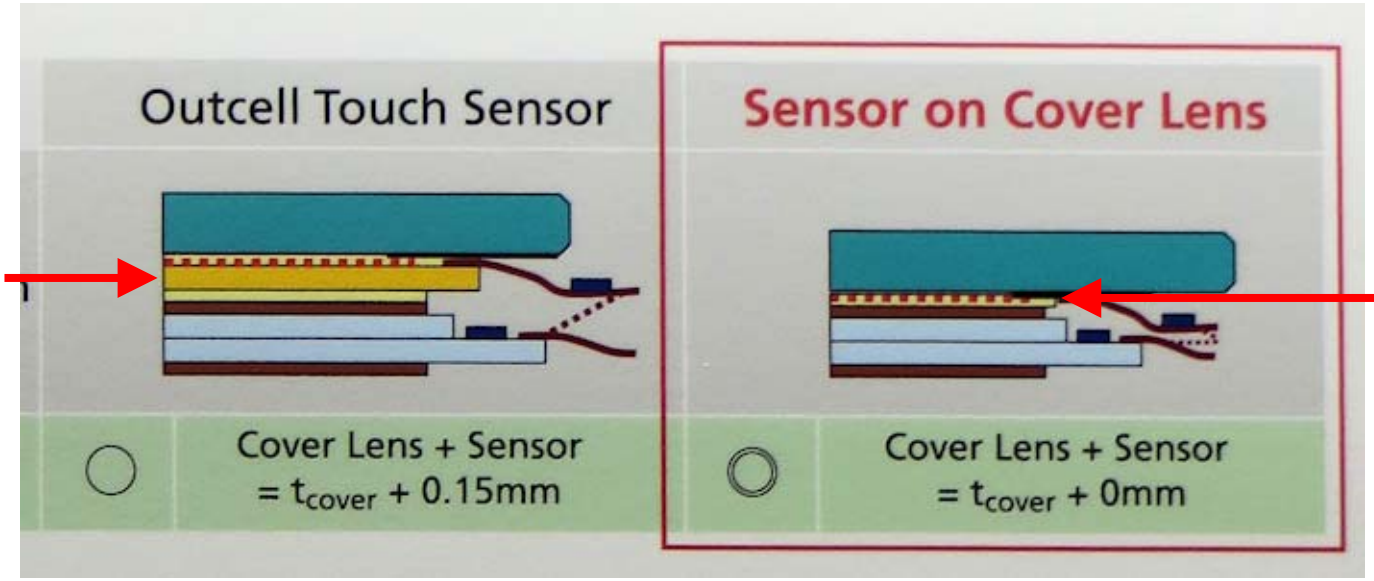
- **JDI also pushed OGS, not just embedded touch**

Ultra-Light Media Tablet (ULMT) Series

Embedded Touch: JDI…5

- **JDI's "Sensor on Cover Lens" = OGS**

PET film with ITO & bridges on top, laminated to cover glass and to LCD

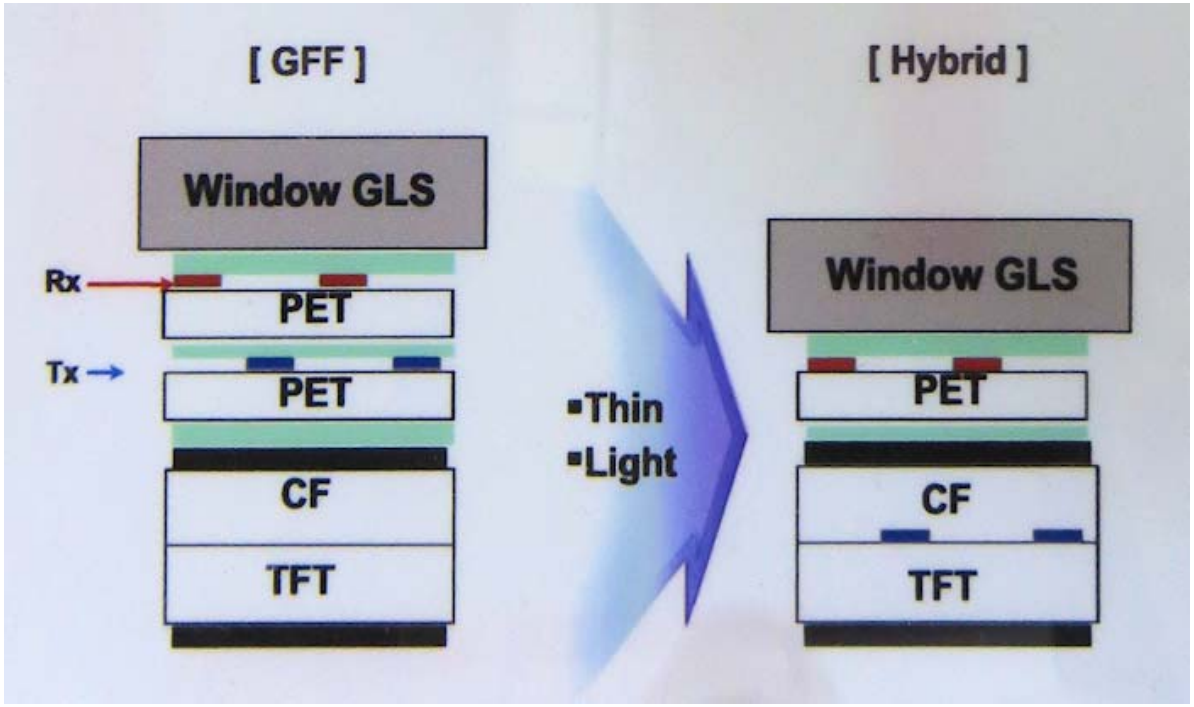


ITO deposited directly on cover glass, which is laminated to LCD

Drawing by JDI; annotation by Author

Embedded Touch: LG Display…1

- **LG Display showed a 7-inch hybrid in-cell**
  - This is a different hybrid structure than JDI's
  - Touch performance was terrible; booth staff claimed that the problem was too much EMI at the show (I don't believe it)



Drawing by LG Display

Embedded Touch: LG Display…2

- From this chart you can calculate that 40 VCOM electrodes (1280 / 32) are grouped to form each of 32 transmit electrodes

7" WX Hybrid In - cell (Oxide TFT)

Size	7.0 inch
Resolution	800 x RGB x 1280
Display Mode	AH5-IPS
Backplane	Oxide TFT
Touch Type	Mutual Cap. (F1T)
# of Touch Channel	32(Tx) X 20(Rx)
Report Rate	120Hz
Input	Finger, Pen Φ2.5

Note that they're making up their own abbreviations as they go!

Note also the pen-tip diameter spec!

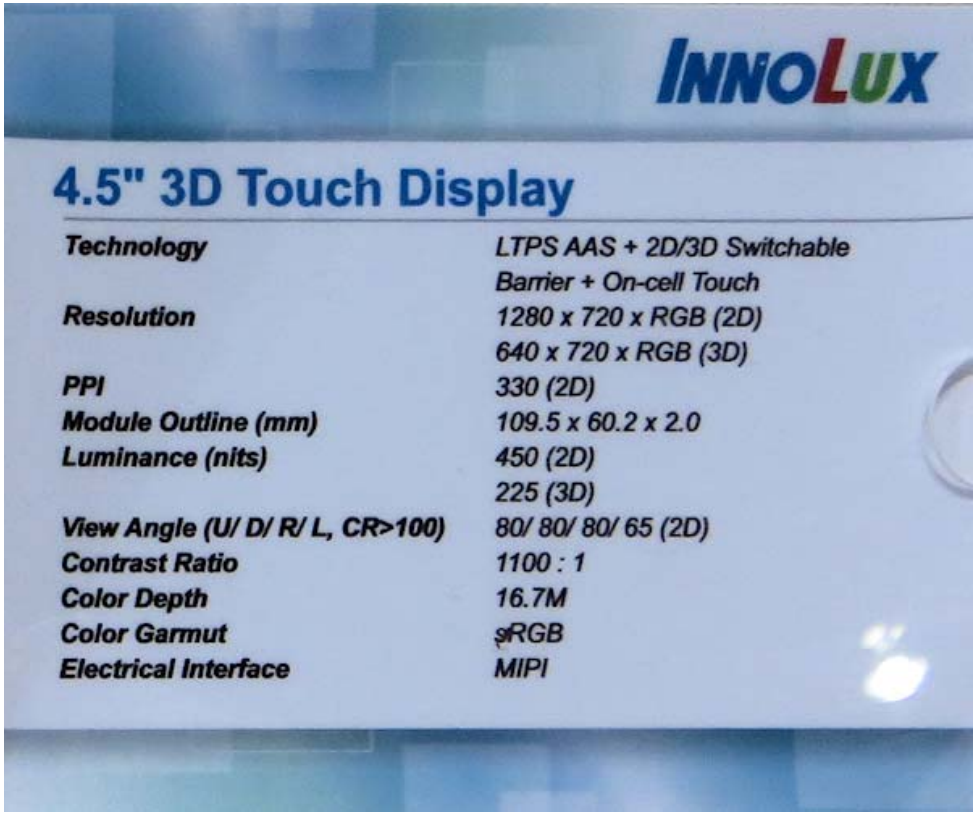
Table by LG Display

Embedded Touch: Innolux…1

- **Innolux was emphasizing on-cell in order to keep their LCD yields high**
  - Complete cell is built, including glass-thinning, then on-cell touchscreen is added
  - ITO quality is lower using this method (can't anneal at high temperature) but Innolux would rather have high LCD yields
    - They say they're still working on in-cell (not exhibited this year)
    - They confirmed that "Touch On Display" (TOD) is a brand that covers ALL of their in-cell, hybrid, and on-cell technologies (this is relevant to the Apple iPhone-6)
    - BUT, they're not using the brand in their booth this year because they're using it "only with customers"!

Embedded Touch: Innolux…2

- Innolux showed many complete touch displays, including a 4.5-inch 3D touch model



Photos by Author; Poster by Innolux

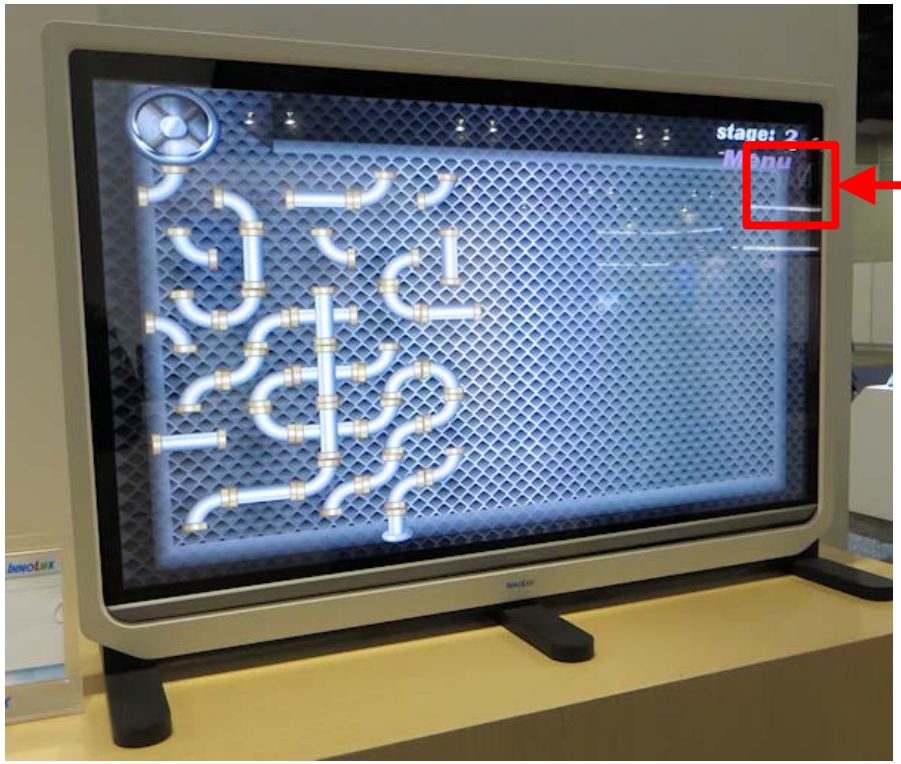
Embedded Touch: Innolux…3

- Innolux was using great photos for 3D…

Photo by Innolux

Embedded Touch: Innolux…4

- **Innolux showed a 39” touch-display with ITO in a diamond pattern at 50 ohms/square**
  - The ITO was so visible it seemed like part of the image



Next slide zooms in on this area

Photo by Author

Embedded Touch: Innolux…5

Photo by Author

Touch-Module Makers: 3M Touch

- **3M was showing off their prowess at large-format wire-based p-cap (55” prototype)**

There’s a laptop strapped underneath a standard NEC display – it’s a true prototype!

Photo by Author

Touch-Module Makers: Fujitsu

- **Fujitsu isn't slacking off their resistive business**

Posters by Fujitsu

Touch-Module Makers: AM Touch USA

- **AM Touch USA (part of AMT-Taiwan) showed a 21.5-inch p-cap with surprisingly good performance**

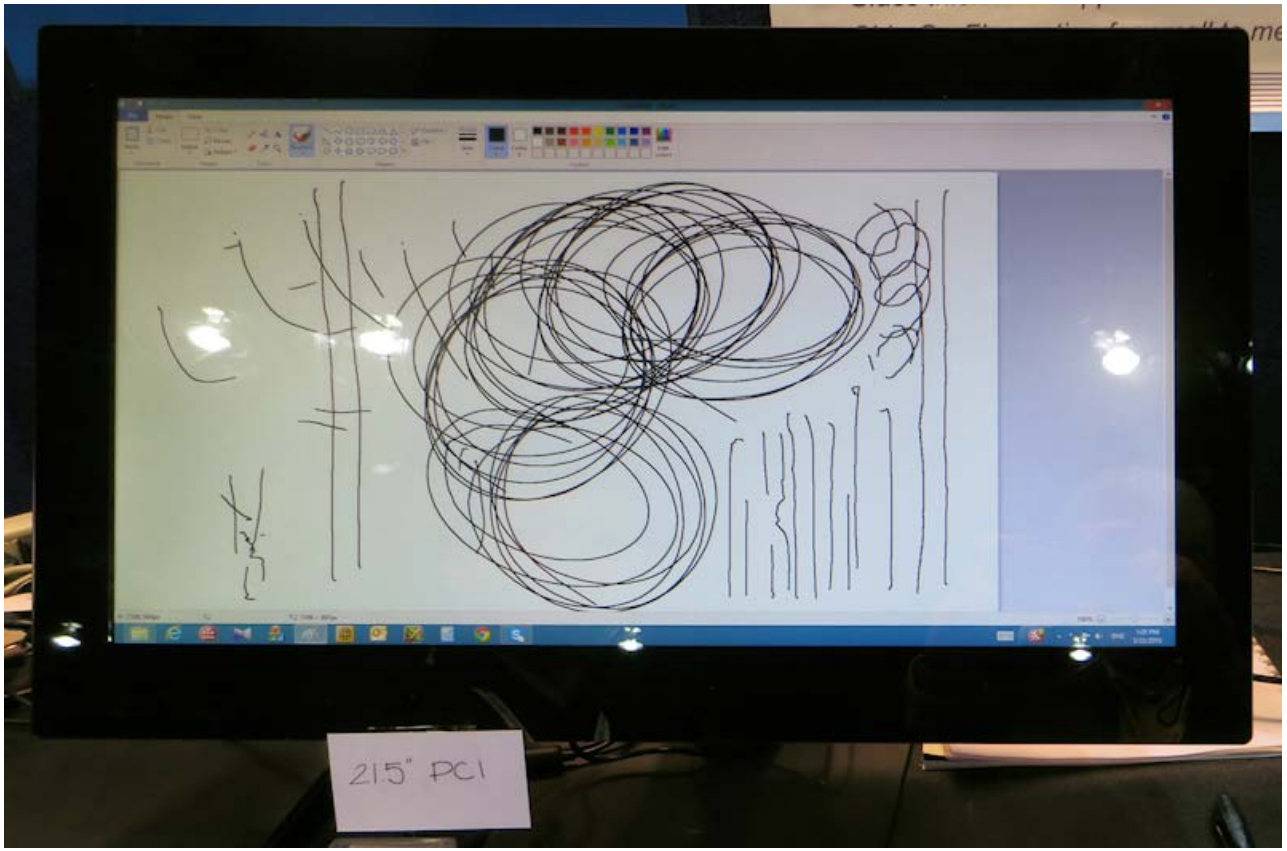


Photo by Author

They do their own controller so they can provide better support to their commercial customers

Touch-Module Makers: Panjit

- **New management at Panjit (Mildex Optical) finally allows taking photos of their products!**

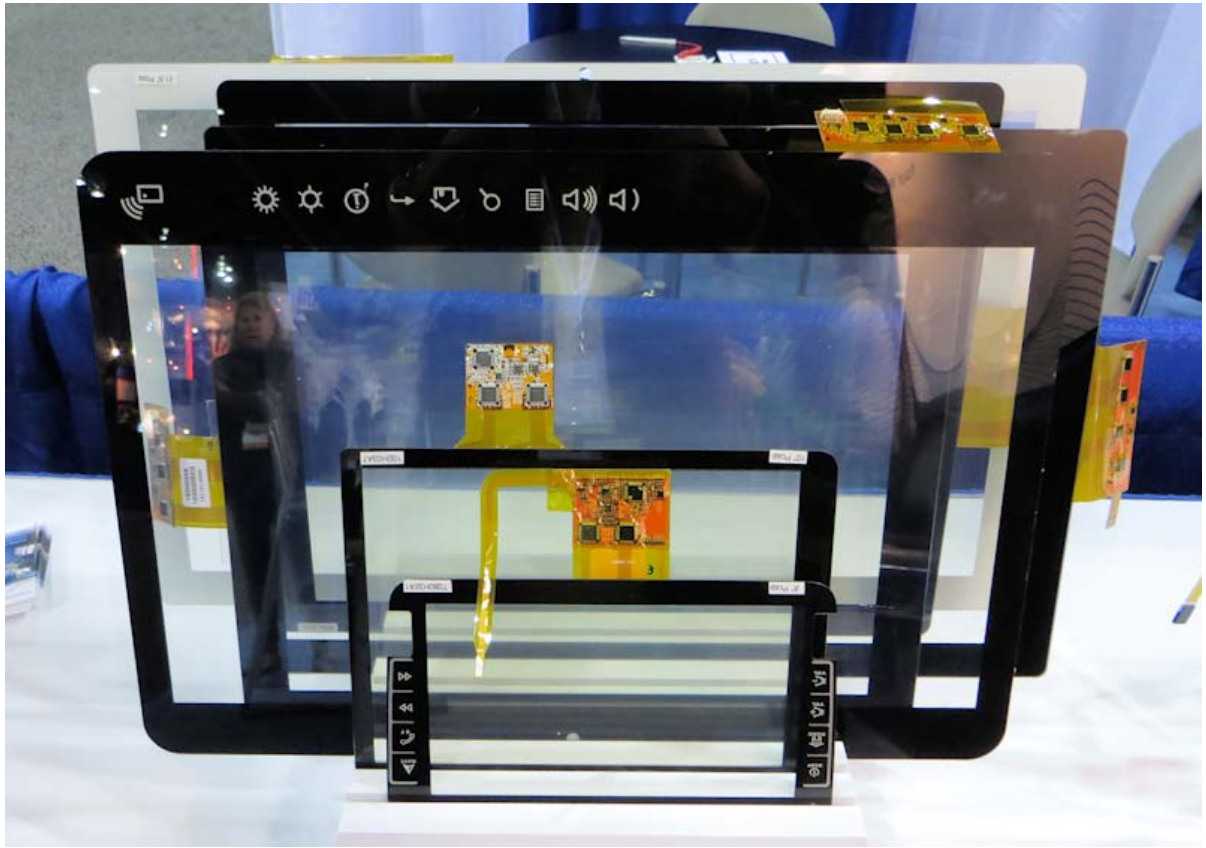


Photo by Author

Touch-Module Makers: Touch International…1

- Touch International's new marketing campaign

What is the "WoW" Factor?

WEIRD OR WACKY!

What does that mean?

Touch-Module Makers: Touch International…2

- **Touch International's new marketing campaign**

Touch-Module Makers: UICO vs. Ocular

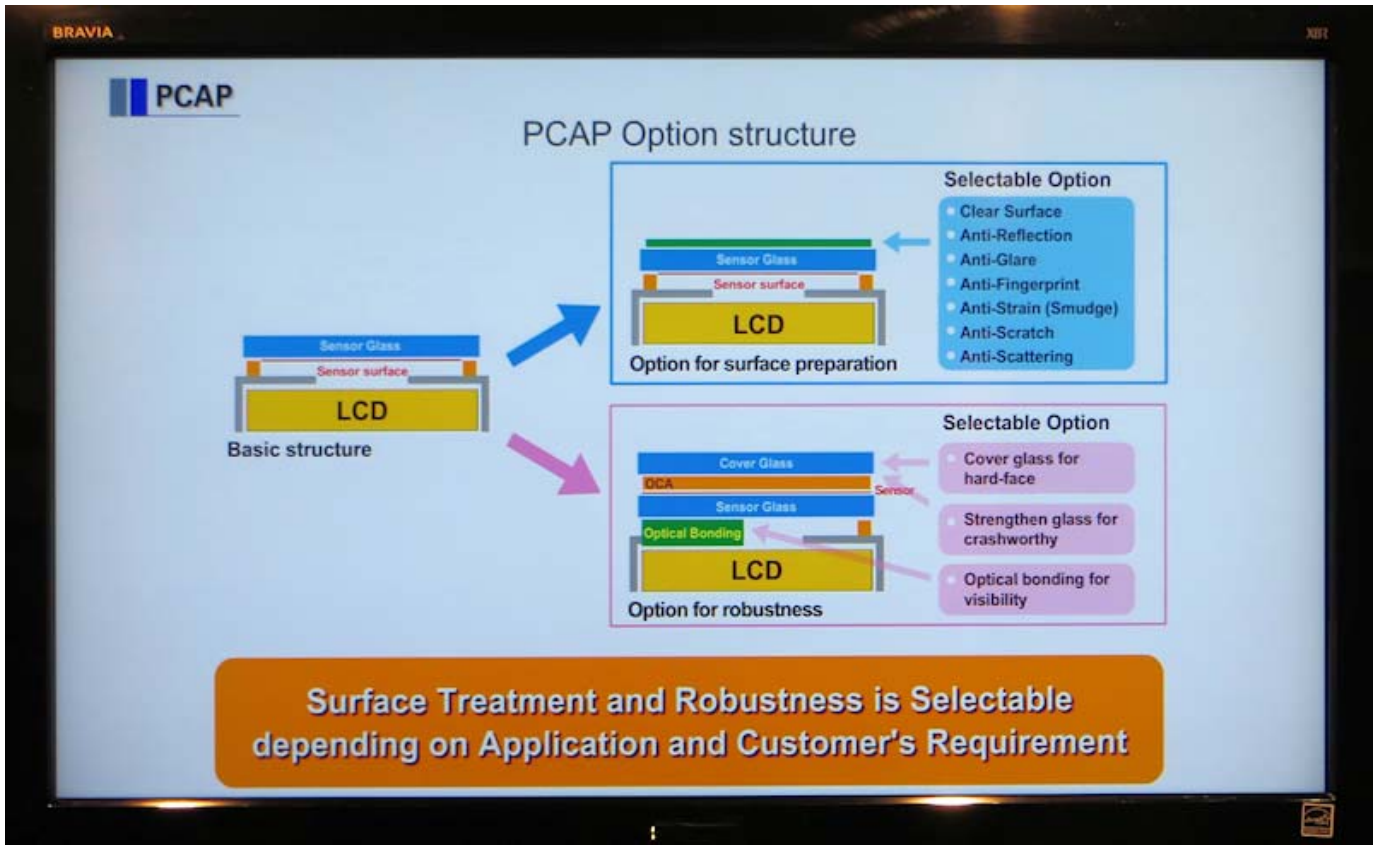
- UICO develops their own touch controller in order to optimize for water & gloves (etc.)
- Ocular partners very closely with Atmel and tries to convince them to optimize for water & gloves (etc.)
- **Which strategy is better?**

Handheld shower spray

WaterSENSE® from UICO

Touch-Display Makers: Renesas/NLT

- **Renesas/NLT (formerly NEC) finally stopped showing surface-capacitive**



This slide shows a good example of p-cap options for commercial applications

Photo by Author; Slide by Renesas/NLT

Touch-Display Makers: Bi-Source

- **BSI showed the only IR touchscreen at the show!**

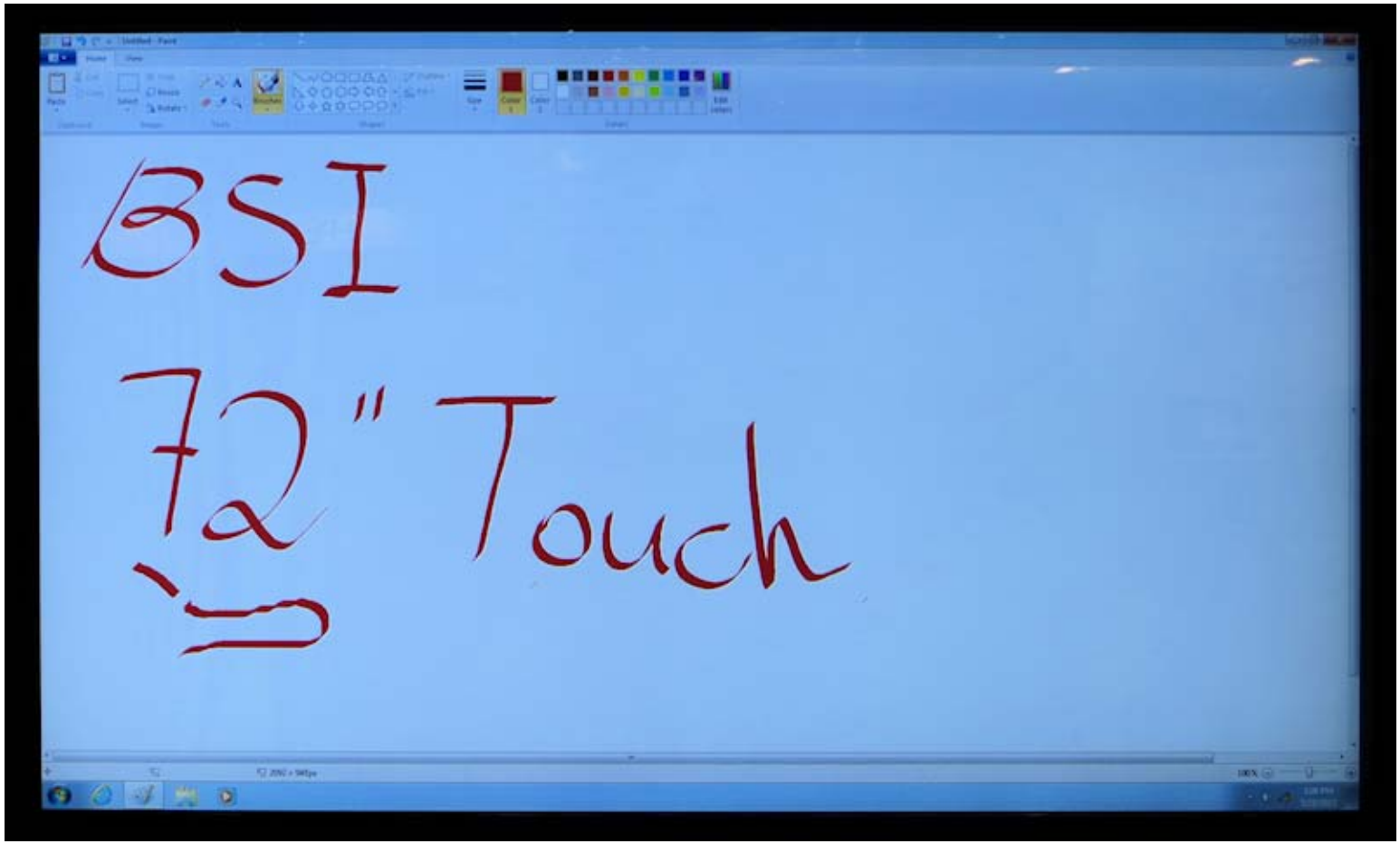


Photo by Author

Fogale: Something Unusual…1

- **Fogale (from France) has developed multi-touch/ multi-touchless self-capacitive**
  - Derived from their “anti-collision system” for medical machines (contactless body detection for X-rays) developed with GE
  - Technology specs
    - Multi-touch: 5 touches on 5” screen, 10 touches on 10”
    - Multi-touchless: 5 cm for fingertip, 10 cm for whole hand
    - Accuracy and linearity: better than 1 mm
    - Works through dielectrics (glove, glass, plastic, wood, etc.)
  - Technology uses “active shield” to totally eliminate all parasitic capacitance, allowing measurement of 0.001 pF between electrode and target (100X better than current)
    - 0.001 pF corresponds to a hand 100 mm from a 1-cm^2 electrode

Fogale: Something Unusual…2

- **It's possible to integrate the technology into a smartphone, but the applicability is TBD**

Sensor:
Concept active guard
Electrodes design & drawing
Concept & drawing of flex

IC:
Concept / Design (AFE)
Architecture
Signal processing (FW)

Applications:
Gesture & optical & vocal
Combined technologies
3D commands

(30 patents)

Artwork by Fogale

Summary of Observations

- Not as many truly new developments as in 2012
- # of material-makers > # of module-makers exhibiting
- P-cap has knocked out everything except resistive
- Embedded touch (hybrid, on-cell, in-cell) is growing
- ITO replacements (especially metal-mesh) are growing
- Enhancements are very important in commercial apps
- Exhibitors appeal more to commercial than consumer
- Even though p-cap is dominant, innovation continues

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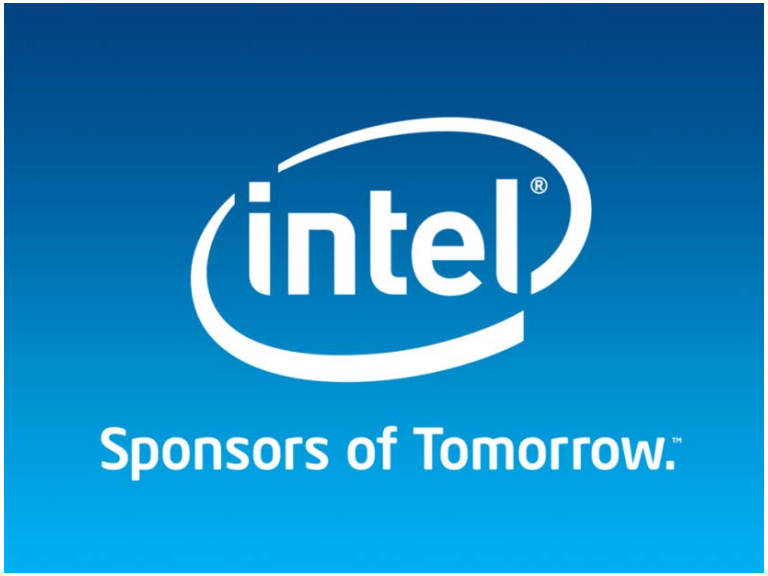

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