



MTO

Microsystems Technology Office (MTO)

DARPA Tech 1999

Dr. Noel MacDonald, Director



MTO

- Microsystems via ‘Chip-scale’
Integration of Core Technologies:
 - Electronics
 - Photonics
 - MEMS (Microelectromechanical Systems)



MTO (cont.)

- Materials, processes, devices & supporting technologies for chip-scale integration of Core Technologies



MTO Support Programs



MTO

- CAD (Computer Aided Design) for heterogeneous integration
- Simulation tools for ‘chip-scale’ microsystems
- Advanced Lithography



Microsystem Technology

MTO

Electronics

Photonics

New Microsystem
Components for the
New Millennium

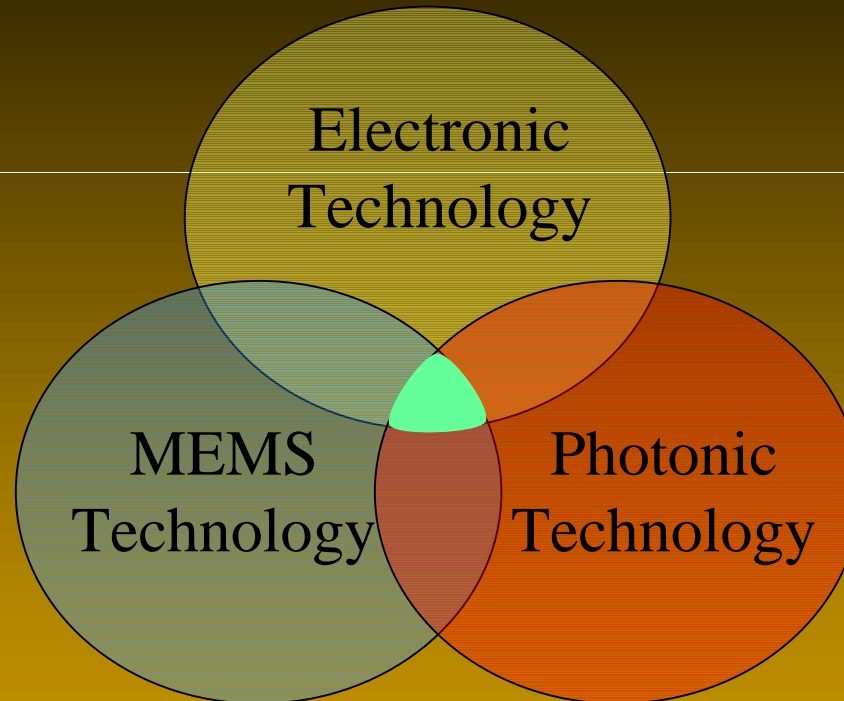
MEMS

‘Chip-scale’ heterogeneous integration



No Boundaries

MTO



The 'new gold' is found at the intersections of the 3 technologies



Commercial Examples:

‘Chip-scale’ Heterogeneous Integration

Ink Jet Printer Head:

(Microelectronics/MEMS)



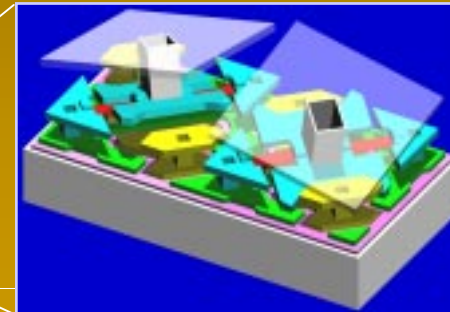
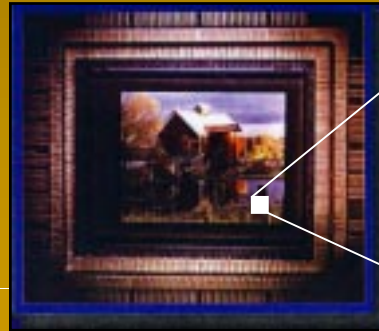


Commercial Examples:

MTO

‘Chip-scale’ Heterogeneous Integration

Texas Instruments Digital Micromirror
Device (DMD) TM: (Microelectronics/
MEMS to direct photons)





Commercial Examples:

'Chip-scale' Heterogeneous Integration
Micro Accelerometer (Airbag Deployed):
(Microelectronics/MEMS)





Microsystem Technologies



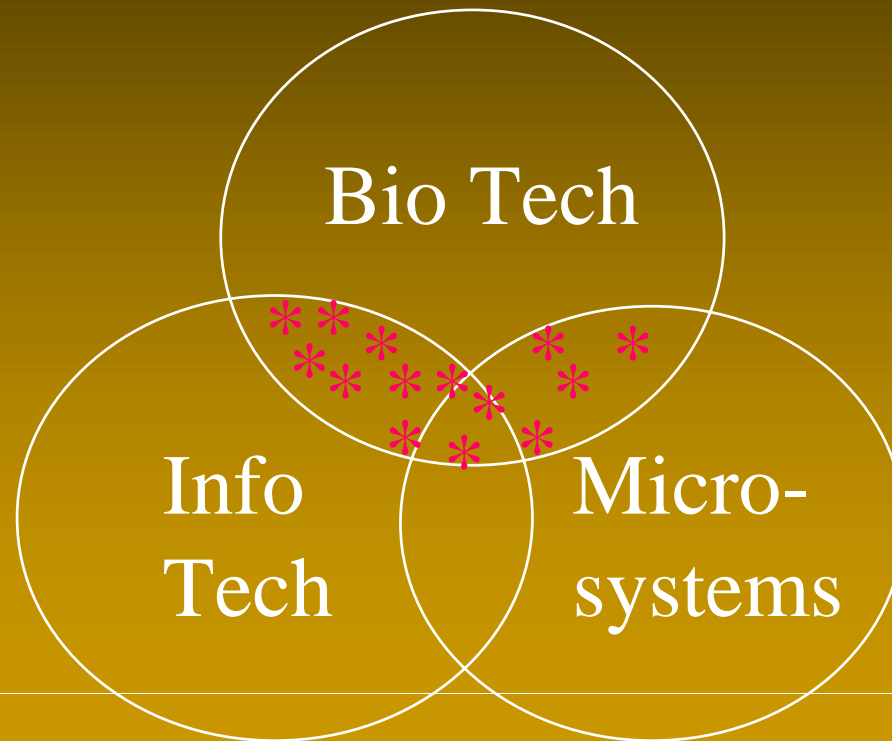
Focus on the “I Word” - Integration at the micro/nm scale

- Processes
- Contacts, isolation and interconnects
- Mixed materials and mixed technologies
- Multiple chip integration (not packaging)



Exploring the Interface between Biological Technology and More Conventional DoD Technologies

MTO

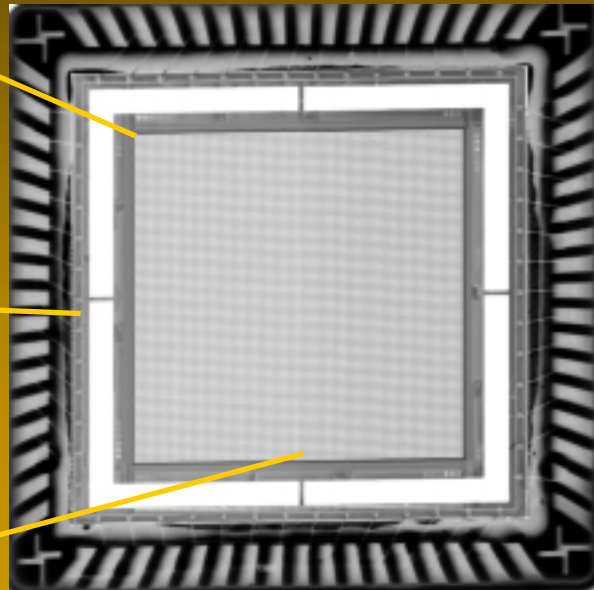
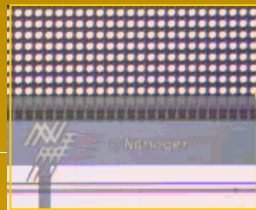
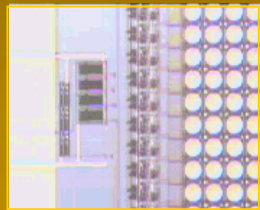
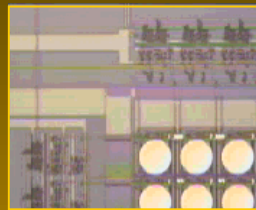




Biological Technology **MTO**

Examples

10,000 Site Assay Chip

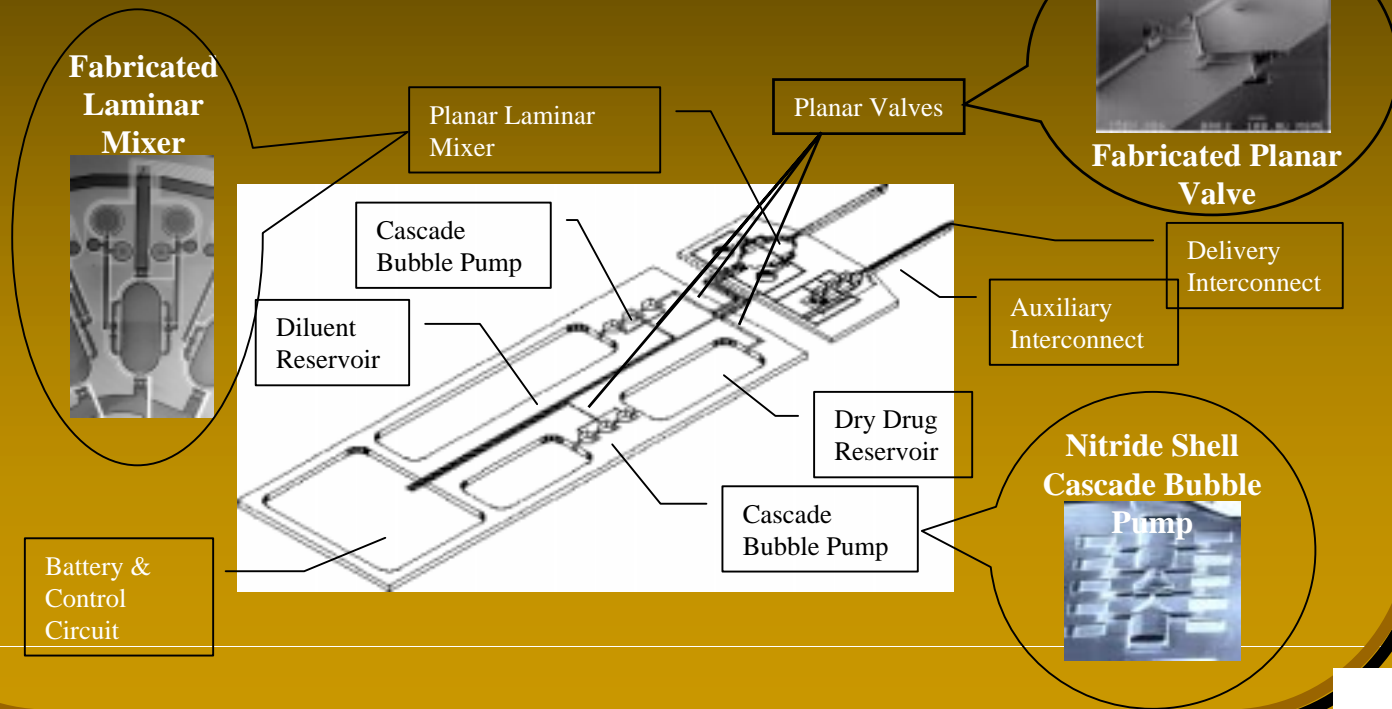




Biological Technology **MTO**

Examples

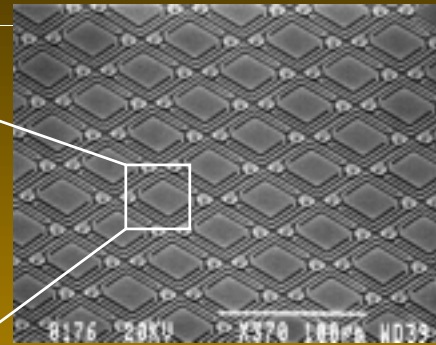
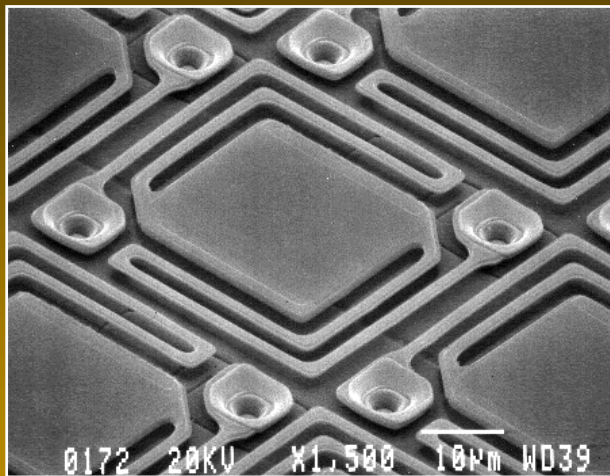
Reconstitution and Delivery System





Photonic Imaging Examples

MTI



Single-Frame @ $f/2.2$
(50% Trans)



Raytheon

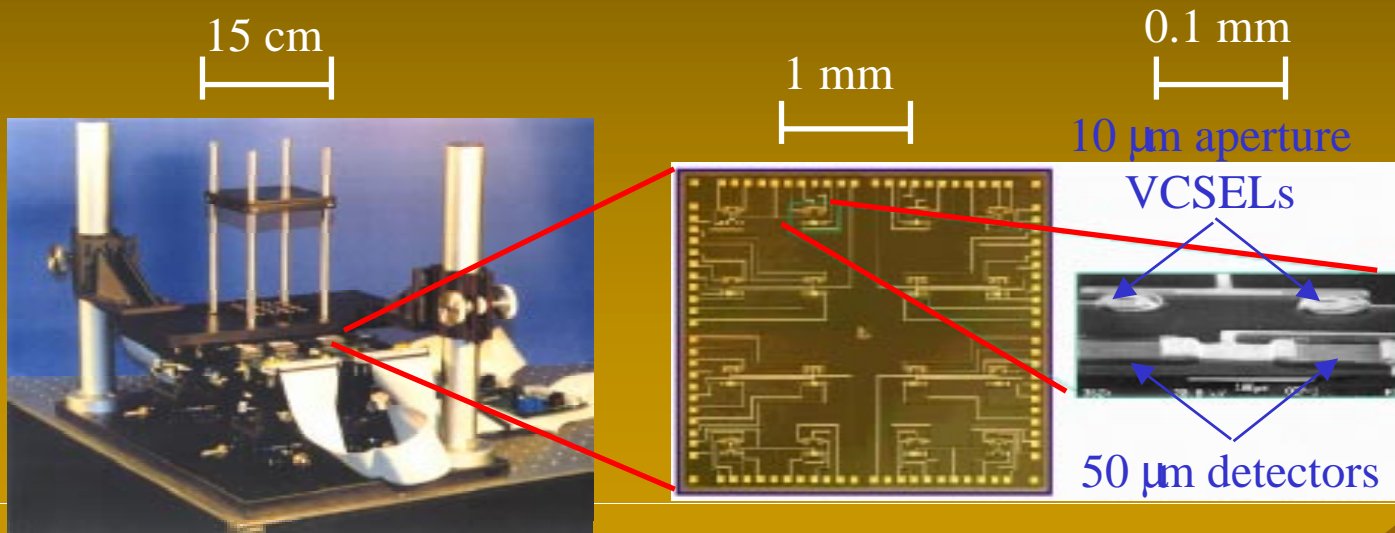


MTO

Photonic Technology Examples

Free-Space Interconnect Demo:

First system level demonstration of integrated 2-D interleaved arrays of VCSELs and detectors (1/98)



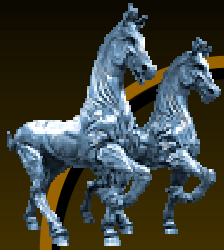


Warfighter Support Programs

MTO

Test cases for microsystem technologies

- Wearable microsystems
- Micro-scale human interfaces
- Small size
- Micro-UAV
- cm^3 -scale robot



Warfighter Technology **MTO**

Examples

Small Image Sources:



1280 x 1024 high brightness
AMLCD for Comanche

640x480 AMEL
for Land Warrior



Members of the Team:

DARPA, SSCOM, CECOM-NVESD, ARL, USARARL, Armstrong Labs, NAWC
Kopin Corp, Planar Inc., Sarnoff Corp., Allied Signal, Thesys, UMC, MIT-LL,
U of FI, GTRI, GIT, Oregon Graduate Institute, Honeywell, Hughes, Kaiser



Summary

- ‘Chip-scale’ integration of microsystem technologies
- Heterogeneous integration of electronics, photonics & MEMS
- ‘Bio Chips’ signal a new era of heterogeneous integration



The letters "MTO" in a blue, bold, sans-serif font, surrounded by a blue starburst graphic with multiple points.

Summary (Cont.)

- Micro-components for new systems & new system architectures
- High-profile commercial products have demonstrated the power of heterogeneous integration