

Emerging Areas in Research with Commercial Interest in Engineering and the Physical Sciences

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Outline

- Specific Examples of Startup Companies Derived from UC Davis Technology and Research
- Examples of Emerging, Promising Research
- List of Opportunities within Departments

Center for Aircraft Health Management

- At McClellan Field, CA (Sacramento)
- Institutional support from University of California
- Broad-based program objectives
 - Commercial activities in support of airworthiness
 - Aircraft maintenance, repair, and overhaul
 - Depot-level non-destructive inspection and NDI engineering
 - Aircraft structural engineering
 - Mechanical and metallurgical testing
 - Application-focused research and development
 - Advanced methods for non-destructive inspection
 - Health monitoring systems
 - Aircraft structures
 - Education
 - Aeronautical engineering: undergraduate and graduate
 - Professional education
 - Key partnership with USFS Wildland Fire Training Center

Center for Aircraft Health Management

Key Contacts

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UC Davis, Office of V.C. for Research
530-757-3442
- Prof. Michael Hill
UC Davis, College of Engineering
530-754-6178
- Jim Smith
UC Davis Extension
530-754-6487

Advanced Luminescence Inc.

Scott Blackstone, CEO

Prof. Charles Hunt, CTO

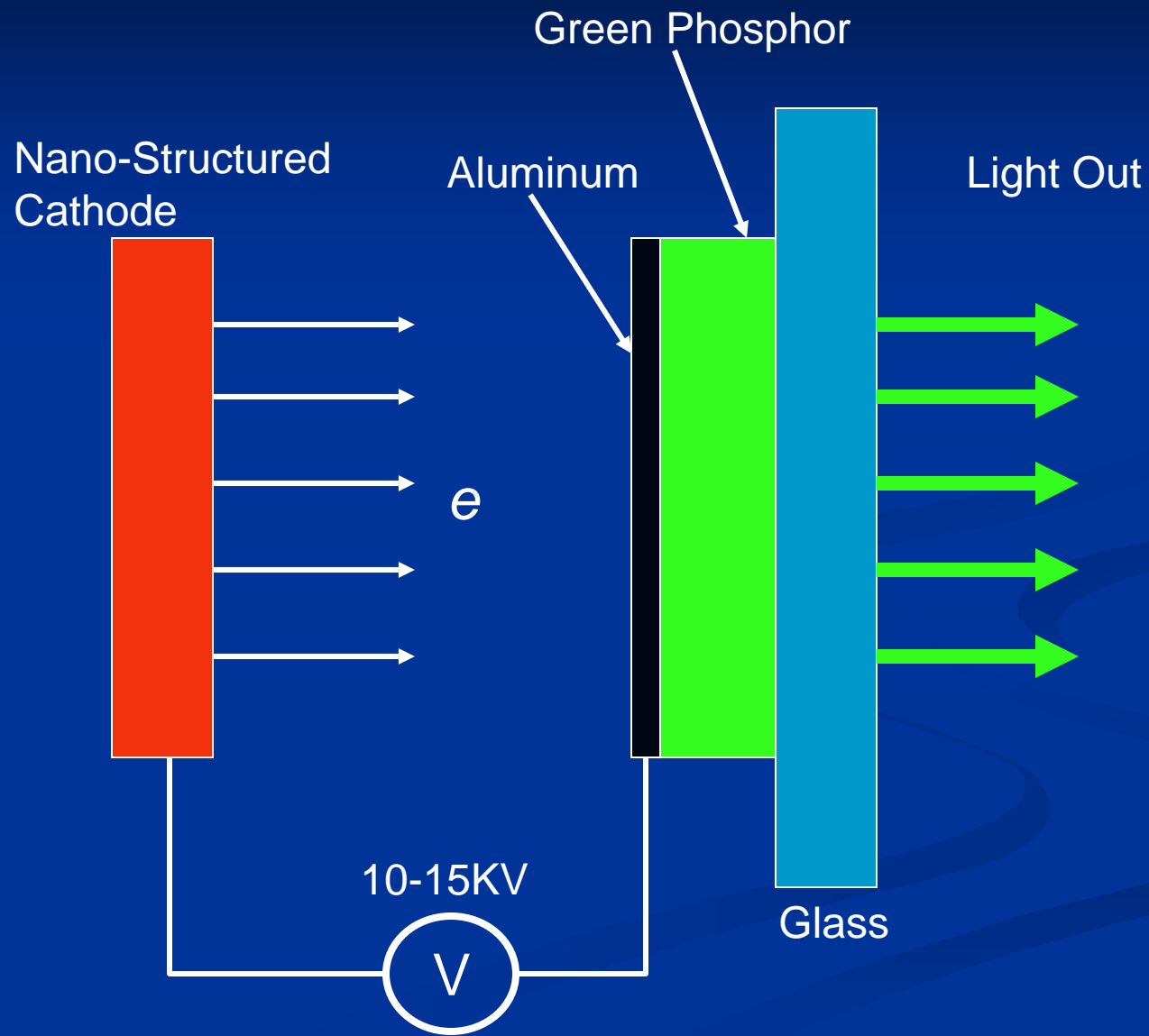
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www.advlum.com

Advanced Luminescence:

- A company based on the Nanotechnology Field Emission work of Prof. Charles Hunt at UC Davis and the DuPont Research Center.
- We are offering a mercury-free lighting source which has the potential to replace conventional lighting fixtures, based on both cost and performance.
- Competes head to head against LEDs in many applications unique to LEDs, but at the cost of conventional lighting products.

AL Diode Lamp Operation



High Brightness Triode Lamp Prototype



$V_a = 8,000 \text{ V}$
 $V_g = 3,500 \text{ V}$
 $I_a = 100 \mu\text{A}$
 $L = 10,000 \text{ cd/m}^2$

Advanced Luminescence Lighting

- **Field-Emission Lighting Offers Important Features:**
 - High Efficiency (50 Lumens/Watt)
 - Wide Color Spectrum From Infrared to Ultraviolet including White (Any Color on your TV)
 - Long Life (10-20+K hours)
 - Dimmable
 - Insensitive to Temperature
 - Low Cost
 - Rugged
 - No Toxic Materials, recyclable

Markets

- Technical Lighting
- Traffic Control/Safety
- LCD Backlighting
- Signage
- Very Large Screen Video Displays

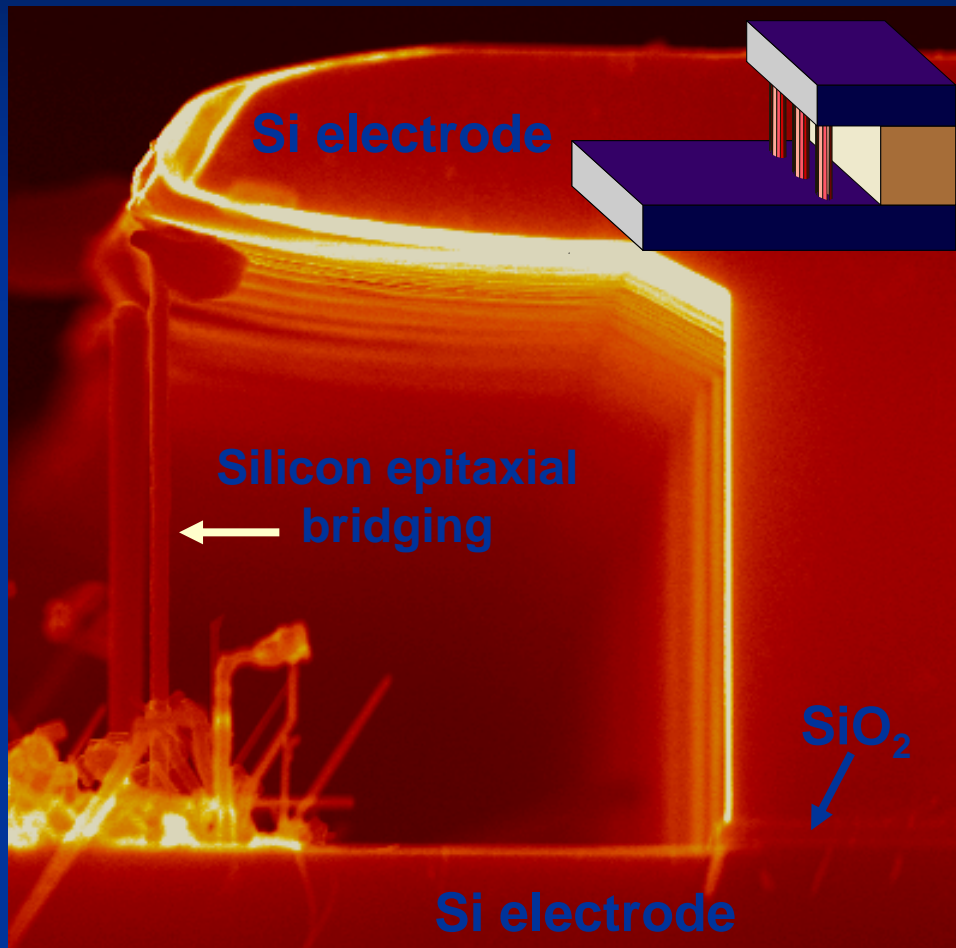
Lighting Technology Comparisons

	Incandescent	Fluorescent	LED/OLED	AL field-emission
Efficiency	very low	high	low / very low	high
Brightness	low-high	low	high / low	low-high
Lifetime	1K hr	10K hr	very high / low	20K hr
Durability	medium	medium	high/medium	high
Lamp Price	very low	medium	high/low-medium	medium
Colors	full gamut	limited	wide gamut	full gamut
Dimmability	yes	no	yes	yes
Op Temp	broad	fixed	narrow	broad
Toxicity	low	high	low	low

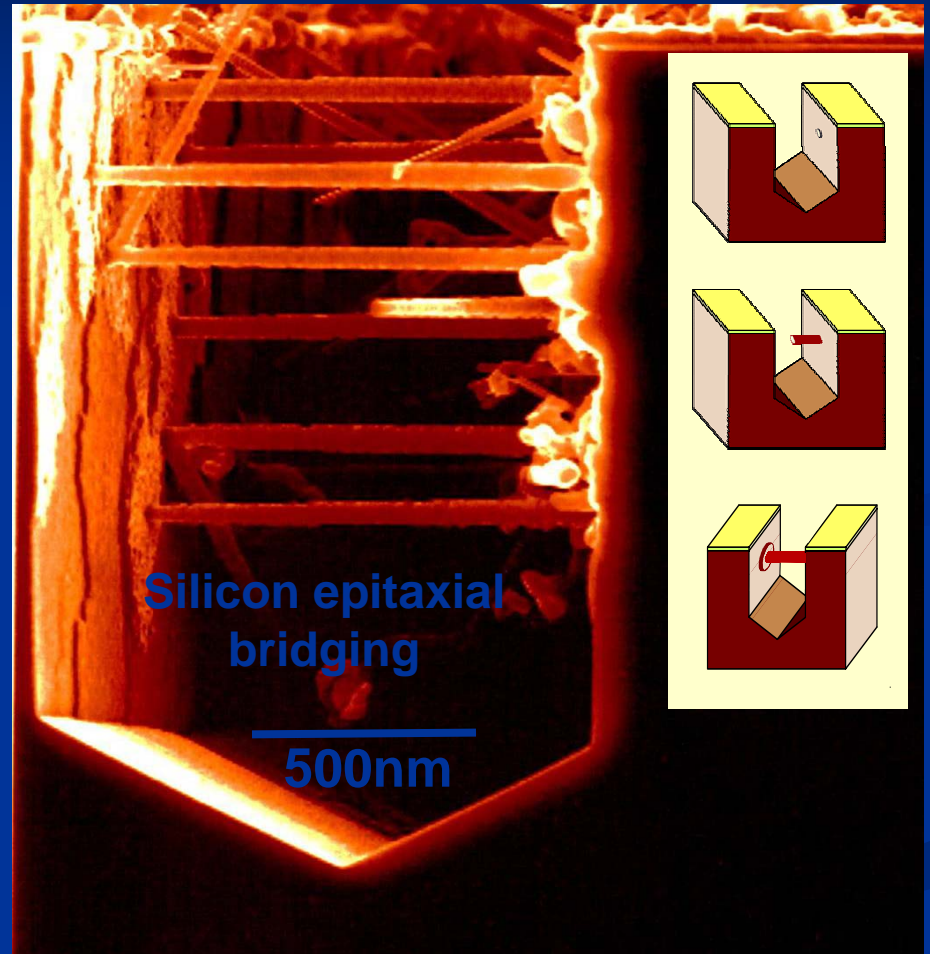
Other Prospects in Engineering

Massively Parallel & Manufacturable Integration of Nanowires for Nanoelectronics and Nanophotonics

M. Saif Islam, University of California, Davis, CA, saif@ucdavis.edu



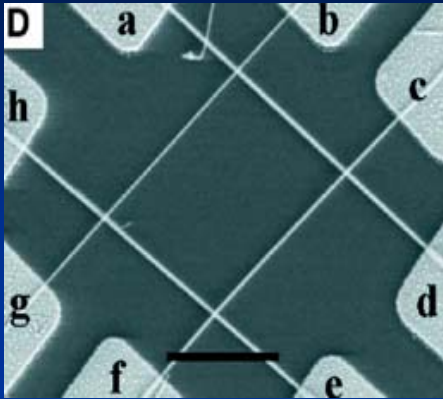
Vertical nanowire integration



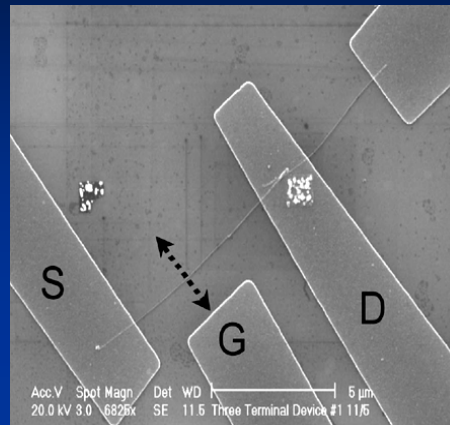
Lateral nanowire integration

Currently exploring CMOS integrations and novel biological, NEMS applications

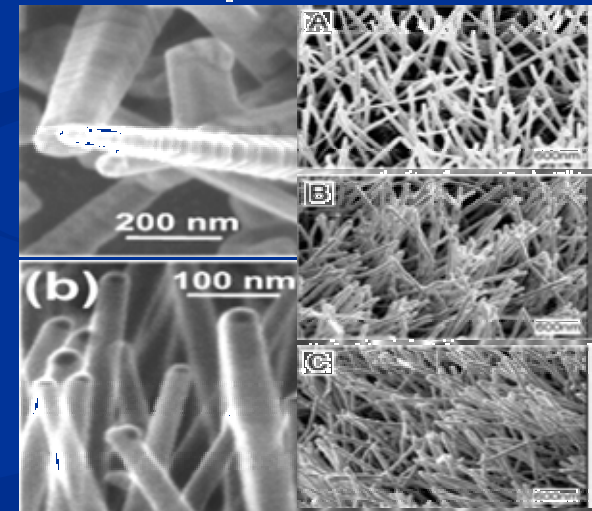
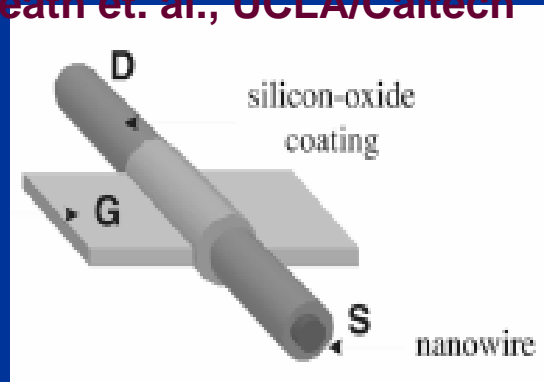
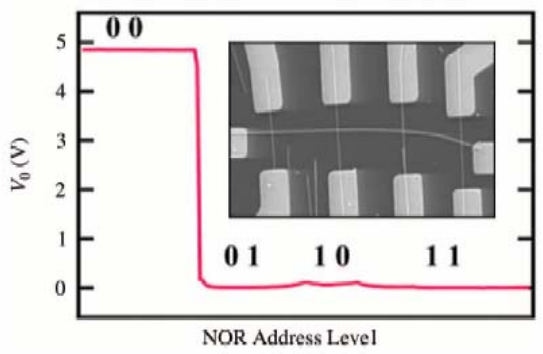
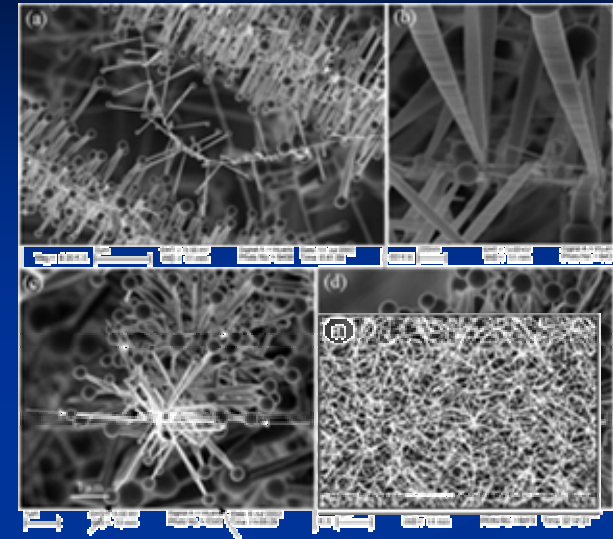
Potential of 1D Nanowires as Sensors, Logics, Electronic and Photonic Devices



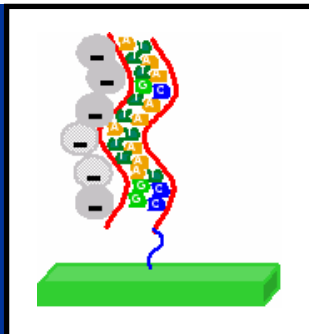
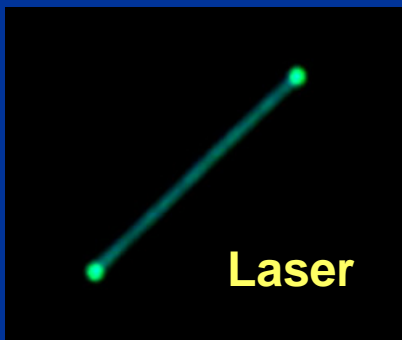
Lieber et. al., Harvard



Heath et. al., UCLA/Caltech



Wagner, Hiruma, Lieber, Wang, Yang, Martin, Samuelson, Kamins, Zhao, Xia..



Biological Sensor

Nanoscale format for biosensors
assays on a nanoparticle:

Applications to toxin detection, high
throughput proteomics, immunoassays

Professor Ian M. Kennedy

Mechanical and Aeronautical Engineering

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Lanthanide oxide nanoparticles

- Sharp emission spectrum increases spectral sensitivity
- Long lifetime emission permits gated detection
- Surface treatment permits conjugation
- No need for chelation
- Magnetic moments useful for separation and for imaging contrast agents
- No photobleaching

Reconstruction and Visual Exploration of Sensor Network Data

Bernd Hamann,
Oliver Kreylos, Oliver Staadt,
and Valerie Szudziejka

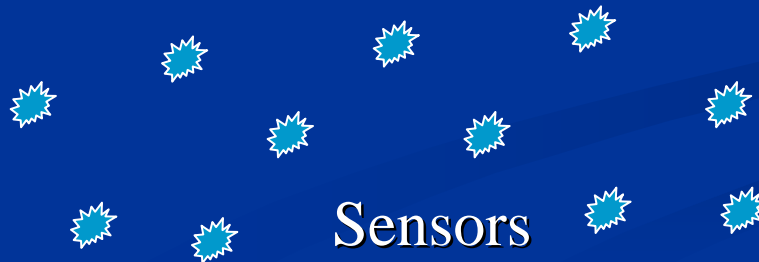
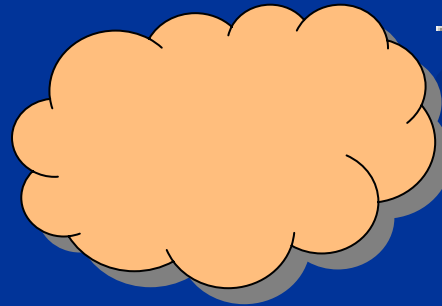
Institute for Data Analysis and Visualization (IDAV)
Department of Computer Science
University of California, Davis

Distributed Environments for Visualization

Data Exploration Servers

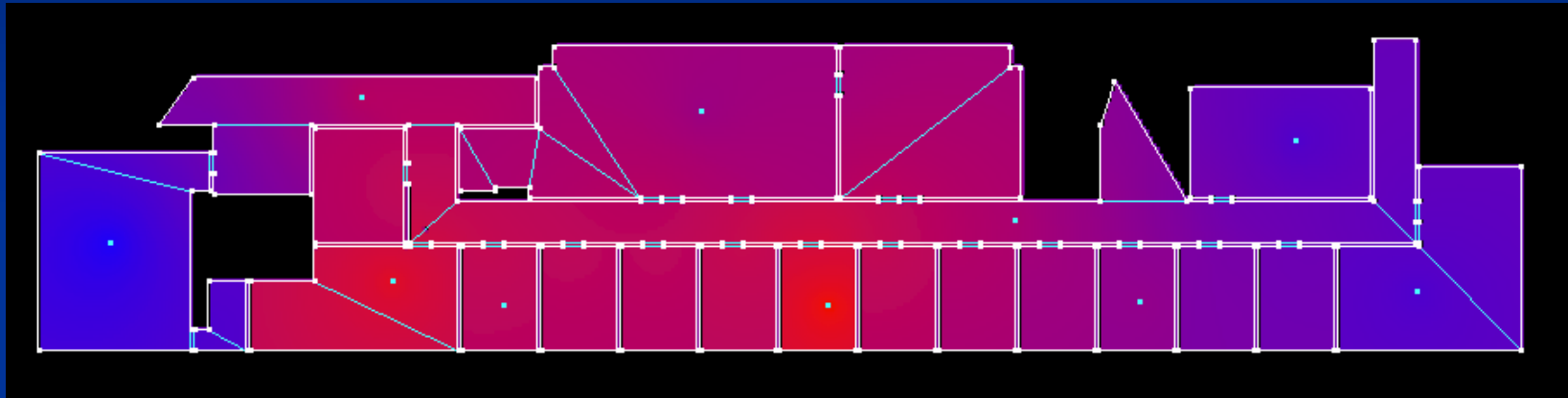


Visualization Portals

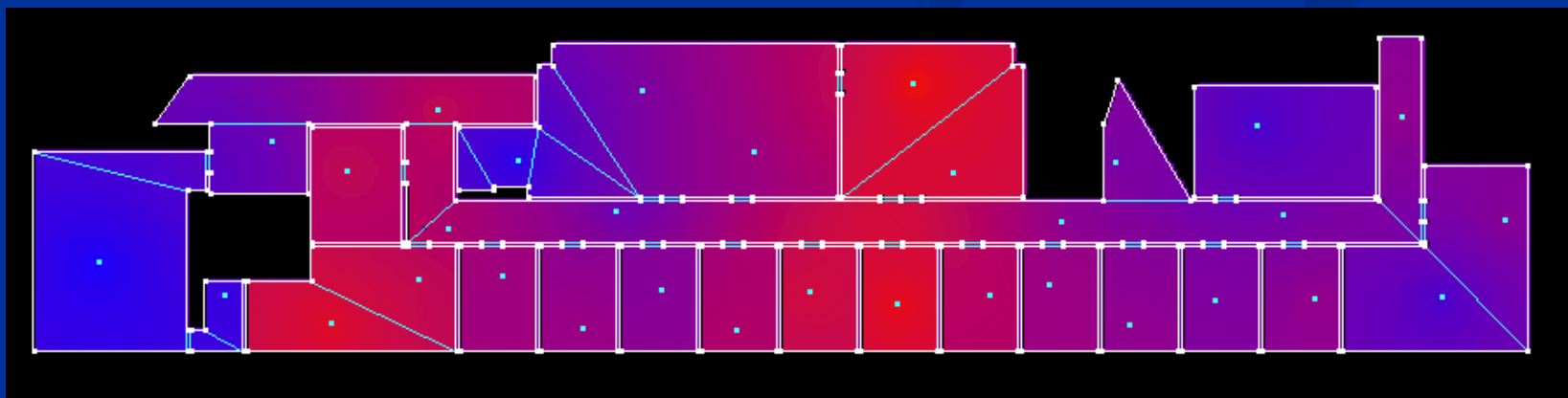


Sensors

Sensor Network Data Visualization (Reconstruction of Building Temperature)



Sparse placement of sensors



Dense placement of sensors

(Images courtesy of V. Szudziejka)



California Lighting Technology Center

Mission --“To advance the application of efficient lighting technologies in the State of California”

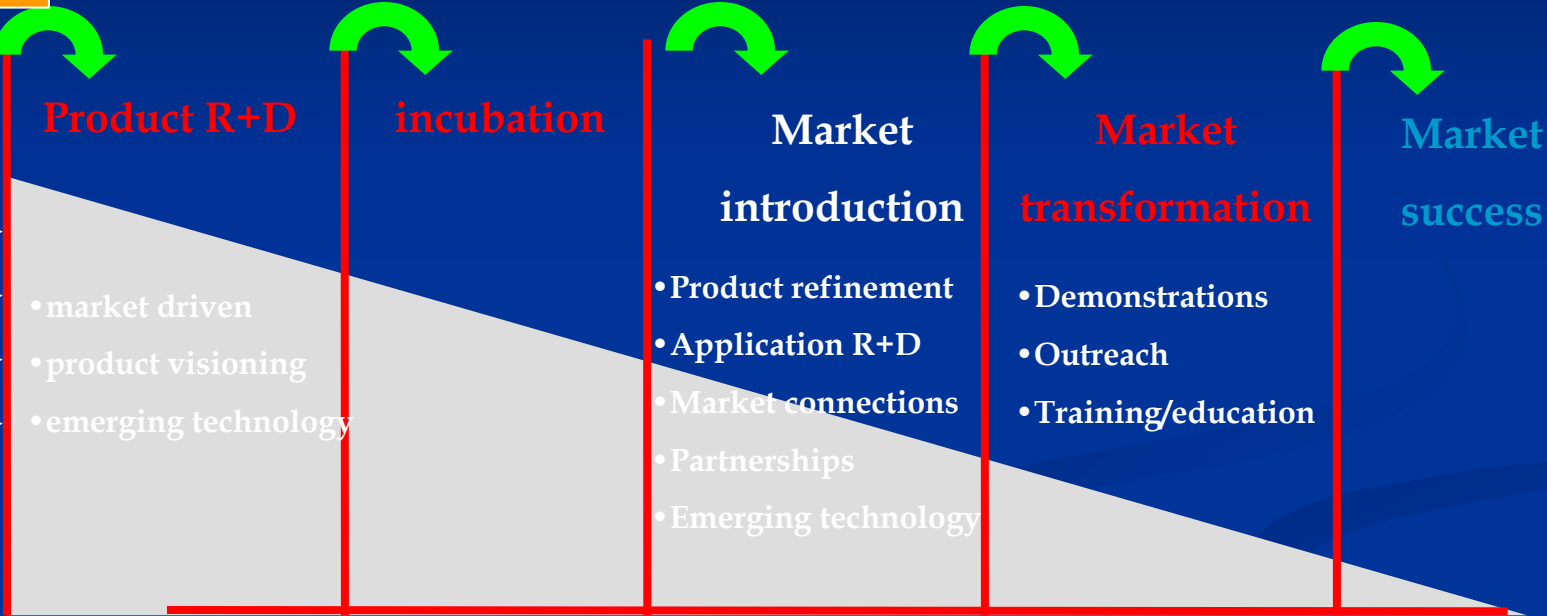


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Market Driven

Product Driven

Basic Research



PIER Program activities

Emerging Technology Programs



Commercialization Process

Programs in Physics

- **HIGHLY SENSITIVE IMAGING CAMERA FOR SPACE APPLICATIONS**
- and
- **HYBRID PHOTON DETECTOR WITH A PHOTOCATHODE IN REFLECTIVE MODE**
- Prof. Daniel Ferenc
- Physics
- (no NCD)

- **SWITCHING DEVICES MADE OF HALF METALS**
- Prof. Ching Yao Fong
- Physics
- (no NCD)

- **A NON-FLUORESCENCE BASED OPTICAL TECHNIQUE FOR BIOCHIP DETECTION**
- Prof. Xiangdong Zhu
- Physics
- (No NCD)

Programs in Mechanical Engineering

- **Hand Portable Single Particle Sensor**
- Prof. Anthony S. Wexler
- Mechanical Engineering
- <http://research.ucdavis.edu/ncd.cfm?caseno=2003-049>

- **Hybrid cars and compact variable transmission (portfolio)**
- Prof. Andy Frank
- Mechanical Engineering
- (no NCD)

- **Highway maintenance machines**
- Prof. Steven Velinsky
- Mechanical Engineering
- <http://patron.ucop.edu/ncd/docs/ott.1998-115-0.00.html>

Chemical, Materials, Electrical and Computer Engineering

- **Nanocables and Nanotransistors**
- Prof.s Pieter Stroeve, Ruxandra Vidu
- Chemical Engineering
- <http://research.ucdavis.edu/ncd.cfm?caseno=2004-451>

- **Carbon Nanotube Toughened Ceramic Nanocomposites Portfolio** (9 inventions)
- <http://research.ucdavis.edu/ncd.cfm?caseno=2003-028>
- **Enhanced Nano-Materials Produced More Efficiently**
- <http://research.ucdavis.edu/ncd.cfm?caseno=2003-008>
- Prof. Amiya Mukherjee,
- Materials Science

- **Optical Networks** (portfolio)
- Prof. Ben Yoo
- Computer Engineering
- <http://research.ucdavis.edu/ncd.cfm?caseno=2002-232>

- **Chemically-Selective Silicon Etching Techniques** (Portfolio: 8 patents)
- Prof. Charles Hunt, Dr. Jeff Peterson
- Electrical Engineering, Materials Science
- <http://research.ucdavis.edu/ncd.cfm?caseno=2001-255>

Other Engineering

- **ITS/Fuel Cells/Hydrogen**
- (Dan Sperling, Paul Erickson)

- **Nanomaterials**
- (Saif Islam, Atul Parikh, Subhash Risbud, Pieter Stroeve)

- **Robotics**
- (Sanjay Joshi, Nesrin Sarigul-Klijn)

- **Sensors**
- (Ian Kennedy, David Slaughter, David Horsley)

- **Data Visualization**
- (Bernd Hamaan, Ken Joy, Oliver Stadt)

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