



# *From Lab to Market: Commercializing Nanotechnology*

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CEO & Founder  
Zyvex Group*



## Background

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- Zyvex Corporation started in 1997 to develop molecular nanotechnology
- Commercialized nanomanipulator tools, high performance materials, spun off as companies
- My involvement in nanotech since 1996
  - Started Zyvex: first molecular nanotech company
  - Co-endowed Feynman Prize in Nanotechnology
  - Started Texas Nanotechnology Initiative
  - Endowed UT Dallas NanoTech Institute + VE Chair
  - Spent more personal funds on nano than anyone

## An illustration

***Molecular nanotechnology*** is the precise, controlled rearrangement of atoms into higher value products.

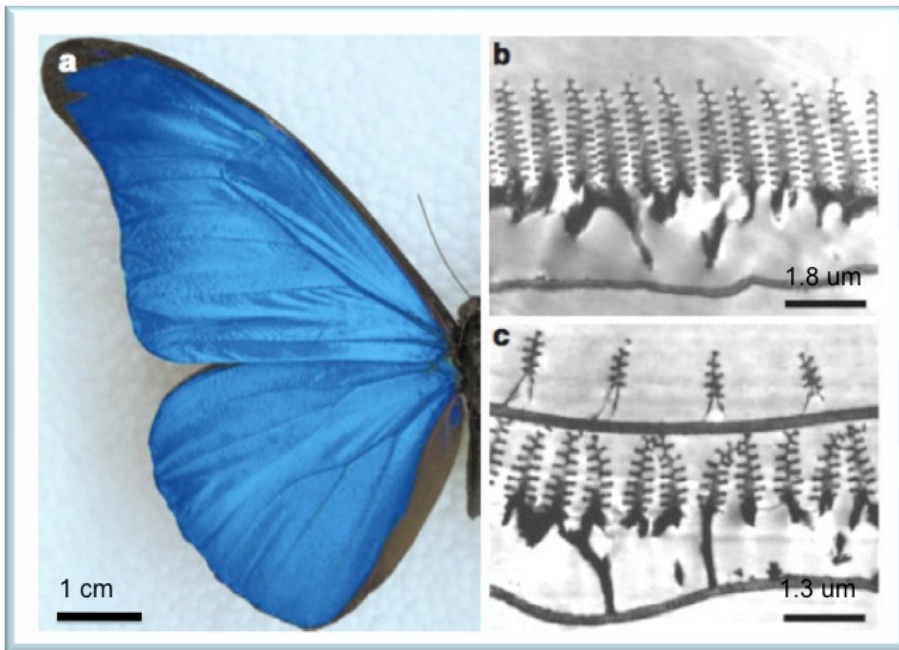
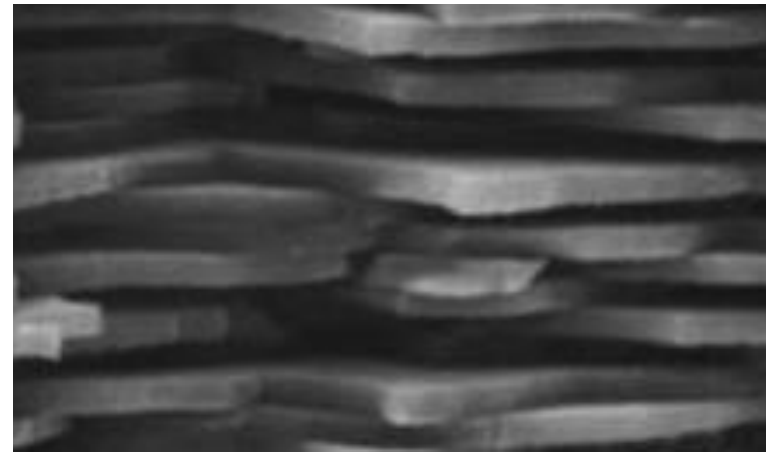


# Nanotechnology applications

- **Materials**
- **Clean, cheap energy**
- **Computers**
- **Medicine**

Stacks of aragonite tablets  
from nacre of a red abalone shell

Source: UC Santa Barbara



Nano-structured features of  
Morpho butterfly wing

Source: Exeter University



## Rearranging Atoms

- Nature's way

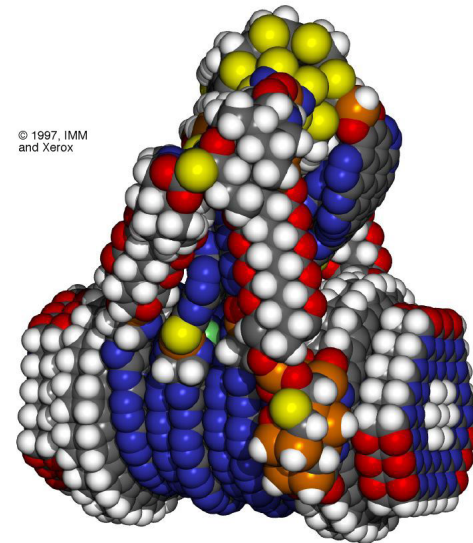
“The creation of a thousand forests is in one acorn.”

Ralph Waldo Emerson (1803-1882)



## Rearranging Atoms

- Nature's way
- **Engineer's way**
  - Positional chemistry
  - System design



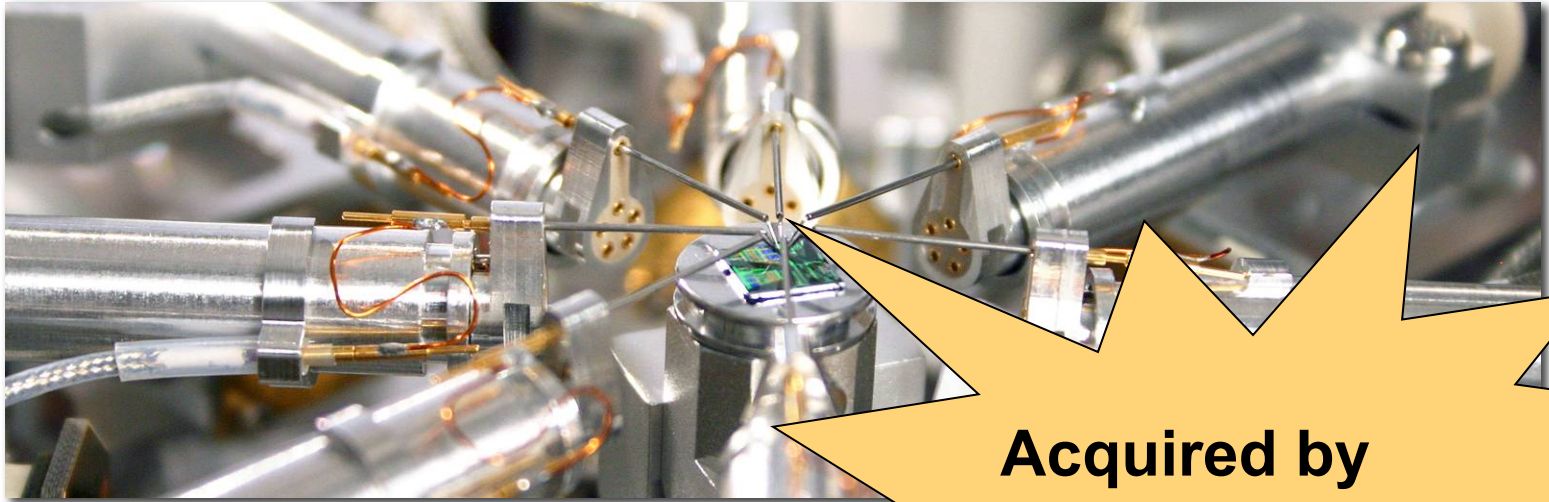


## Commercialization history

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In the course of developing our nanotechnology capabilities, Zyvex split into three focused entities:

- Zyvex Instruments: nanoprobing tools for failure analysis in the semiconductor industry (acquired by Thermo Instruments)
- Zyvex Performance Materials: high-performance materials for sports, defense, and industry
- Zyvex Labs: Atomically Precise Manufacturing, Biomedical microsystems



**Acquired by  
Thermo Scientific**

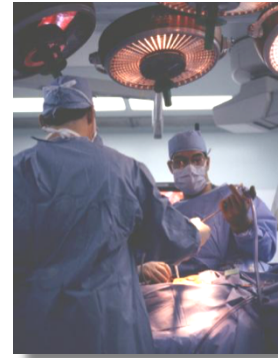


*Advanced Instrumentation for the Nanoscale*

[www.zyvex.com](http://www.zyvex.com)







 **zyvex**<sup>TM</sup>  
performance  
materials

[www.ZyvexPro.com](http://www.ZyvexPro.com)

# Corporate introduction

- 15 years experience in nanomaterials
- Leading brand in nanomaterials
- HQ in Columbus OH, also Richardson TX, Rapid City SD
- Strategic investors: Arkema and Lockheed



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# What we do

- Carbon nanotubes are the strongest material known
- Zyvex developed a technology to take advantage of this
- Our products make possible:
  - Lighter
  - Stronger
  - Tougher
  - “Greener”



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# Applications in use today...



Customers



# ZyCraft



Nano-enabled  
maritime  
security:



- Lighter
- Faster
- Longer range



# VIGILANT IUSV

We operate the most advanced Independent Unmanned Surface Vessel in the world, providing sea patrol, merchant vessel escort, and delivery services worldwide, from our Singapore HQ.

**ZyCraft**



# Armed security



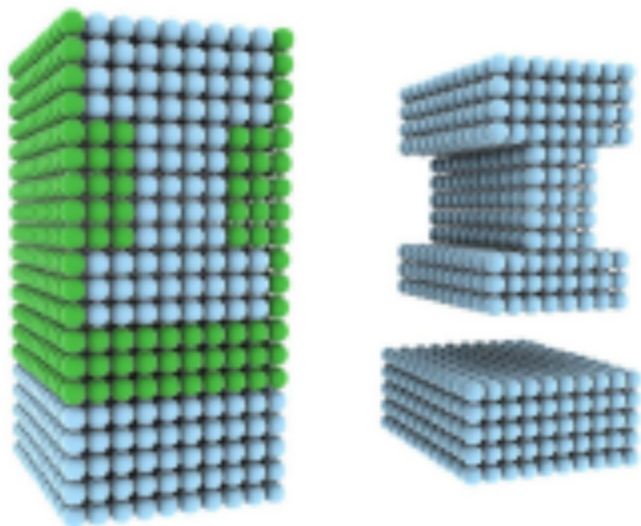
Shomari LRV-17 (Long Range Vessel)

-1200 NM range on one tank of diesel, 15 knots cruise, 40 knots max

-Carries up to 6 staff, for missions up to one week

-Gyroscopic stabilizer, twin 480 HP diesels

**ZyCraft**



**zyvex**<sup>TM</sup>  
**L A B S**

*Atomically Precise Manufacturing*

[www.ZyvexLabs.com](http://www.ZyvexLabs.com)

# Zyvex Labs vision

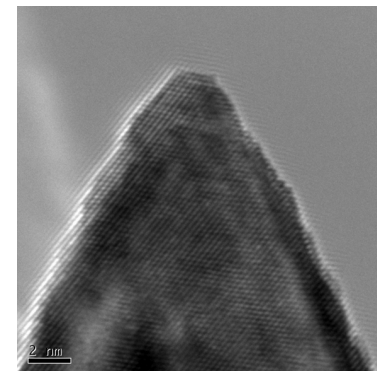
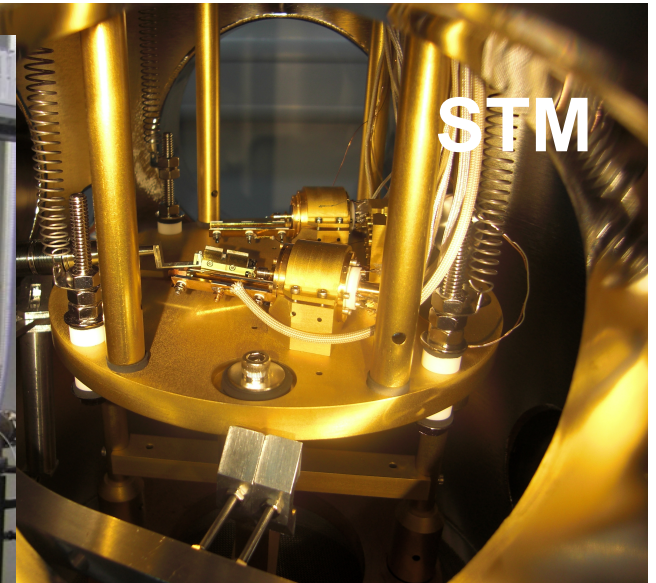
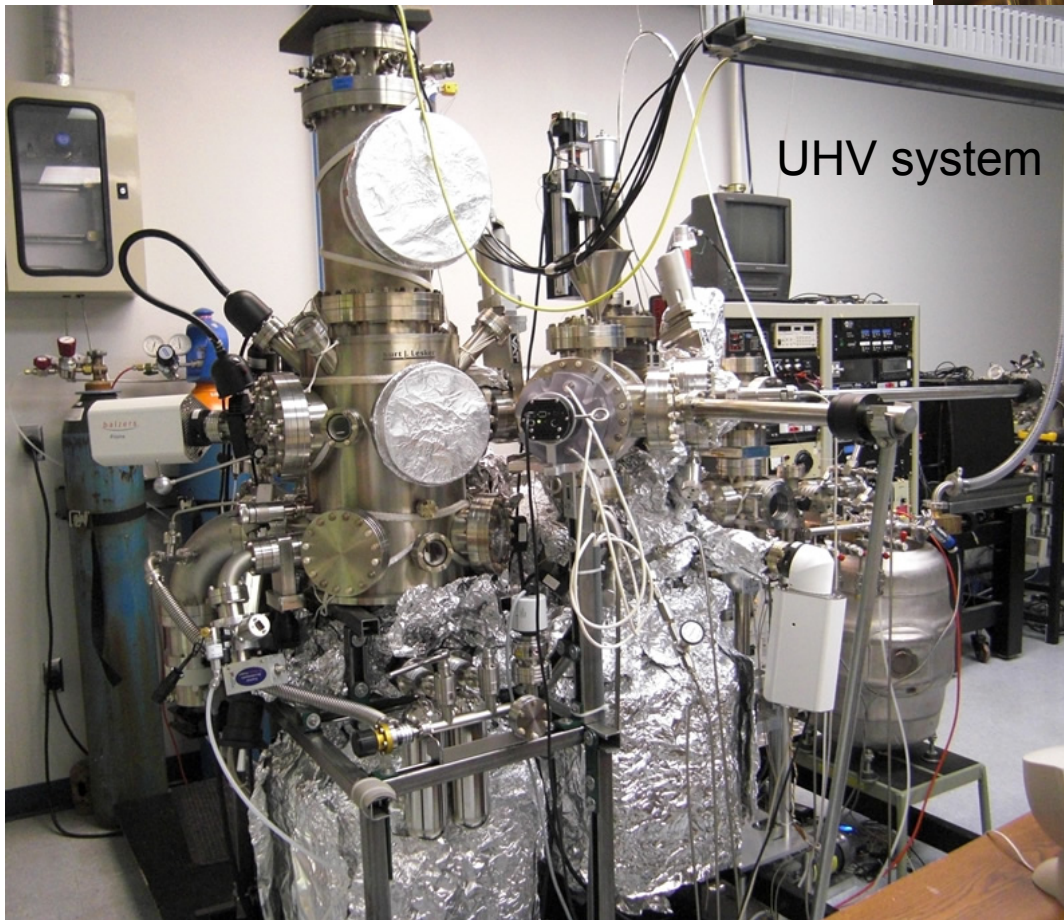
**Lead the commercialization of adaptable, affordable, atomically precise manufacturing.**

**Creating the final step in precision manufacturing...**

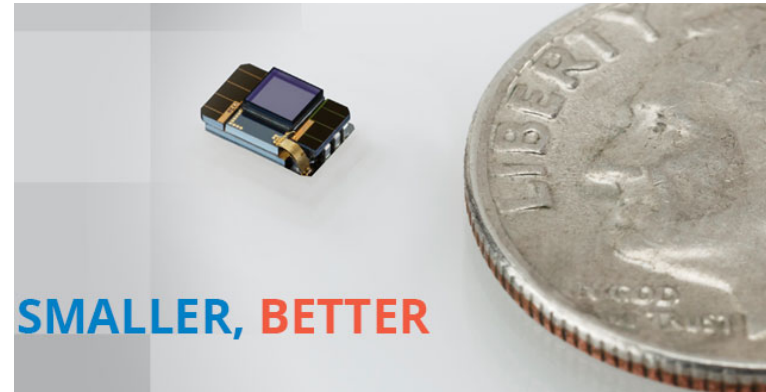
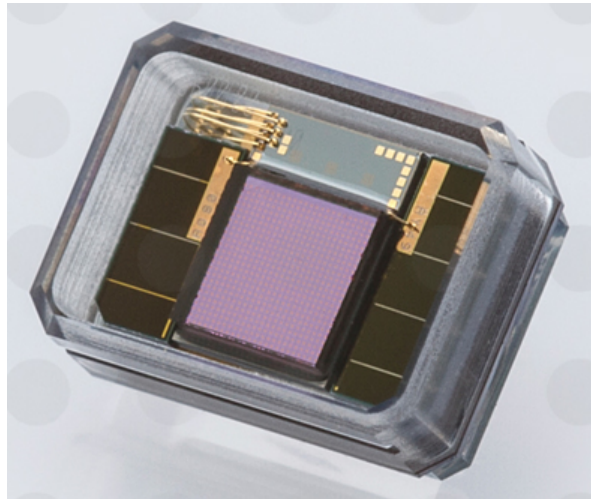
- Hand-crafting (blacksmith) →
- Precision mass-manufacture (Ford) →
- Semiconductor lithography (Intel) →
- Atomically Precise Manufacturing (Zyvex Labs)



# UHV STM system



**1 nm  
tip  
radius**



- JV with Rainbow Medical, Israel
- Neural prosthetic (bionic eye)
- Device packaging by Zyvex, medical team in Israel
- Human trials in 2017





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[www.zycraft.com](http://www.zycraft.com)



[www.nano-retina.com](http://www.nano-retina.com)

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