Welcome to the International Congress of Nanotechnology 2004

November 7-10, 2004, San Francisco

Lloyd L. Tran
International Association of Nanotechnology, Inc.


International Congress of
Nanotechnology 2004
Bridging to the
Next Frontier
November 7-10, 2004
San Francisco Airport Marriott Hotel
San Francisco, California
IAnano

ICNT Theme: Bridging to the Next Frontier !

- Convergence
- Collaboration
- Communication

ICNT 2004: Bridging to the Next Frontier !

- Convergence: bridging over the **convergence** of physical sciences, Information technology, engineering and biomedical sciences.
- Collaboration: bridging the global **collaboration** to explore the mystery of the nanoscale world and how to make use of its applications for the benefits of mankind.
- Communication: bridging the **communication** gap to address key issues facing the scientific research, business development and social, environmental and health safety implications of Nanotechnology.

The State of Nanotechnology: a brief overview

Lloyd L. Tran
International Association of Nanotechnology, Inc.

The State of Nanotechnology: a brief overview

- Brief History
- Definition & Why Nanotech is important
- Global race in R & D Funding
- Market size of Nanotech products
- Intellectual Property Landscape
- Highlight of some Nanotech products
- Opportunities & Challenges
- Conclusion

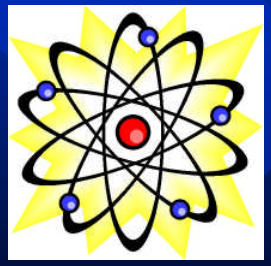
Brief History of Nanoscience

Nanoscience has a solid foundation dated back to the 5th Century B.C.

5th Century B.C: Democritus and Leucippus proposes Atomic Theory : matter was made up of tiny, indivisible particles in constant motion.

Aristotle rejects the theory, and it was ignored for centuries

1808: John Dalton concludes that all atoms of an element have the same size and weight, and that atoms of elements unite chemically in simple numerical ratios (as molecules) to form compounds

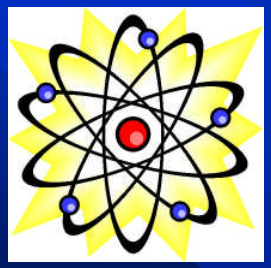


Brief History of Nanoscience

1911: Ernest Rutherford explains an atom's structure in terms of a positively charged nucleus surrounded by negatively charged electrons orbiting around it.

1913: Niels Bohr uses quantum theory to explain why electrons remain in certain allowed orbits without radiating energy.

1920s: quantum mechanics satisfactorily explains all phenomena related to atoms, atomic particles and atomic energy



Key Nanotechnology Milestones

1959 - Feynman delivers: “Plenty of room at the bottom” speech

1974 - First molecular electronic device patent filed

1981 - Scanning Tunneling Microscope (STM) invented

1985 - Buckyballs discovered

1986 - Atomic Force Microscope (AFM) invented

1987 - First single-electron transistor created

1988 - First “designer protein” created

1991 - Carbon nanotube discovered

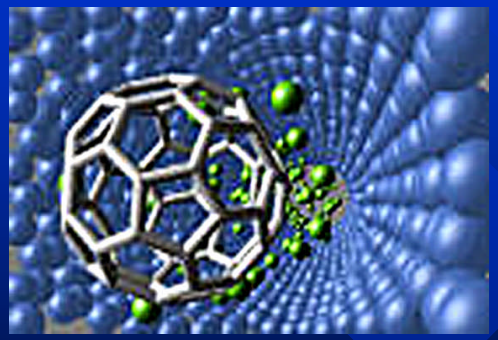
1993 - DNA-based molecular device created

1997 - Molecular –scale computer switch created

2000 - US launches National Nanotechnology Initiative (NNI)

Nanotechnology: definition

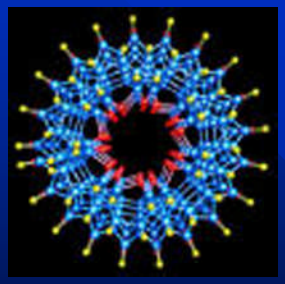
"Research and technology development at the atomic, molecular or macromolecular levels, in the length scale of approximately 1 - 100 nanometer range, providing a fundamental understanding of phenomena and materials at this scale and creating and using structures, devices and systems that have novel properties and functions because of their small size"
(NSF 2002)



Why is Nanotechnology important?

Nanotechnology is a fundamental and enabling technology that will profoundly transform across all industrial sectors, including:

- **Material Sciences:**
- **Physical Sciences**
- **Electronic Engineering**
- **Mechanical Engineering**
- **Information Technology**
- **Biotechnology**
- **Medical Devices**
- **Diagnostic**
- **Nanomedicine**
- **Textiles**



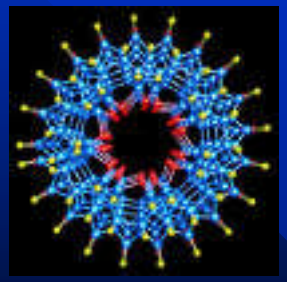
Commercialization Drivers for Nanotechnology

1. **Technology Development Needs:**

- Silicon Chip Design Will Soon Hit Physical Limit
- Computer Magnetic Storage
- Consumer Devices Require Micro-Sized Parts
- Nano-particle pharmaceutical enhances solubility & bio-availability

2. **Market Needs for Nanoscale products**

- Nanoparticles for Clear Lotions and Special Coatings
- "Anything-On-a-Chip" Devices
- Biosensors for Homeland Security
- Medical products Requires Tiny Devices for New Therapies



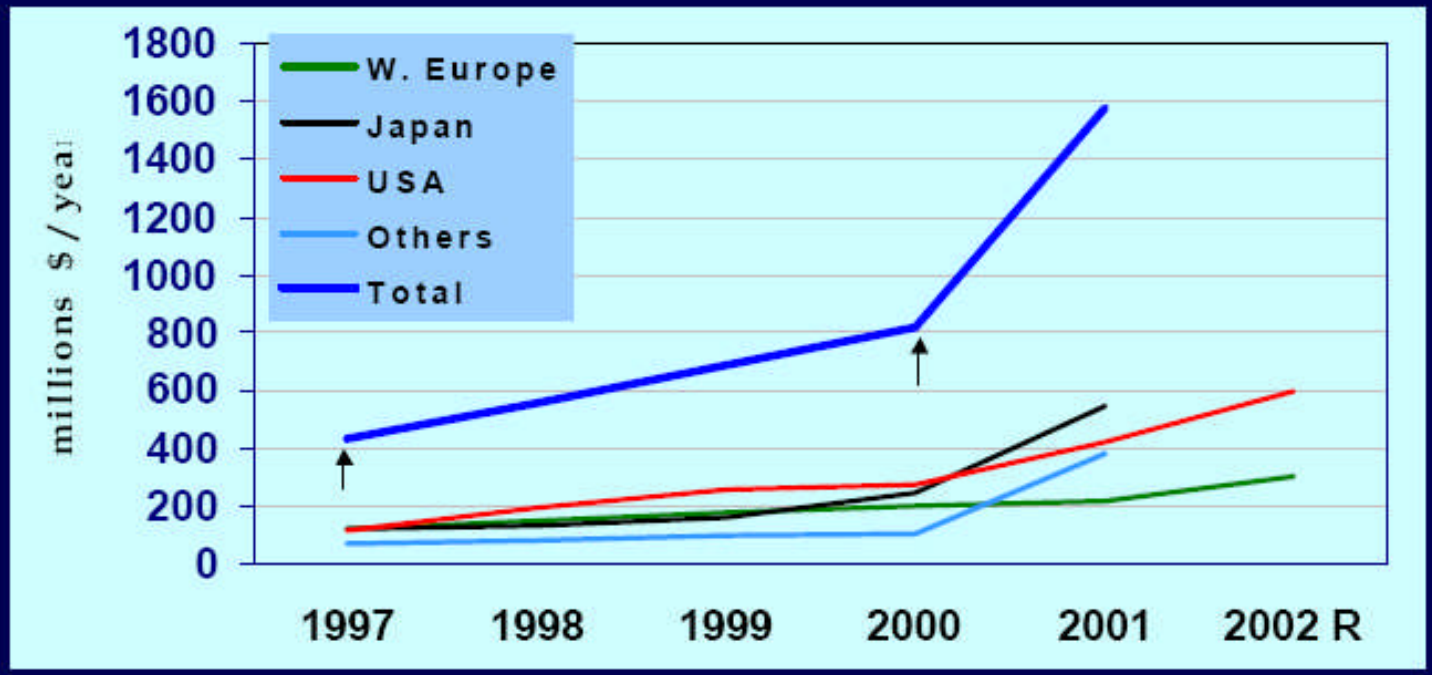
The 21st Century Nanotechnology Research and Development Act of the USA

- Passed by the House and Senate
- Signed by the President on December 4, 2003
- Implemented a National Nanotechnology Program
- Developed goals, infrastructure, management, oversight and reporting requirements
- Authorized funding for FY's 2005-2009 for Federal agencies

The 21st Century Nanotechnology Research and Development Act in the USA

Fiscal Year ($ million authorized)	2005	2006	2007	2008
Dept. Defense, National science Foundation,	385	424	449	476
Dept. Energy, DHHS, NIH	317	347	380	415
Natl Inst. Standard Technology	68.2	75	80	84
NASA	34.1	37.5	40	42.3
Dept. Agriculture, EPA, Justice, Homeland Security	5.5	6.05	6.42	6.8
Annual Sub-Total	809.8	889.55	955.42	1,024.1
Grand total : US$3,678 Million				

Global Nanotechnology Funding (US$ million)



Note:

- U.S. begins FY in October, six month before EU & Japan in March/April
- U.S. does not have a commanding lead as it was for other S&T megatrends (such as BIO, IT, space exploration, nuclear)

Slide credit: M.C. Rocco

Estimated Government Nanotechnology R & D Expenditures in 2000 – 2004 (in US$ million)

Region	2000	2001	2002	2003	2004
W. Europe	200	~225	~400	~650	~900
Japan	245	~465	~720	~800	~900
USA	270	465	697	862	960
Others	110	~380	~550	~800	~900
Total	825	~1535	~2367	~3122	3660
(% of 2000)	100%	186%	287%	378%	443%

(Source: Estimates from NSF, Reference: M.C. Roco, Journal of Nanoparticle Research 6: 1-10, 2004)

Global Nanotechnology Funding

- Nanotechnology R & D is occurring in over 50 countries
- Western Europe funded ~US$650 million in 2003, from $126 million in 1997
- Japan funded ~$800 million in 2003, from $120 million in 1997
- US provided $862 million in 2003, from $116 million in 1997
- UK recently announced $150 million funding over the next 6 years

Source: M.C. Rocco

Samples of Nanotechnology Products on the Market

- Babolat tennis rackets using nanotubes
- Nucelle sunscreen using Titanium Dioxide nanoparticles from Nanophase
- Wilson Double Core tennis balls using nanomaterials from Inmat
- Eddie Bauer khaki pants using molecular textile coating from Nano-Tex
- GAP, Old Navy, and Clairborne shirts from Nano-Tex
- Maui Jim sunglasses with nanocoating from Nanofilm
- Nanowax DERAX ski was used by Olympic ski teams from Nanogate
- Evidots (Quantum Dots) for medical imaging from Evident Technologies
- Nanox ceramic nanocoatimngs on Navy ships hulls from Inframat
- L'Oreal manaoparticles in cosmetics
- Non-stick, germicidal nanocoating for hearing aids from Germany's Insititute of New Materials.

(Source: "The Nanotech Report 2003"- Lux Capital)

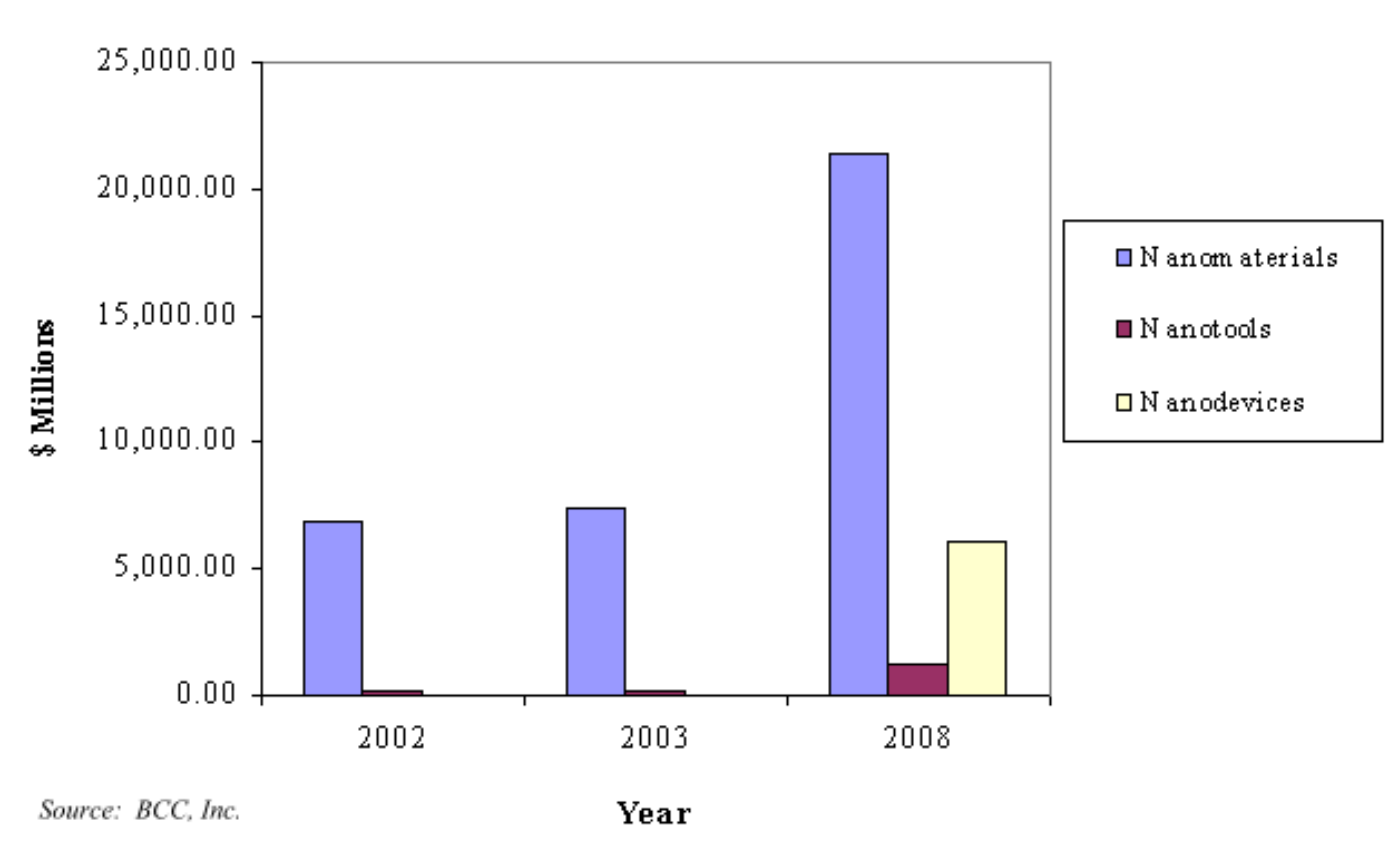
Nanotechnology: Market Size

Global Nanotechnology Market, 2002, 2003 and 2008 (US$Million)
(Source: BCC, Inc.)

Product Categories	2002	2003	2008	AAGR % 2003-2008
Nanomaterials	6,825.6	7,366.6	21,424.8	23.8
Nanotools	168.0	181.0	1,241.0	47.0
Nanodevices	0	0	6,030.0	NA
Total	**6,993.6**	**7,547.6**	**28,695.8**	**30.6**

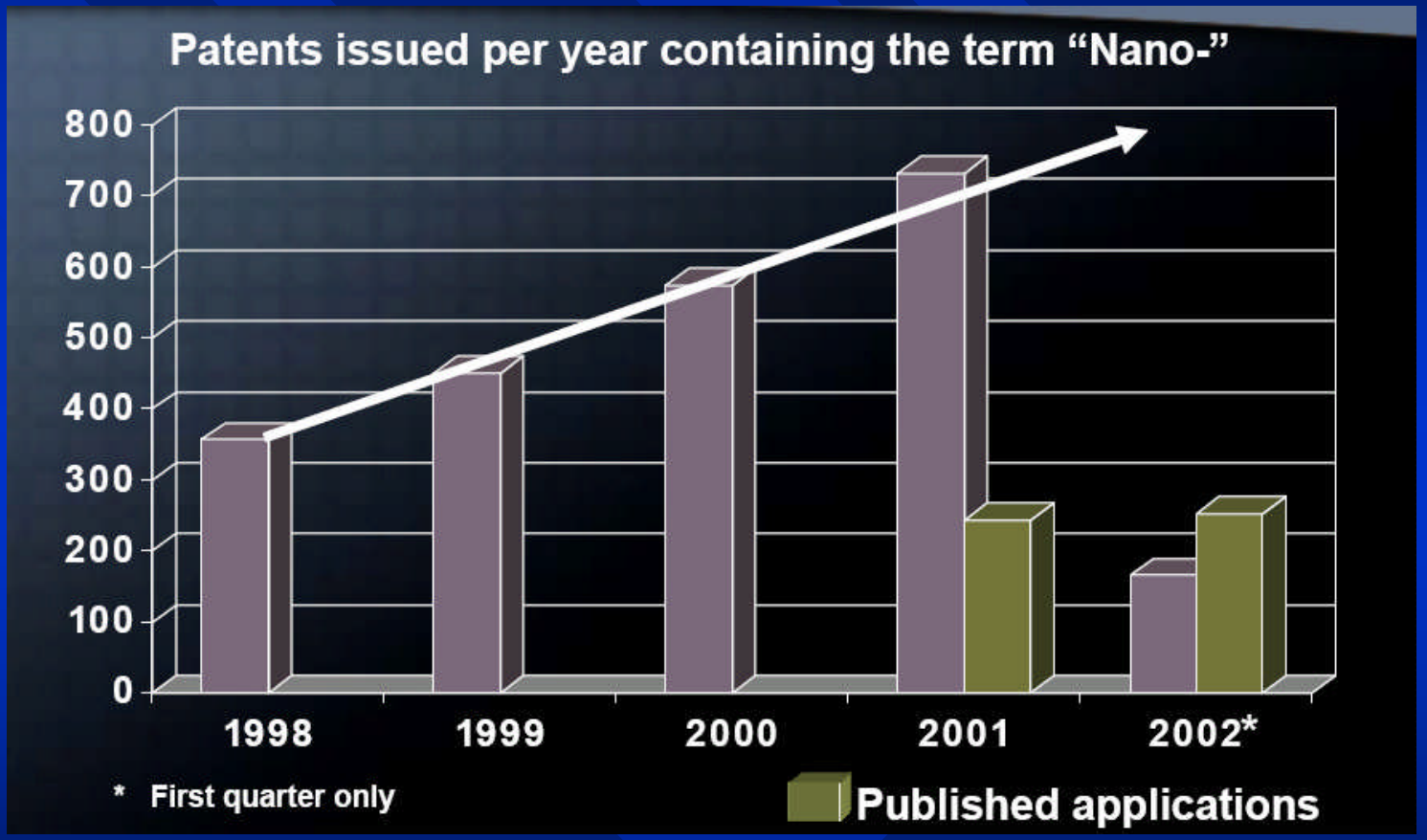
Nanotechnology Products: Market Size

Global Nanotechnology Market, 2002, 2003 and 2008 (US$ Million)



(Source: BCC, Inc.)

Nanotechnology: Intellectual Property



Slide credit: Robert M. Hansen – Foley & Lardner

Nanotechnology: Patent Statistics

4819 Issued U.S. Patents including "nano" in specification

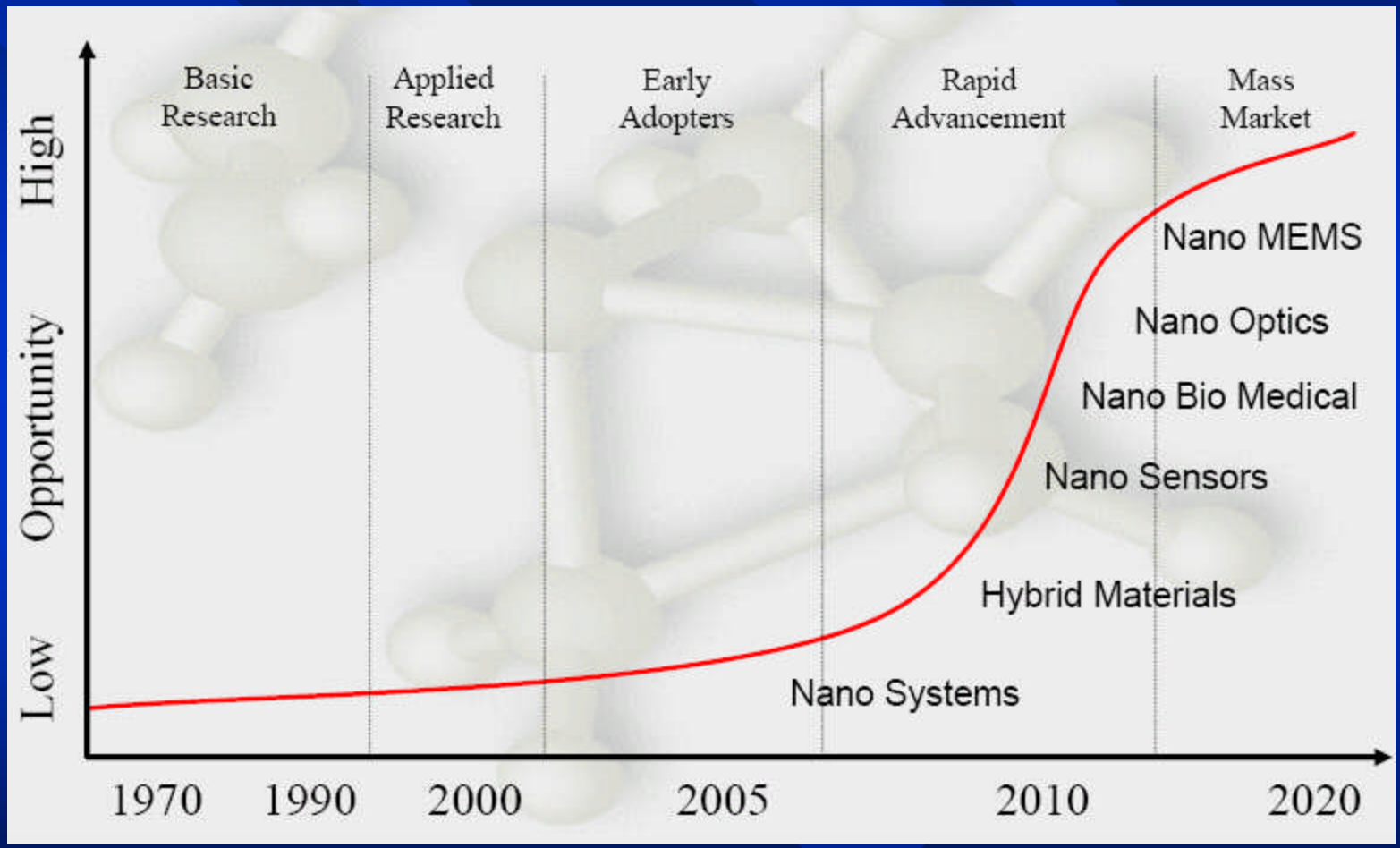
342 Issued U.S. patents including "nano" in claims

1486 Published pending applications including "nano" in specification
(since 3/15/2001)

236 Published pending applications including "nano" in claims
(since 3/15/2001)

(Source: Todd Dickinson – Howrey Simon Arnold & White)

Nanotechnology Growth Model



Slide credit: Technolytics.com

Nanotechnology : New Opportunities

- New Paradigm Shift in Technology Development
- New Applications and Markets
- New Job Creation Opportunity
- New Intellectual Property Landscape
- New Strategic Planning
- New Public Relation Approach

Nanotechnology : Challenges

- Intended Use and Misuse
- Potential Public Policy & Regulations
- Potential Environmental issues
- Ethical Issues
- Privacy Issues
- Other Societal Issues

Nanotechnology : Strategic Planning

The International Association of Nanotechnology serves as an international hub interconnected with local organizations, research institutes, public agencies and private enterprises.

Our strategic planning focuses on:

- **Convergence: multidisciplinary technology convergence is being developed**
- **Commitment: new strategic thinking and long term commitment**
- **Collaboration: global collaboration is fostered via ICNT conference**
- **Communication: open communication to general public**
- **Consortium of public and private sectors to deal with societal concerns**

Conclusion

- Nanotechnology is an enabling and fundamental platform for other industries
- Nanotech is now at the Early Adoption Phase
- Great opportunities
- Great Challenges
- Global collaboration is needed to bridge over the Next Frontier

THANK YOU !

Lloyd L. Tran
President & Program Director
International Association of Nanotechnology, Inc.
2386 Fair Oaks Blvd
Sacramento, CA 95825 USA
Tel. 916-529-4119 Fax. 916-424-1650
http://www.ianano.org
Email: ltran@ianano.org