



From Space flight to Foresight: Exploring the social movement spillover between Space and nanotechnology

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Major: Civil Engineering

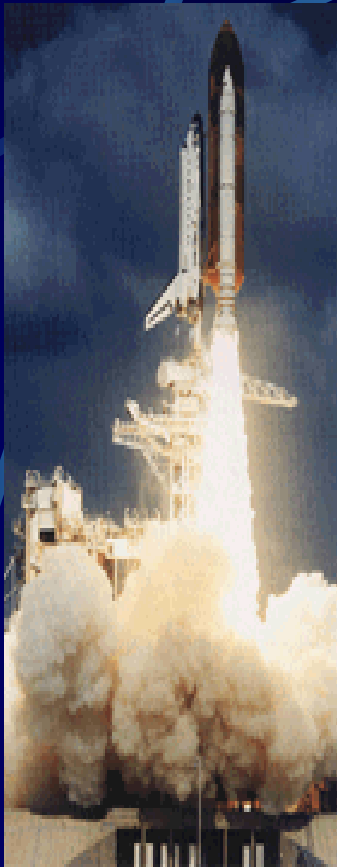
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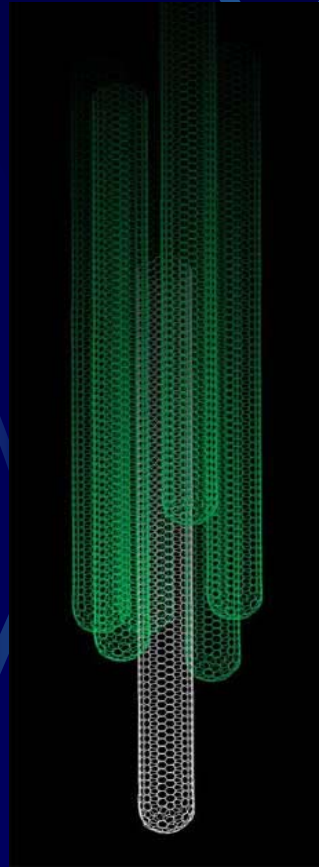
1970s & 1980s
Pro-Space Movement



www.nssdc.gsfc.nasa.gov/database_master_catalog071307

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1980s & 1990s
Pro-Nano Movement



Nanotubes - <http://www.space.com071307>

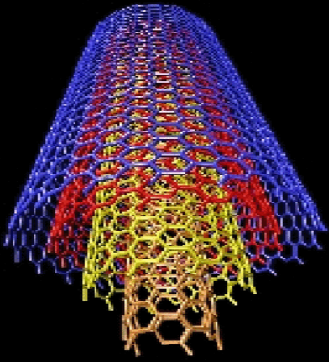
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Space-Nano
Movement



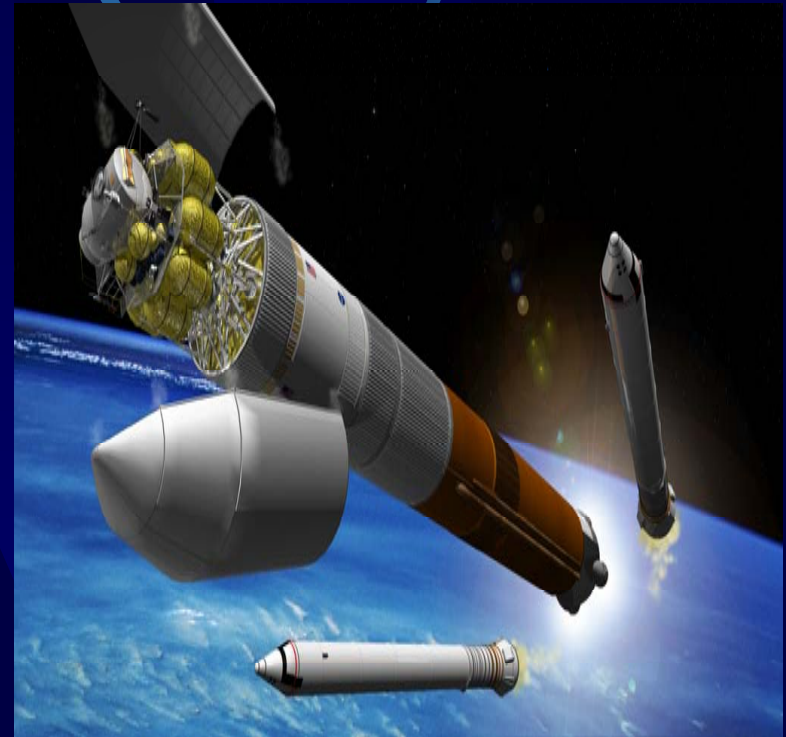
www.sciencenews.org/articles/20021005/bog9.aso071307

Through historical exploration of nanotechnology...



clifton.mech.northwestern.edu/~me381/project/

- Anticipate future societal and ethical implications of nanotechnology
- View nano as an effort to develop technological solutions to social and economic problems
- Historians of science and technology have an opportunity, perhaps even a responsibility to challenge the “standard model” of nanotechnology history



www.nasa.gov/.../133824main_cargo_high.jpg072507

The Standard Model of the Nano History



Standard model is used to frame general articles

1959 - Richard Feynman's famous speech - "Plenty of Room at the Bottom"

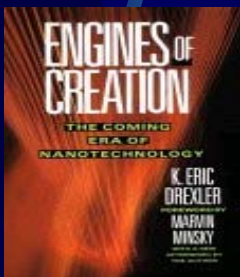
1986 - Eric Drexler published the book "The Engines of Creation"

Nobel prize G. K. Binnig and H. Rohrer - scanning tunneling microscope

1996 - Nobel prize Richard Smalley - helped discover buckyballs

2000 - Passage of the National Nanotechnology Initiative

1959



1986



www.research.ibm.com/images/about/nobel.jpg072107

1986



www.case.edu/news/2004/9-04/smalley_photo.jpg072107

1996

NATIONAL
NANOTECHNOLOGY
INITIATIVE

2000



Hidden histories of nano is the alternative to established versions of its historical stories

...probing the possibilities

- **History of modern science and technology**
 - Supplements taken-for-granted origin of stories
- **Nano's science fiction roots**
 - Gives interesting clues about its current status
 - “What ifs” of scientific innovation
- **Nano's emergence in the public imagination**
 - Science advocacy groups with futuristic goals

Research Methodology

Target population: pro-space and pro-nano advocacy groups

Data Sources

Primary source materials

- Newsletters – e.g., L5
- Web materials
- Interviews
- Policy documents

Data Analysis

Scanning texts

Organizing

Coding

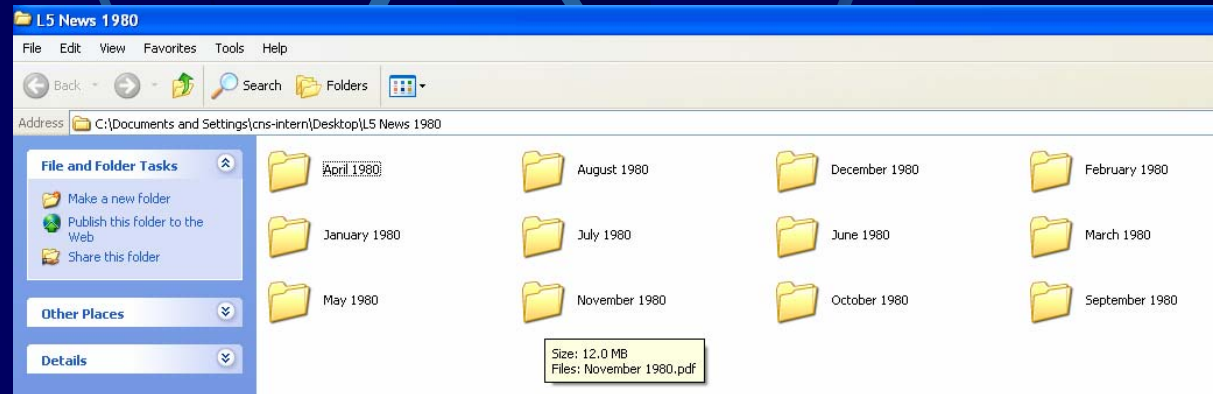
- Thematic elements
e.g., Drexler, nanotechnology,
- Funding sources
- Contributors

Data Collection

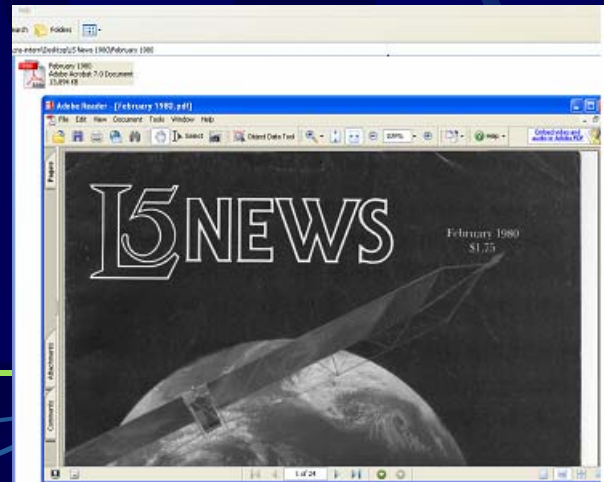
Scan document



Gather lots of data



Convert to
searchable PDF file



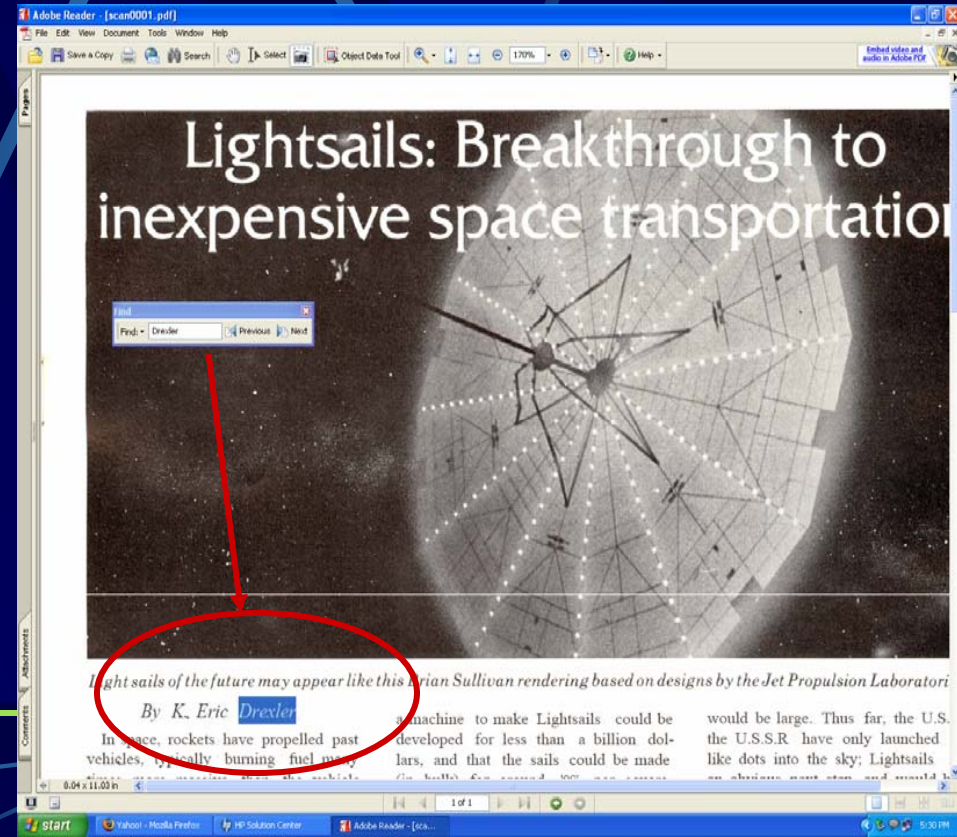
After data collection...

Looking for keywords

Use find command

- keyword – e.g., nanotechnology
- author – e.g., Drexler
- phrase where keyword used

Chart citation example in Excel file



Next Step

- ✓ Make more definitive claims about people who moved between the pro-space and pro-nanotechnology movements.
- ✓ Narrow findings to elucidate mechanisms by which public imagination was evoked regarding nanotechnology.

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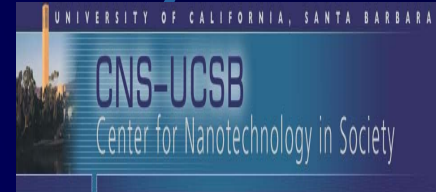
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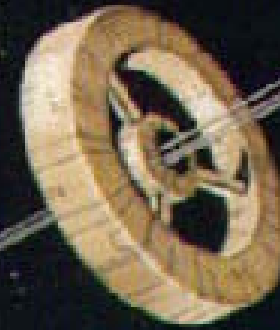
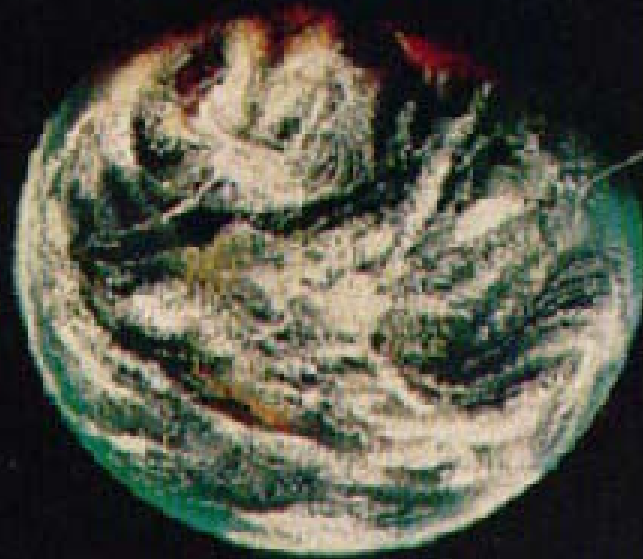
Dr. Nick Arnold, INSET Community College Liaison

Luke Bawazer, INSET Supermentor

To my colleagues and all the others who helped me



The End



Tom Gandy
2011

Less examined histories of nanotechnology

- Molecular Beam Epitaxy (MBE) - perfected in the 1970s – John Arthur and Al Cho – Bell Laboratories – development of MBE allows for the precise fabrication of new materials and nano-structures predates the scanning and atomic forces microscopes of the 1980s



Molecular Beam Epitaxy

1968: Bell Labs' Al Cho (right) develops molecular beam epitaxy, a technique that enabled semiconductor chips to be made one atomic layer at a time, opening the door to vast improvements in chip manufacturing.

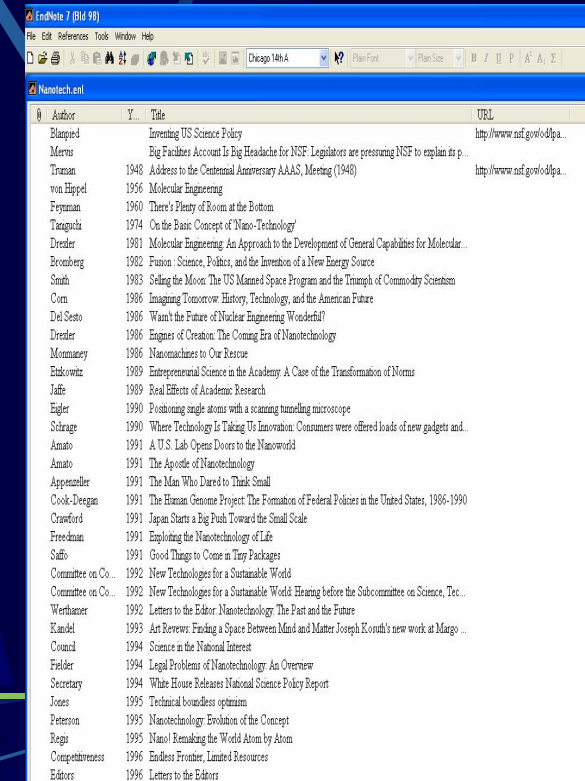
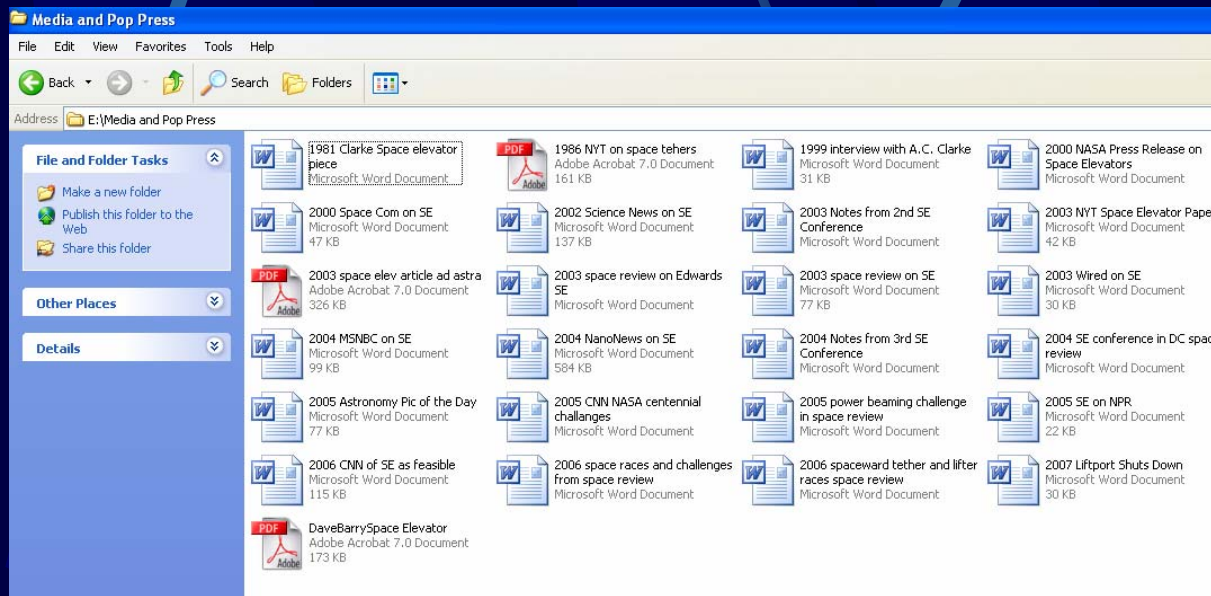
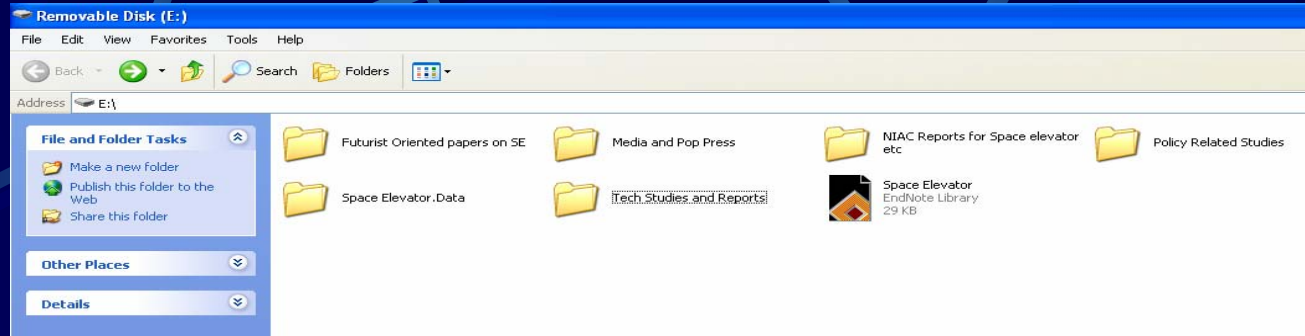
Science fiction roots

- A role of public imagination in fostering policies for nano research
- Public visions of future technologies play an important role in establishing support or opposition for policy
- Futurist groups – cultivate an environment of technological optimism within
- Political and social acceptance of new technologies like nano could flourish

Example: futurist groups initially devoted to promoting the space frontier in the 1970s shifted to pro-technology Activism, including nano, in the 1980s



Additional Data Gathered



Microtechnology

- technology with features near one micrometre
- one millionth of a metre, or 10^{-6} metre, or $1\mu\text{m}$
- led to Industrial Revolution
- 1960s – arrayed large numbers of microscopic transistors on a single chip
- microelectronic circuits could be built
 - improved performance, functionality and reliability
 - cost effective and decreased volume



The bottom-up approach

- These seek to arrange smaller components into more complex assemblies.
- materials and devices are built from molecular components which assemble themselves chemically by principles of molecular recognition
Construct well-defined structures out of DNA and other nucleic acids

The top-down approach

These seek to create smaller devices by using larger ones to direct their assembly.

- nano-objects are constructed from larger entities without atomic-level control

Many technologies descended from conventional solid-state silicon methods for fabricating microprocessors are now capable of creating features smaller than 100 nm, falling under the definition of nanotechnology.