

BROOKHAVEN NATIONAL LABORATORY

**Brookhaven National Laboratory
Long Island's Innovation Engine
- Open for Business -**

Dr. Walter G. Copan
Technology Commercialization and Partnerships

BNL Community Advisory Council

April 2011

BNL – A Passion for Discovery

dis·cov·er·y

- **something new learned or found**
- **the fact or process of finding out about something for the first time**



BROOKHAVEN
NATIONAL LABORATORY

DOE Mission

Discover the Solutions that Power and Secure America's Future

BNL Approach

An integrated, coherent approach among S&T programs, facilities, and collaborators / users



RHIC I, II



CFN



NSLS I, II, JPSI



NY Blue



Core programs

Facilities

Interdisciplinary team-oriented research

Science Challenges

- Energy Security / Climate Change
- Origins of the Universe
- Accelerator Science/Detectors
- Human Health / Environment
- National Security

Collaborators, Users



SBU, Columbia, Cornell, Yale, CERN, ... IBM, Dow, GE, Exxon, Toyota, GM, ...

Public Sector Research



Innovation Engines

- National Labs are increasingly important sources of technologies and enterprises
- Private sector more reliant on universities and government labs, public funding sources for longer-range R&D and new product pipelines
- Licensing, alliances, ventures for “open innovation” complement corporate internal resources and channels
- Economic growth and employment driven through smaller technology businesses
- Spin-outs of National labs attractive investment targets

Major Activity: 21st Century Energy Security

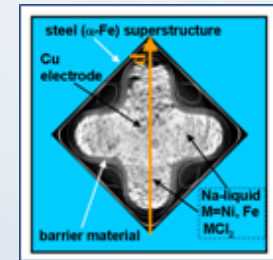
- Mission: To bridge the gap from discovery to deployment
- Major Research Areas
 - Superconducting Materials → Grid Cables
 - Thermoelectric Materials → Heat Recovery
 - Nanomaterials Science → Photovoltaics
 - In-situ Battery Materials → Grid Storage
- Supported by real world connections



AEGIS - Smart Grid Center



Photo courtesy of PNNL



Materials for Energy

BNL Initiatives

CFN/Nanoscience



NSLS II



New York Blue



Core Programs

Materials Focus Topics

Correlated Electron Materials
Materials for Catalysis
Solar Nano-materials
Energy Storage Materials

BNL participation in 4 EFRCs

Collaborators/Joint Appointments



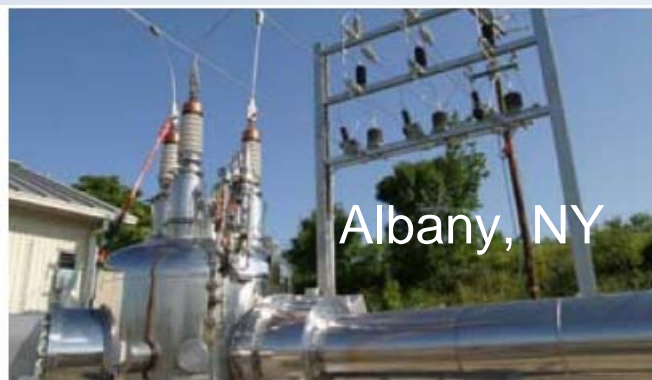
Enhance “discovery to deployment”

- *Partnerships on Energy Technologies*
- *Commercialization of BNL IP*
- *Major resource for New York State/Long Island*

Superconducting Materials for the Grid

- TRANSMISSION: NY State testing

LIPA commissioned the first high temperature superconducting power transmission cable (138 kV) system on June 25, 2008 at Holbrook site, Long Island, NY, capable of carrying 574 megawatts of power.



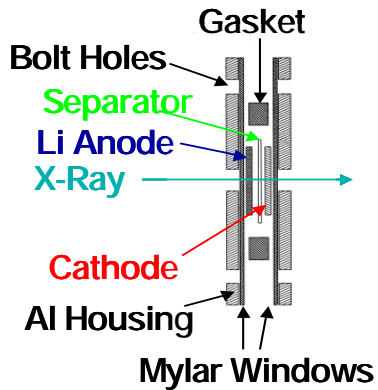
Superconducting Cables

- Increasing the efficiency and capacity of the grid

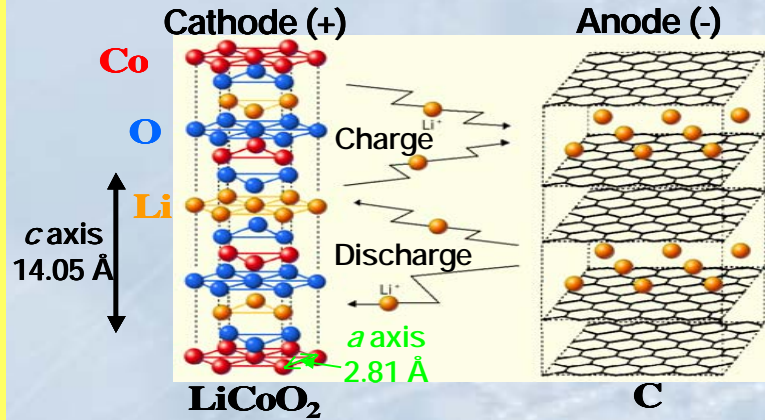
Long Island Power Authority

- Longest cable live on the grid

Energy Storage Materials



In Situ Cell



Layered structure of electrodes in lithium ion batteries

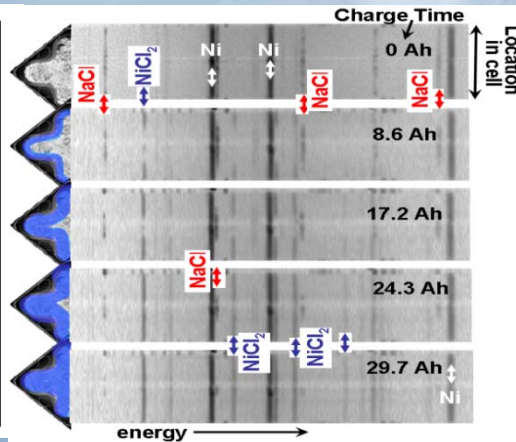
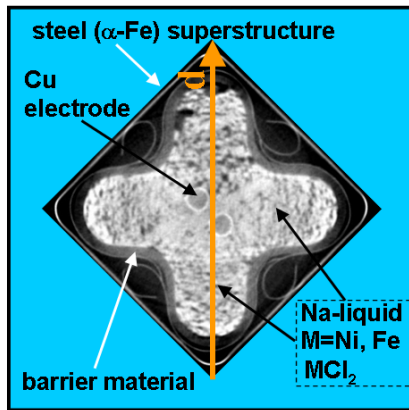
Brookhaven Focus
In-situ analysis
Materials synthesis



GE Global Research

United States - India - China - Germany

NSLS X17: Use hard x-rays to probe through steel cases of functioning batteries



GE chemical engineer Charles Iacovangelo, advanced battery project leader, holds a sodium metal halide battery cell.

Cross-sectional x-ray diffraction patterns taken at various times during charging of a $\text{Na}/\text{MCl}_2 \leftrightarrow \text{NaCl}/\text{M}$ battery

BNL Inventions - Changing the World

- World's First Video Game
- MAGLEV Transportation
- PET reagent ^{18}F FDG – Millions of health diagnoses per year
- L-DOPA – Used in the treatment of Parkinson's Disease
- High Tc Superconductivity (HTS) YBCO Fabrication
- High Resolution Cadmium Zinc Telluride Detector – ProxiScanTM
- Integrated Positron Emission Tomography + Magnetic Resonance Imaging for medical diagnostics
- Small Animal Imaging Systems for health research
- RadioTin systems for Cancer Therapy
- Thermoelectric Power Generators (TEP)
- Core-Shell Electrocatalysts for Fuel Cells, Automotive and Chemical Process
- ... and many more!



Bacteriophage T7 Protein Expression System

Method to produce wide range of proteins

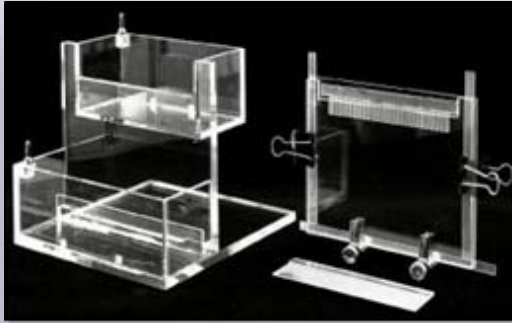
Pioneering discoveries that shaped the field of recombinant DNA technology

AEC*/ DOE

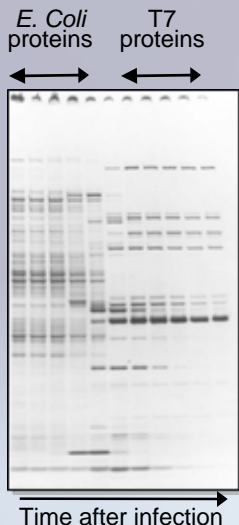
NIH

Industry

Foundation

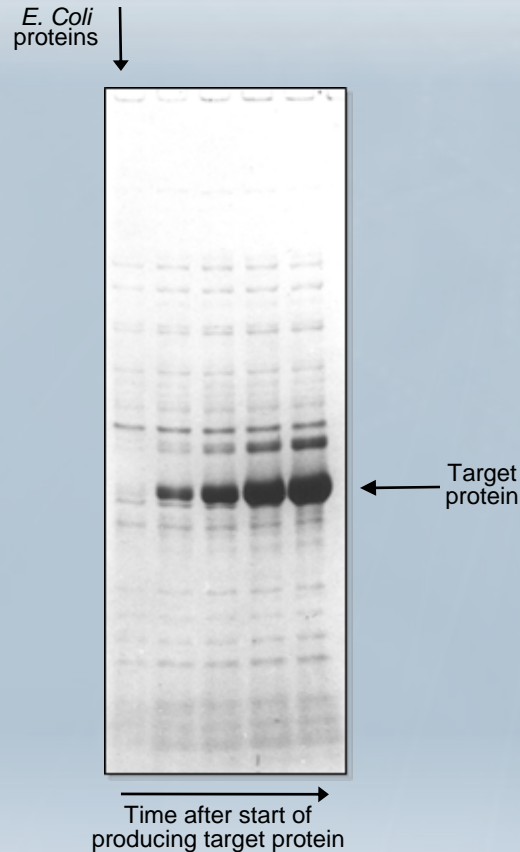


Slab-gel electrophoresis – enables resolution and time lapse comparison of complex biomolecule mixtures (1973).



Basic research discovers how bacterial virus T7 usurps *E. coli* protein production machinery.

Development

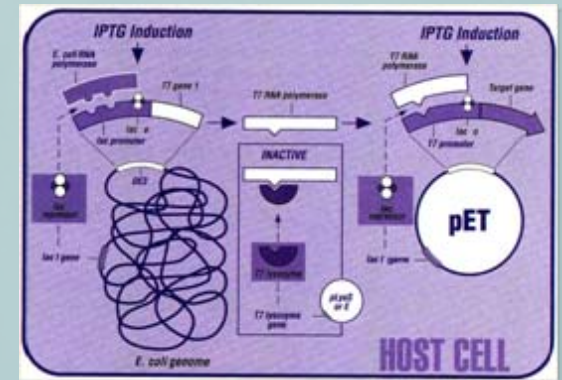


Elements isolated from T7 virus are assembled to direct *E. coli* to produce desired proteins from the cloned gene

Market

700+ companies have licensed to the T7 system for proprietary R&D work

165+ companies have licensed the T7 system for commercial production of proteins such as enzymes or therapeutics



Highly efficient system for producing proteins with end uses in:

- Basic biomedical research
- Diagnostics
- Treatment

* DOE (Formerly AEC)

High Resolution Cadmium Zinc Telluride Detector Miniaturized Gamma Camera for Prostate Cancer Diagnosis

Curtail morbidity by early detection and timely intervention

DOE NNSA

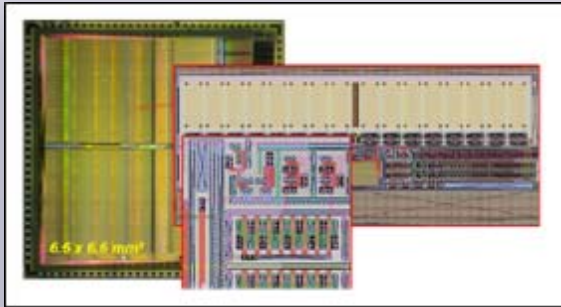
CRADA*

Industry

Foundation

Prototype

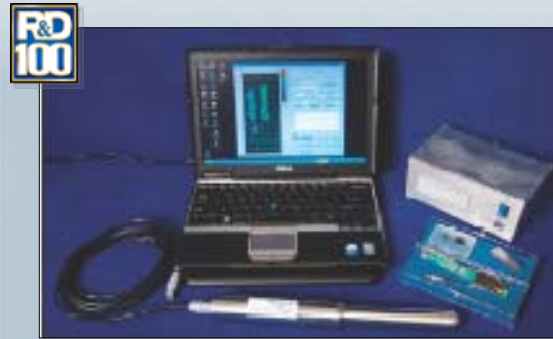
Market



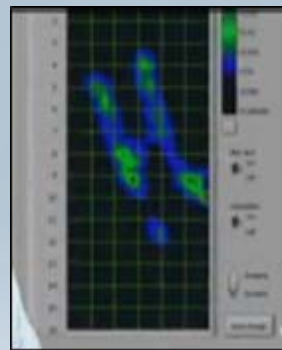
Highly reliable Cadmium-zinc Telluride detectors that can operate at room temperature



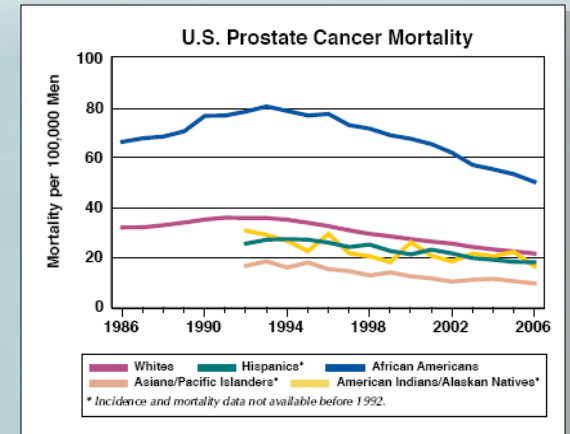
Small, modular easily portable detector that can detect both x-rays and gamma rays with high resolution



Proxiscan™ consists of a prostate probe, an external surge box and a computer



High resolution images using a Proxiscan™



Camera can be modified to for imaging other cancers such as cervical, uterine, colorectal, and breast cancers

Additional uses include applications in homeland-security, environmental monitoring and remediation.

* CRADA with Hybridyne

Thermoelectric Power Generator (TEP) Heat into Electricity

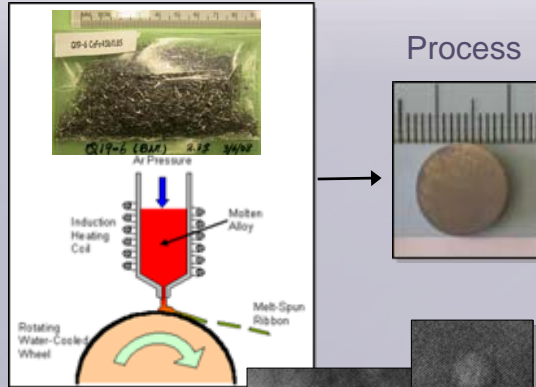
Novel, low cost, and scalable synthesis process for high performance thermoelectric materials

DOE – BES, EE, EERE

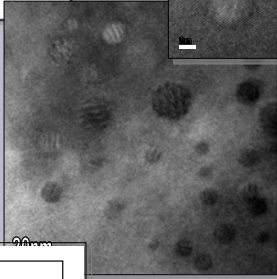
CRADA*, Technology Maturation**

Industry

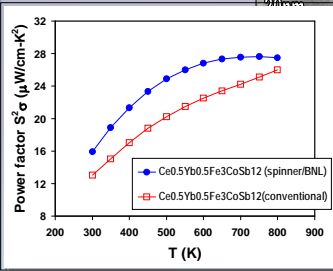
Foundation



Material
TEM –
nanostructures
 $\text{CeFe}_4\text{Sb}_{12}$



Properties



20%-30% enhancement in power factor
over the entire temperature range

Development



TEP Module Parts

Market



Applications include waste
heat recovery from automobiles,
utilities, etc.

* CRADA with GM

** Internal Technology Maturation Funds
(Reinvestment of Licensing Income)

Fuel Efficient Burner Systems

Methods to improve fuel combustion in residential and commercial systems

Pioneering Brookhaven discoveries revolutionized energy efficient heating

BNL LDRD / DOE

CRADA's

Industry

Foundation

BNL has provided foundation research for this industry on combustion, system efficiency, controls, and alternative fuels.

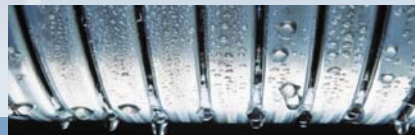
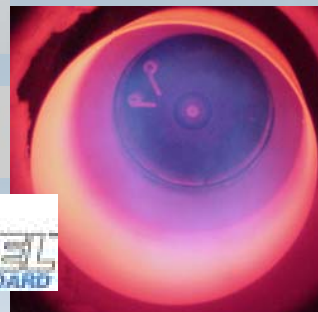


DOE Energy 100 and R&D 100 Award Winner



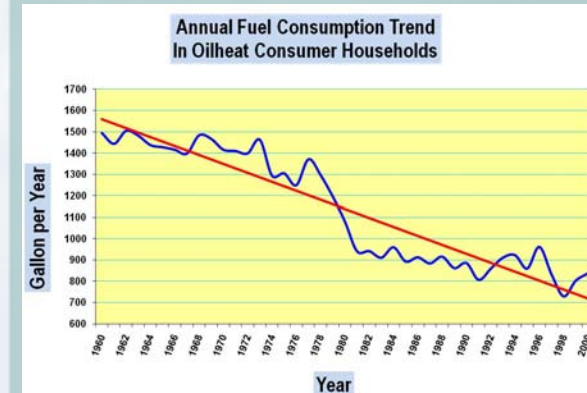
Development

Multiple follow-on programs co-sponsored by DOE, NYSERDA, the National Oilheat Research Alliance and corporate partners



Market

Petroleum distillate heating oil is used in millions of homes and thousands of commercial operations in the U.S.



Since 1980 this BNL research led to estimated savings of over **\$25 billion** in fuel costs to U.S. consumers and avoided over **162 million** metric tons of **CO₂** emissions



Brookhaven Technology Commercialization and Partnerships

Bringing Brookhaven Discoveries to Business



BNL Vision Elements

- Best in Class processes and tools for all aspects of technology commercialization and partnerships
- A Culture of Innovation
- Connected Ecosystem of Commercialization and Partnerships
 - Strong, purposeful external relationships
 - Business-friendly processes

BNL Technology Commercialization and Partnerships and IP Legal Staff *with Karina Edmonds (DOE)*



Go-to-Market Strategies

Collaborate & Accelerate

IP Marketing

University Entrepreneurship Centers

Entrepreneur Mentorship

Market Intelligence

Incubation Access

New Business Partnerships

Maturation Funding

Inventor Incentives

IP Exchange

Launching new ventures

Collaborate &
Accelerate

Market
Intelligence

University
Entrepreneurship
Centers

Entrepreneur
Mentoring

Incubation
Access

Business
in a Box

Ready to Sign
Start-up
Option
Agreements

Maturation
Funding

Investor
Forums

BNL Portfolio Facts

- 200+ Issued or Pending patents
- 80+ Licensed Patents
- 400+ Active License Agreements
- 78+ License Agreements producing products
- Yearly Royalties \$7.5 Million+
- Inventions Commercialized ~35%

- **Business Plans for each intellectual asset portfolio**
 - Target commercialization and partnerships opportunities

Flexible Commercialization and Partnerships

- Commercial licensing of patented technologies
- Software copyright licenses
- Option agreements
 - Start-up businesses
 - Technology evaluation
- Equity-based licenses
- Cooperative Research and Development Agreements (CRADA)
- Sponsored Research
- Technical Services (“Work for Others”)
- Research licenses

BNL – World Leading Science and Technology Available Locally

- **Research and Technology, User Facilities, Partnerships**
- **Accelerate Long Island - Connecting Long Island Innovation Assets**
 - Brookhaven National Laboratory, Stony Brook University, Cold Spring Harbor Lab, NS-LIJ Feinstitute and others
 - Creating industry clusters in life sciences, information technology, energy, advanced materials
- **Research Alliance: Brookhaven National Laboratory + Stony Brook University + Cold Spring Harbor Lab**
- **Collaborating in LI technology commercialization**
 - Connecting technologies, entrepreneurs, sources of capital, service providers, manufacturing, market channels
 - Leveraging NY & LI resources for new and existing businesses
 - LI Seed Fund, New early stage business models
- “It takes a village”, Creating synergy through collaboration
- Building entrepreneurial community

Over 100 technologies are listed on BNL's website for commercial development: www.bnl.gov/tcp

- Gene expression systems
- Catalysts for:
 - Making methanol from syngas
 - Novel cathodes and anodes in fuel cells
 - Direct methanol fuel cells
- Novel battery and energy storage technologies
- Radiotracers
- ASIC circuits
- Biological imaging instruments
- Aerosol monitoring systems
- Waste remediation
 - Bioremediation
- Radiation detectors
- PET/MRI scanners
- Superconductors
- DNA-guided nanoparticle assemblies
- CNT fabrication and uses
- Solar cell designs and compositions
- Etc.

Doing Business With BNL

Opportunities to be a supplier or sub-contractor to BNL

<http://www.bnl.gov/ppm/SDB/>

Small Business Suppliers

Mentor-Protegeé Program

Commercial Agreements are with BSA

Agreements meet U.S. DOE requirements / F.A.R.

Maintain confidentiality wherever needed

BNL Buys from Small Business

FY10 procurements by BNL/BSA with Small Businesses:

<u>Small Business Category</u>	<u>Dollars</u>		<u>Percent*</u>
Small Business	\$149.0 MM	Or	63.62%
Disadvantaged	\$ 17.9 MM	Or	7.63%
Woman-owned	\$ 28.6 MM	Or	12.20%
HUB-Zone	\$ 8.8 MM	Or	3.75%
Veteran-owned	\$ 10.4 MM	Or	4.45%
Service-Disabled Veteran-owned	\$ 3.4 MM	Or	1.50%

* Percentages do NOT include the \$147.8 MM in BNL/BSA procurements with large business / construction projects.

Brookhaven National Laboratory Contacts

Small Business Liaison

Jill Clough-Johnston

Ph: 631-344-3173, Email: clough@bnl.gov

Technology Commercialization and Partnerships

Dr. Walter G. Copan,

Ph: 631-344-3035, Email : wcopan@bnl.gov

www.bnl.gov/tcp



New York Innovation Marketplace

Introduced at BNL

April 25, 2011

1:00 – 2:30 PM Overview

2:45 - 7:15 PM Workshop

<http://www.bnl.gov/imworkshop>

www.bnl.gov/tcp

Overview of the New York Innovation Marketplace

1:00 – 2:30 p.m.

Break

Hands-on Innovation Marketplace Workshop

2:45 – 7:15 p.m.

To obtain the most benefit from this hands-on workshop, please visit <http://www.bnl.gov/imworkshop>

To Register for this event please visit

<http://www.bnl.gov/imworkshop>

Deadline: April 21, 2011



Reducing Barriers for Entrepreneurs

America's Next Top Energy Innovator

“When it comes to job creation, start-ups are not everything, they are the **ONLY** thing.”

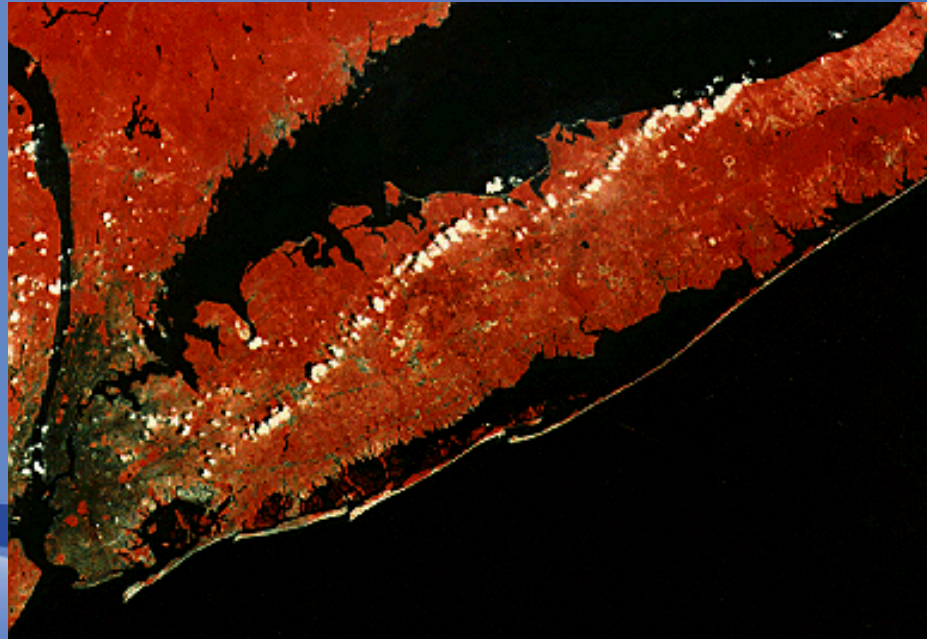
Carl Schramm, Kauffman Foundation



- Goal: Even more successful start-ups from DOE National Labs
 - Start-up option agreement for a BNL patent
- Browse BNL website www.bnl.gov/tcp
- DOE portfolio of technologies: <http://techportal.eere.energy.gov/>
- Submit business plan

Brookhaven National Laboratory - No Longer the “Mystery on Long Island”

BNL is Open For Business



BROOKHAVEN
NATIONAL LABORATORY

a passion for discovery

 **Office of
Science**
U.S. DEPARTMENT OF ENERGY

