

BES All Hands Meeting April 28, 2010

Jim Misewich



SIXTY YEARS
OF DISCOVERY
1947-2007

BROOKHAVEN
NATIONAL LABORATORY



Outline

- BNL Mission and the Energy Challenge
- BES Excellence in Science
- Blueprint and Excellence in all we do
- BES Local Topics
 - Knowledge of Lab ESSH Policy
 - Fresh Eyes Safety Observations
 - Chemistry Synthesis Incident
 - Traffic Citations: New Rules
 - EMS/OHSAS Audit

New York Visioning 2050

Executive Order 24

- 80 percent carbon reduction relative to 1990 levels by 2050

277 MT CO₂e → 55 MT CO₂e

VISIONING 2050 Workshop

- Analysis of scenarios to meet goals
- Carbon reduction scenarios most often replace oil with electricity
 - Additional zero carbon generation
 - Renewables, Nuclear, CCS
 - Reliability and capacity of electric grid to meet demand

All scenarios suggest great increase in use of electricity

The Ultraviolet Scenario attacks transport through electrification

Sector	Ultraviolet	Deep Blue	Yellow	Baseline	Notes
Residential	0	0	7.5	37.6/45.0	
Commercial	0	0	4.5	27.2/39.1	
Industrial	12.7	12.7	14.1	19.0/24.1	
Transport	20.1	20.1	51	88.3/126	
Electricity	10	13	24	49.2/83.3	
Other	12.3	12.3	12.3	28.8/43.0	
Total	55.1	58.1	113.4	250.2/360.5	Goal – 55.4

The HDV an Aviation sectors are the same as Deep Blue
LDV is 100% PHEV – 95% electric with balance met with ethanol

38, 500 GWh to the grid

Energy Challenges

- Must increase our efficiency
- Must generate even more energy in a carbon neutral manner
- Increased use of renewable generation (wind/solar)
 - Intermittency
 - Power quality
- Increased ability to deliver/manage electrical energy
 - Grid Congestion
 - Higher capacity transmission
 - Storage of Energy
 - Distribution level
 - Substation, Community, Distributed storage
 - Transmission level
 - pumped hydro, CAES

Brookhaven Strategic Energy Plan

BNL Energy Vision: effective use of renewable energy through improved conversion, transmission, and storage

BNL Initiatives

CFN/Nanoscience



NSLS II



New York Blue



Core Programs

Energy Strategy Materials Focus

Correlated Electron Materials

Materials for Catalysis

Solar Nano-materials

Energy Storage Materials

Aligned with DOE PRDs/Grand Challenges

BNL participation in 4 EFRCs

Collaborators/Joint Appointments



GE Global Research

United States - India - China - Germany



EFRCs

BNL Lead

- Center for Emergent Superconductivity
 - Team: BNL (lead), ANL, UIUC, American Superconductor
 - Focus: Transformative Grid Technology

BNL Partnerships

- Center for Excitonics
 - Team: MIT (lead), BNL, Harvard
 - Focus: Controlling photons and excitations at the nanoscale for solar and solid-state lighting
- Center for Re-Defining Photovoltaic Efficiency Through Molecule Scale Control
 - Team: Columbia (lead), BNL, Minnesota, Purdue, Arkansas
 - Focus: Increased PV efficiency through nanostructuring
- Northeastern Chemical Energy Storage Center
 - Team: SUNY-SB (lead), BNL, MIT, Rutgers, ANL, LBNL, Michigan, Florida
 - Focus: New materials for enhanced energy density and lifetime in batteries

Basic Energy Sciences: Excellence in Science

- Performance Evaluation (BES directorate)
 - *CMPMSD programs: "...research programs have demonstrated world leadership and sustained impact in superconductivity..."*
 - *CSGB programs: "...quite strong and continue to make excellent progress..."*
 - *CFN: "...in it's first full year of full operations indicated effective and efficient operations and significant involvement in outreach and other aspects of user facility operation"*

Publications:

Last 2 years:

10 Science

21 Nature, Nature Physics, Nature Materials

29 JACS

...

BNL Has Very High Citation Rates

e.g. HTSC: 50 papers > 200 citations; 9 papers > 500 citations; 2 papers > 1500 citations

Recent Honors:

Kamerlingh Onnes Prize for Superconductivity: Seamus Davis and John Tranquada

National Academy of Science: Seamus Davis

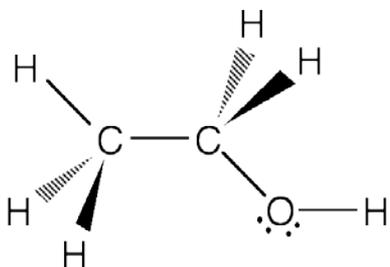
APS Fellows: Chuck Black, Greg Hall

Brookhaven Town Recognition Award: Etsuko Fujita

...

New BES research on catalysts for ethanol fuel cells

Brookhaven National Laboratory

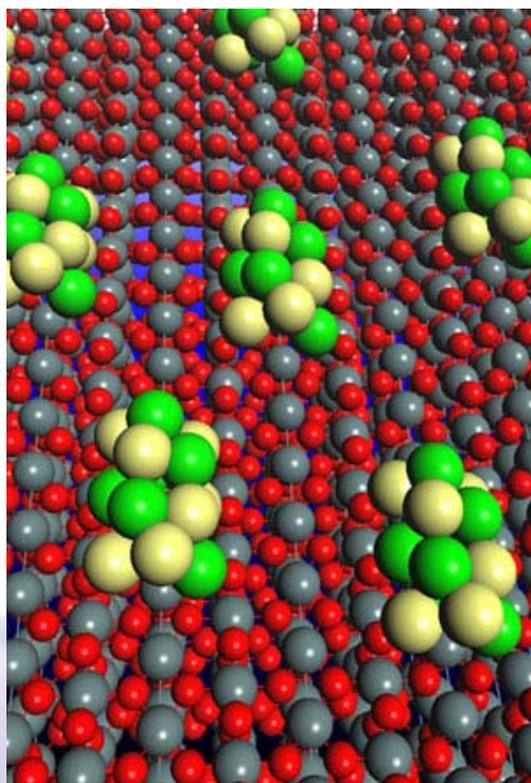


Challenge: stable, selective and energy-efficient C-C oxidation in a fuel cell with fuel molecules containing C-C, C-O, C-H bonds.

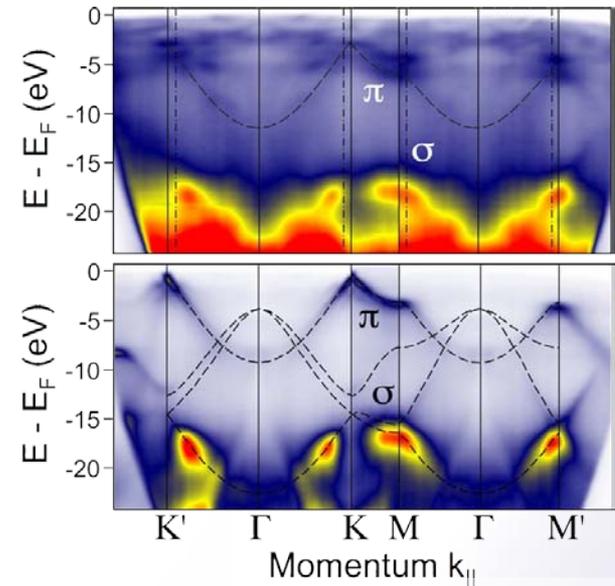
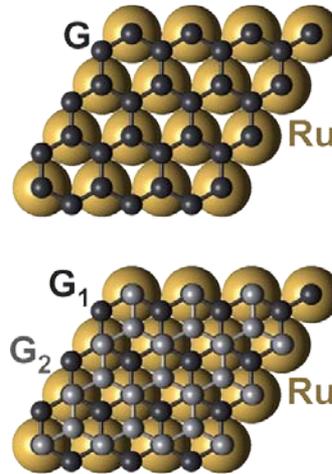
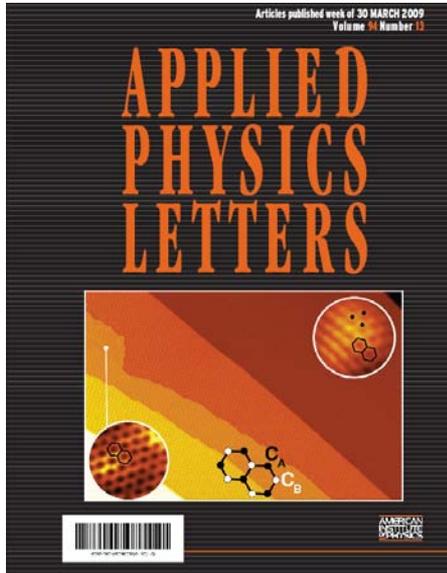
- Model of a ternary electrocatalyst for ethanol oxidation consisting of platinum-rhodium clusters on a surface of tin dioxide. For the first time, this catalyst can split the carbon-carbon bond selectively at a fuel cell anode.

- Hydrogen adsorbate binds through the hollow Rh-Pt site, all other species bind through the bare Rh sites; the cluster structure forces the formation of a cyclic intermediate that results in C-C bond breakage.

BES-supported critical advance: use of characterization techniques (EXAFS, IRRAS) at NSLS and CFN and molecular modeling techniques (DFT) to understand the role of bimetallic cluster structure, support structure, electronic structure, and charge transfer on the mechanism of C-C splitting and oxidation.



Macroscopic Graphene on Ruthenium



Key bottleneck to realizing potential of graphene for applications: Synthesis of *structurally perfect, macroscopic graphene sheets* into which devices can be carved.

We have grown *graphene on transition metals* that can meet this challenge:

- monocrystalline sizes » 100 μm
- low defect density

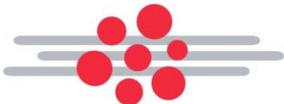
Combining experiments and theory, we have established the electronic coupling between graphene layers and Ru.

Variations in the electronic structure may be used to tune functional properties, such as the chemical reactivity of graphene.

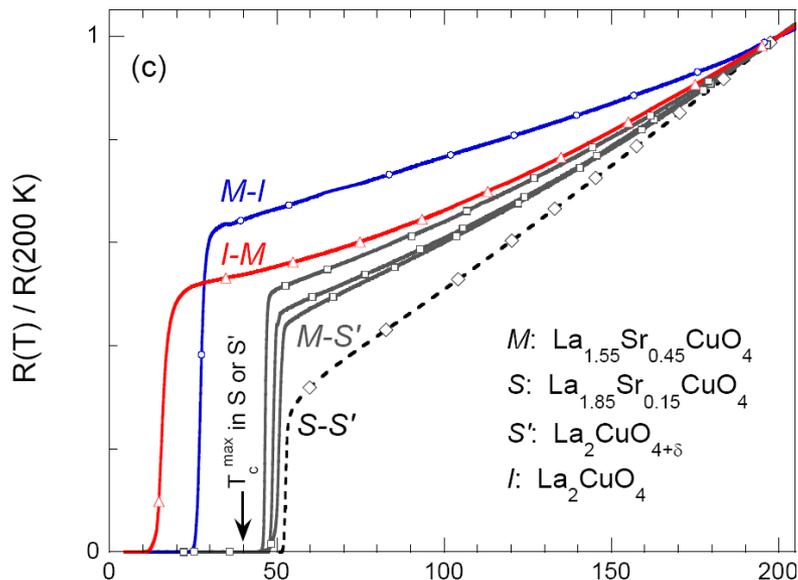
Nature Mater. 7, 406 (2008)

Nano Lett. 9, 2654 (2009)

Appl. Phys. Lett. 94, 133101 (2009)



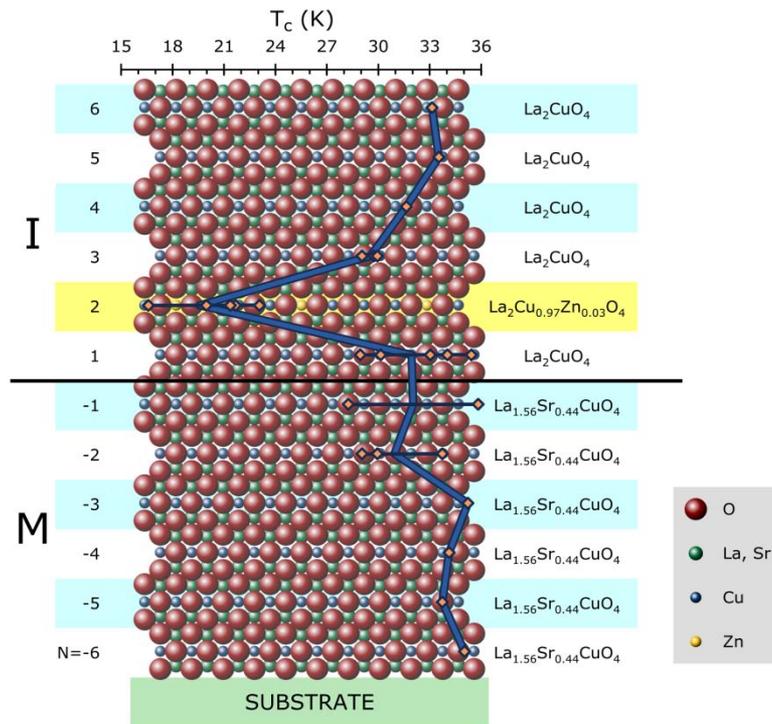
INTERFACE SUPERCONDUCTIVITY IN CUPRATES



Cuprate bilayer films are superconducting below the critical temperature $T_c = 32 \pm 4 \text{ K}$, although neither of the two component materials is superconducting *per se*.

High-Temperature Superconductivity in a Single Copper-Oxygen Plane

Science **326**, 699 (2009).



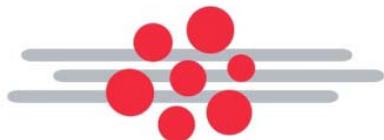
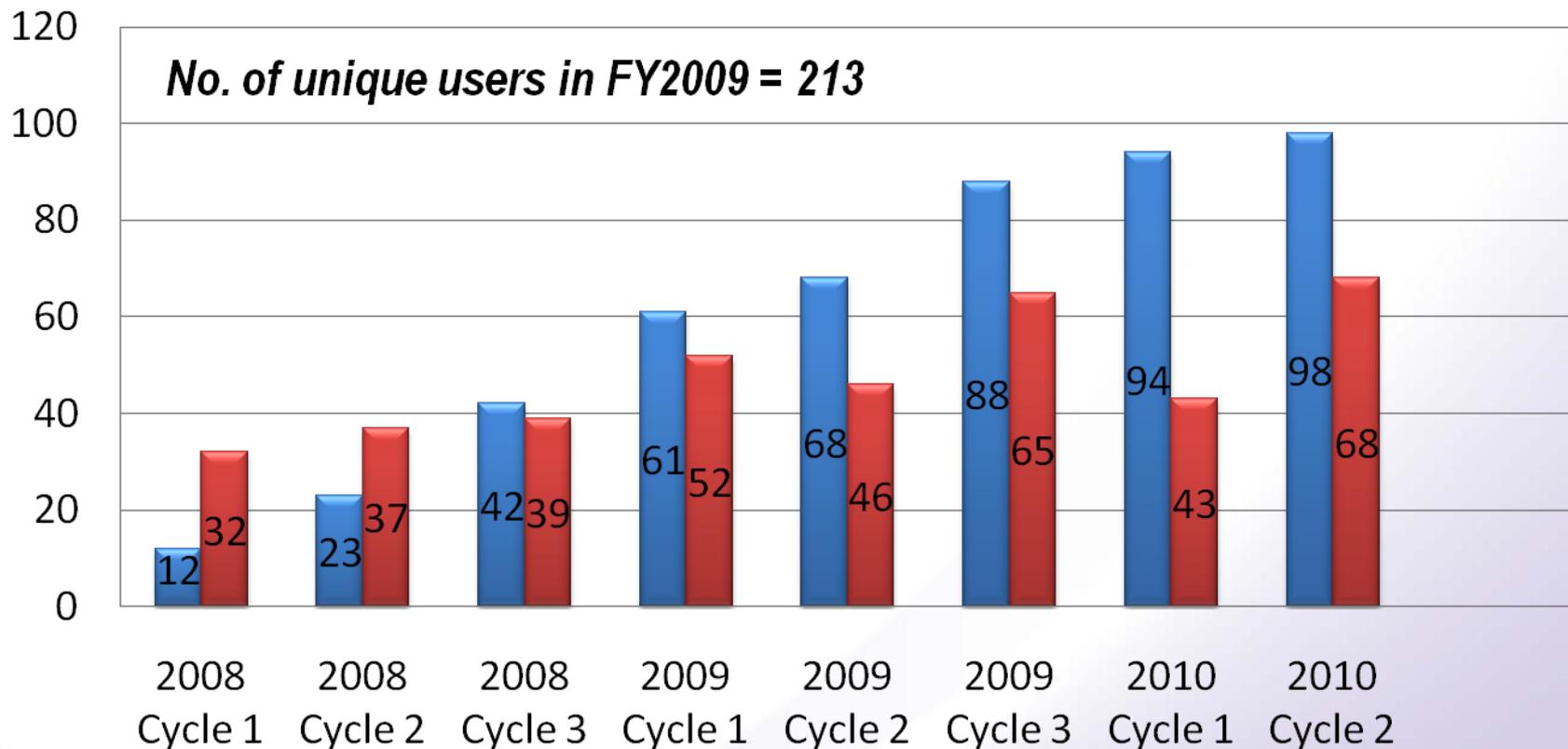
T_c is not affected by this doping except when Zn dopant atoms are placed in the (highlighted) second CuO_2 layer above the metal-insulator interface. This shows that high- T_c superconductivity is confined to a single CuO_2 layer (N=2).

Bozovic Group
 Brookhaven National Laboratory

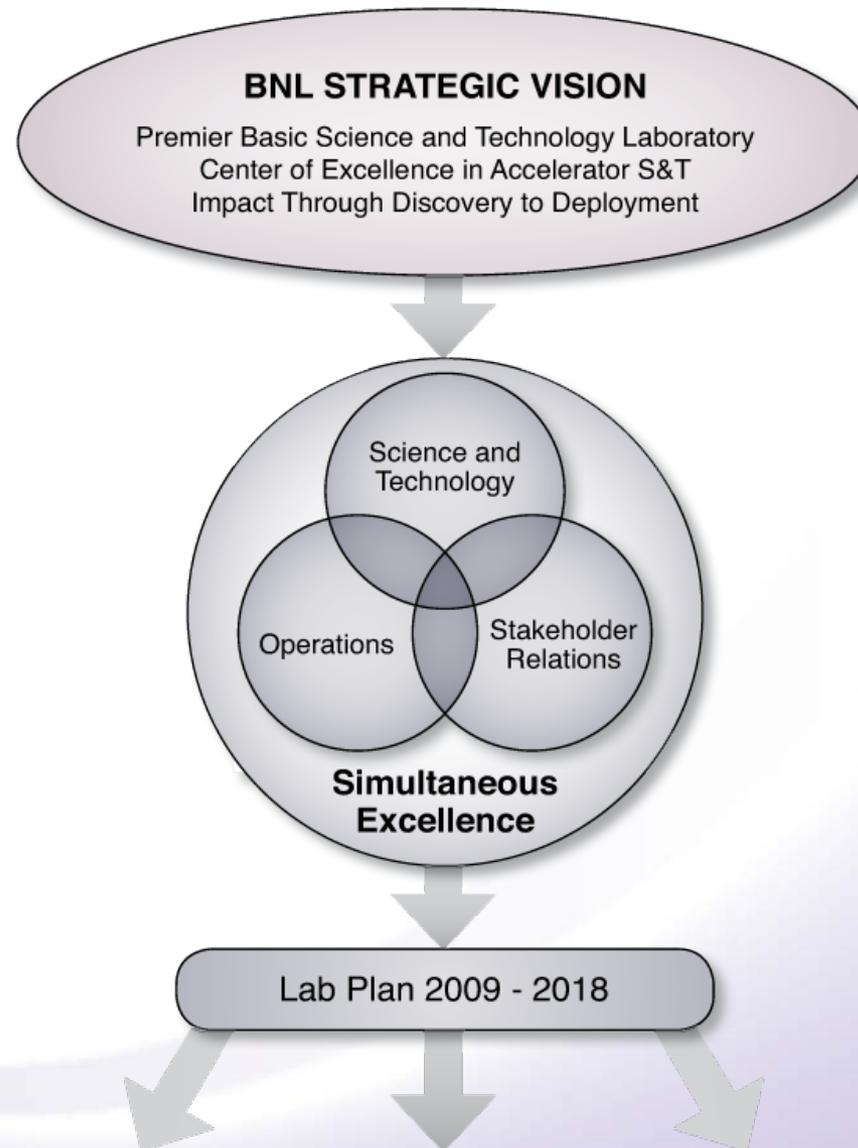
CFN: Excellence in Operations—Growing User Base

(Includes Rapid Access Program)

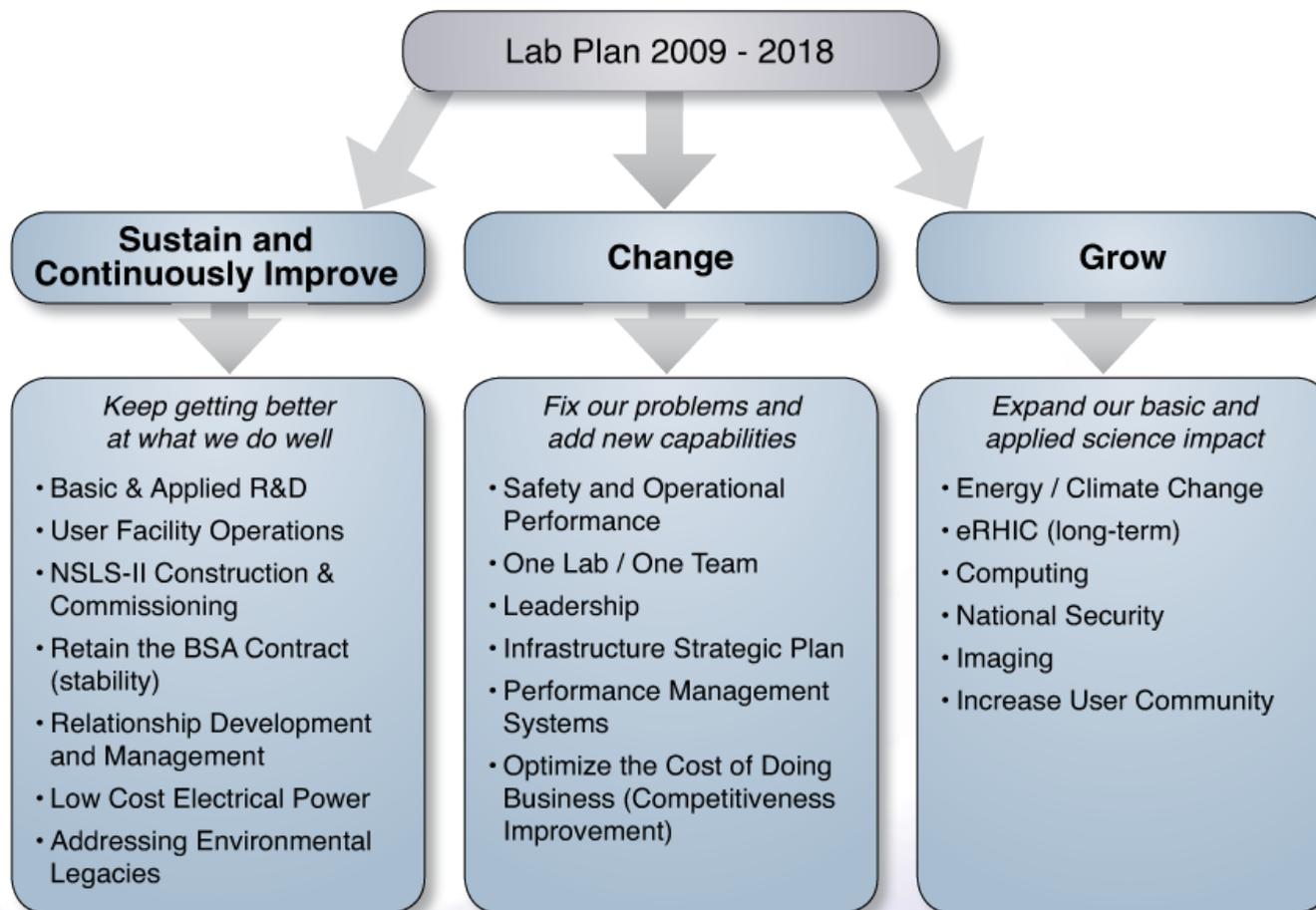
■ Continuing Proposals ■ New Proposals



BNL Blueprint Project



BNL Blueprint Project



BNL Blueprint Project

WHY GROW?

Our vision requires expansion of our science and technology portfolio and impact

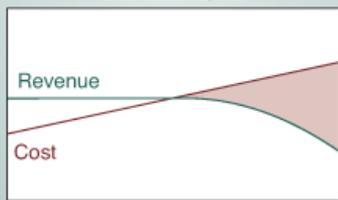
Expansion requires additional investment funds

Investment funds are steadily eroding – we are not financially sustainable

Options for Increasing Investment Funds

- Raise "Taxes" → Decreases our competitiveness and limits growth opportunities
- Cut Costs → Will help – but not enough and not soon enough
- Increase Income → By-product of success and generates needed funds

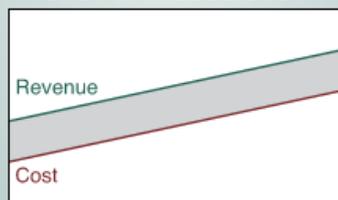
Status Quo



Investment Funds Disappear

Go Out of Business

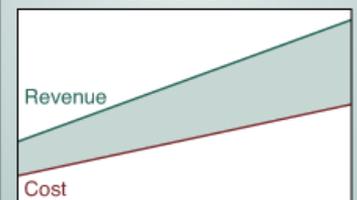
Growth = Escalation



Investment Funds Flat

Stagnation / Struggle

Real Growth

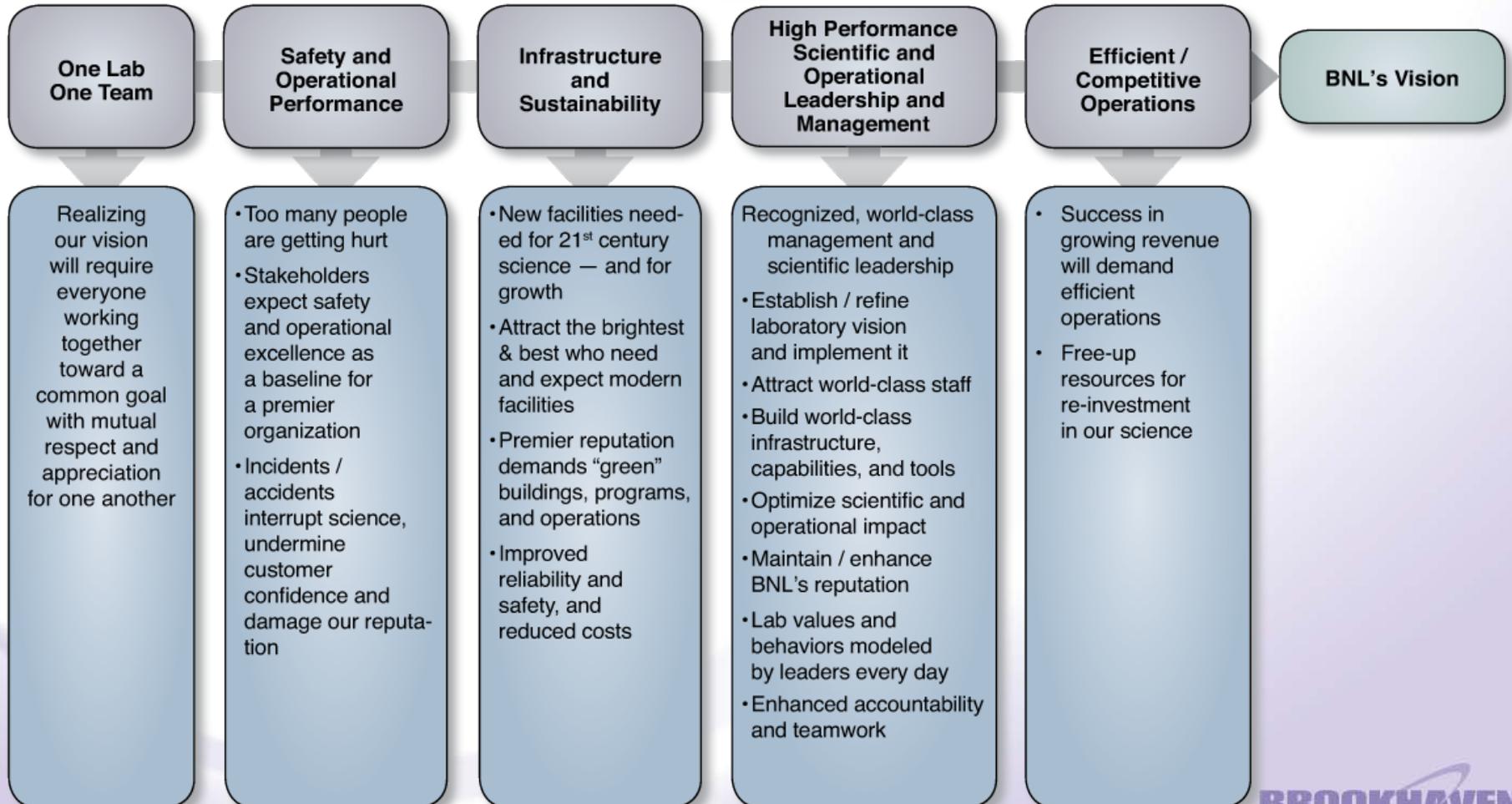


Investment Funds Grow

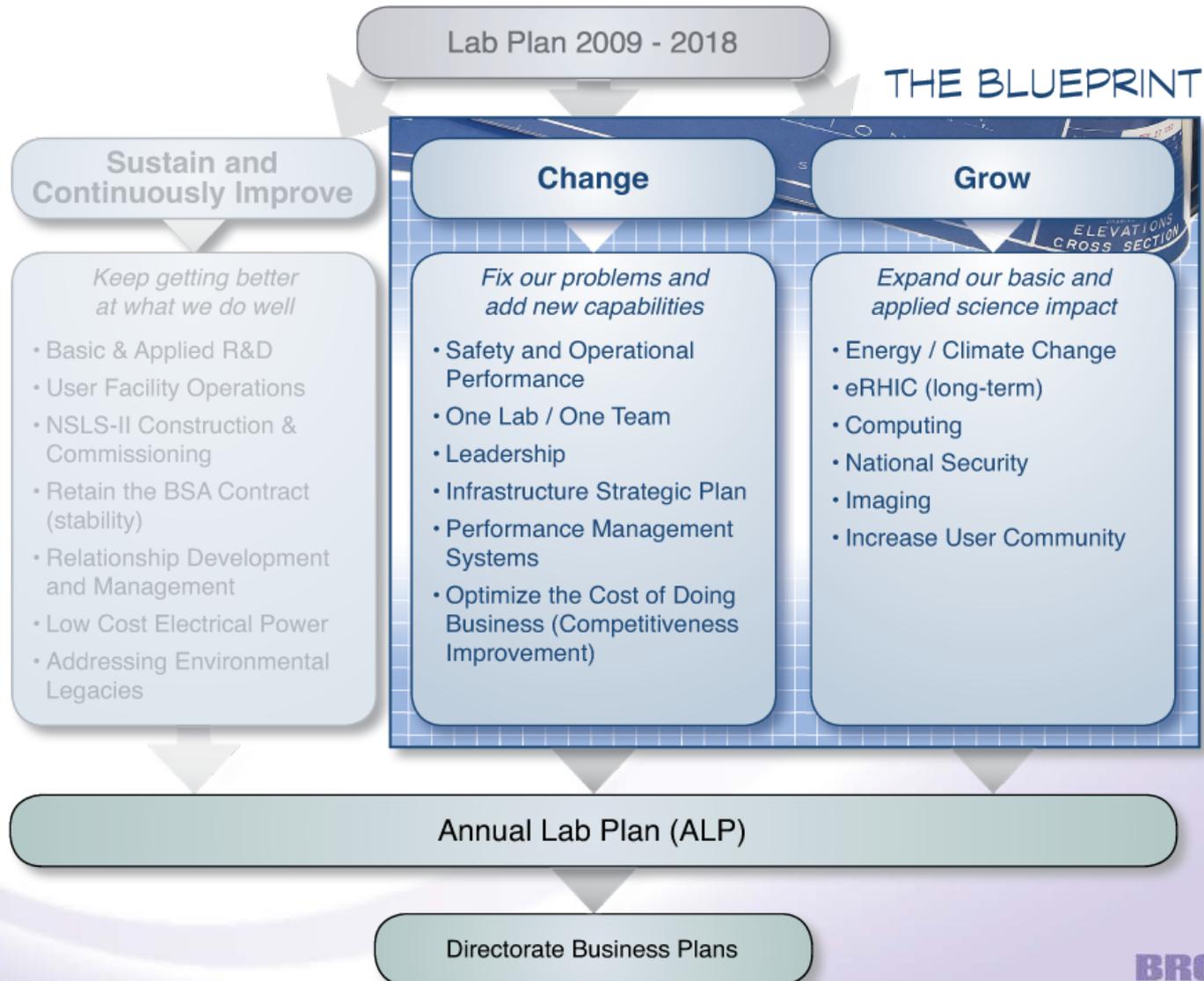
Realize the Vision

BNL Blueprint Project

WHAT NEEDS CHANGING?



BNL Blueprint Project



BNL Blueprint Project

How can I help?

- Keep an open mind and a positive attitude.
- Openly contribute your reactions, suggestions and critical opinions on the overall direction of Blueprint and on the individual actions we are planning to take.
- Be an active advocate within your organization for the Lab's vision and the Blueprint as a path to achieving it.
- If you are a Policy Council or Task Lead for one of the Blueprint projects or tasks, give it high priority, set realistic but challenging targets and deliver on them.
- Contribute your people's time to participate in the teams and working groups that are implementing Blueprint, and recognize and reward their efforts.
- Explain the Lab strategy and the elements of Blueprint to your staff.
- When requested, become personally involved and support the activities of our DOE and BSA review committees by contributing your time and your people's time to brief on your project or task.

BNL ESSH POLICY



Environmental, Safety, Security, and Health Policy

Brookhaven National Laboratory

This document is a statement of BNL's ESSH policy. BNL is a world leader in scientific research and strives to demonstrate excellence in protecting people, property and the environment.

I expect every employee, contractor, and guest to take personal responsibility for adhering to the following principles:

- **Environment:** We protect the environment, conserve resources, and prevent pollution.
- **Safety:** We maintain a safe workplace and we plan our work and perform it safely. We take responsibility for the safety of ourselves, coworkers and guests.
- **Security:** We protect people, property, information, computing systems, and facilities.
- **Health:** We protect human health within our boundaries and in the surrounding community.
- **Compliance:** We achieve and maintain compliance with applicable ESSH requirements.
- **Community:** We maintain open, proactive and constructive relationships with our employees, neighbors, regulators, DOE, and our other stakeholders.
- **Continual Improvement:** We continually improve ESSH performance.

In addition to my annual review of BNL's progress on ESSH goals and adherence to this policy, I invite all interested parties to provide me with input on our performance relative to this policy, and the policy itself.

Signed 
Sam Aronson, Director

September 6, 2006

Fresh Eyes Safety Observations

- Get people from other departments observing work practices
- Increase understanding of what is happening across the directorate
- Carol Parnell organizing safety observation tours
 - 2 group leaders from each department
 - Led by Carol Parnell
 - Schedule 3 lab visits
 - CP writes up database entries

Chemistry Department Synthesis Incident

- Small SEALED reaction vessel in an oil bath for overnight synthesis procedure
- Next morning the vessel was broken as was the pyrex oil bath container
- Done inside a hood, oil glass bits found nearby outside the hood
- No injuries
- Alex Harris determined it was a management concern and therefore OORPS reportable

Traffic Safety

Requirements: Traffic Safety Subject Area revised 3/01/2010

Who must comply: BNL staff and non-BNL staff when driving government or privately owned vehicles and bicycles

Summary of Regulations

- Follow speed limits
- Park in appropriate areas
- Wear seat belts
- Obey stop signs
- Yield to pedestrians at crosswalks

Citations

Increasing levels of disciplinary action for moving violations starting with conference with ALD and supervisor, then on to driver training, HR meeting, letter to file, up to suspension **without pay**

Traffic Citations – Minimum Disciplinary Actions

(Within 12-Month Period**)

Moving Violations*		Required Action		
		BNL Employee**	Guest, User	Contractor
Severity of Violation*	Level One <ul style="list-style-type: none"> • Moving violations (other than those below) • Exceeding speed limit 1-15 mph 	a. Conference with ALD, supervisor, and offender	a. Conference with ALD	a. Violations are contractual, handled by PPM
	Level Two <ul style="list-style-type: none"> • Exceeding speed limit 16-25 mph • Following too closely • Reckless driving 	a. Conference with ALD, supervisor, and offender b. Driver training c. HR meeting d. Warning Letter to file	a. Conference with ALD b. Letter to home institution	See above
	Level Three <ul style="list-style-type: none"> • Exceeding speed limit >25 mph • DUI/DWI • No Driver’s License • No Insurance 	a. HR meeting b. Disciplinary action (e.g., suspension without pay)	a. Suspension of on-site driving privileges for 14 days	See above
Parking		Conference with ALD, supervisor, and offender	Conference with supervisor and offender	See above

* Two Level One violations within 12-month period will be treated in accordance with Level Two disciplinary actions

* Three or more Level One violations within 12-month period will be treated in accordance with Level Three disciplinary actions

* Combination of a Level One and a Level Two violation within 12-month period will be treated in accordance with Level Three disciplinary actions

** For employees covered by labor contract, consult your Labor Relations representative before proceeding to determine what, if any, impact the collective bargaining agreement has on these items



EMS/OSH Audit

- **When:** May 3-7, BES Directorate, Thursday, May 6th
- **Scope:** Review of BNL ESH (OSH/EMS) operations, with focus on laboratory activities

AUDIT TIP: keep handout available for reference

What you need to know (handout available):

- Our compliance is primarily assured through work planning; specifically ESRs, Work Permits and Standard Operating Procedures (SOPs)
- The OSH process includes risk assessment processes (JRAs/FRAs) that provide a mechanism to identify and mitigate high risk tasks/hazards
- Environmental issues to be covered in the audit include waste management, satellite accumulation area (SAA) management and posting of rules, secondary containment requirements, and sink discharge posting in laboratories.



EMS/OSH Audit

What you need to know (cont'd):

- **Two way communication among workers and supervisors is a fundamental principle in OSH and Integrated Safety Management. You are encouraged to express concerns/comments with respect to ESSH issues.**
- **ESH/OSH Contacts:**
 - **Departments – Bob Sabatini (NC), Diane Cabelli (CO), Arnie Moodenbaugh (PM)**
 - **Directorate – John Taylor**
 - **BNL – Bob Lee (EMS), Ed Nowak (OSH)**

Emergency numbers:

BNL Phone : x2222 or 911

Outside: 631-344-2222



EMS/OSH Audit

Environmental, Safety, Security and Health Policy

An expectation that all employees, contractors and guests will adhere to the following principles:

- Protect the environment
- Maintain a safe workplace and work safely
- Provide security protection
- Protect human health within and outside of the lab
- Maintain compliance with ESSH requirements
- Community involvement with employees, neighbors and regulators
- Continual improvement of ESSH performance

Policy Handout Available

EMS/OSH Audit

Basic Energy Sciences EMS/OHSAS Review Sheet



(OHSAS)/(EMS) Audit during the week of May 3-7, 2010. The BES Directorate, including all three departments, will be audited on Thursday, May 6, 2010.

BNL's Environment, Safety, Security and Health (ESSH) Policy <http://www.bnl.gov/ESHQ/ESSH.asp> sets the BNL vision of excellence in research & operations while incorporating health & safety into every action. This policy is posted in the lobbies.

In the case of an emergency, call x2222 or 911 from a BNL phone. From a cell phone call 631-344-2222.

DOE Integrated Safety Management (ISM) uses a **continuous improvement cycle** to deliver health and safety evaluations of operations in the planning stage, during work, and in follow-up reviews. EMS and OHSAS are components of ISM.

ESRs and Work Permits defines the scope of your work, identifies the hazards, and the controls used to mitigate the hazards.

Standard Operating Procedures (**SOPs**) describe the scope, hazards and controls for certain specialized tasks, including Laser Operations.

Be prepared to describe **your** involvement in the work planning process.

Training -- web based (e.g. Lab Standard, Haz Waste etc.), classroom/lecture based, supervisor qualification (e.g. knowledge of ESR content, hands-on training for using lasers and x-ray generating devices, and for use of machine shop tools).

Job Risk Assessments/Facility Risk Assessments -- JRAs/FRAs are part of the audit - work was observed and individual steps were rated for risk. The JRAs/FRAs are available using a link from the CFN website Operations page.

The Standards Based Management System (**SBMS**) provides the documentation and the basic rules on how to conduct operations at BNL.

Environmental issues to be covered in the EMS part of the audit include waste management, satellite accumulation area (SAA) posting of rules, rules for secondary containment, and sink discharge posting in laboratories.

Bob Lee is the Lab's BNL EMS Rep. **Ed Nowak** is BNL OSH Rep.

John Taylor is the BES EMS/OHSAS Rep.

Department POCs: CFN - **Robert Sabatini**,
Chemistry - **Diane Cabelli**,
CMPMSD - **Arnie Moodenbaugh**

Two-way communication among workers and supervisors is another fundamental principle in OHSAS and ISM. Every worker is encouraged to interact with the supervisor and/or contribute questions, concerns, and comments regarding ESSH issues

Thank you

- Keep up the great work!