

SURF 2008



SUMMER UNDERGRADUATE RESEARCH FELLOWSHIP

PROGRAM AND ACTIVITIES

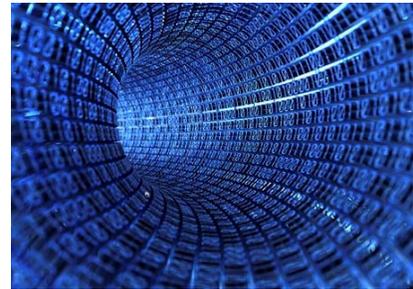
2008 SURF Summer Seminars and Tours

May 27 First official work day and orientation for SURF Session I students

June 5 James Filliben
NIST Information Technology Laboratory, Statistical Engineering Division

Catapults, Funnels, Science and Statistically Designed Experiments

In years past as part of one of its stat courses, the Air Force Academy had its students examine and optimize the distance accuracy of a simple catapult system. In a week-long NIST stat course, one of the props used was an elementary funnel apparatus with the goal of characterizing, understanding, and maximizing the “roll-time” of such a system. In 2001



Congress mandated that NIST study the collapse causes of the World Trade Center disaster; to that end, the amount of core damage that was done to the South Tower based on video evidence and FEA (finite element analysis) computational code became of interest—such damage needed to be estimated, characterized and understood. In last year’s SURF program, one of the students conducted a scientific investigation of carbon nanotube contamination in water; in her study it became necessary to identify primary factors and interactions that affected the degree of such contamination.

In all of the above four examples—plus a large number of other NIST and non-NIST scientific studies—the systematic, structured, rigorous approach known as statistically designed experiments (DEX) played a critical role 1) to produce a dataset that had the capacity to answer the scientific question at hand, and 2) to do so with the minimal expenditure of money and time (as is especially relevant in your SURF environment with its 10 week window of data-generation and analysis). This seminar provided an introduction to the DEX approach, described selected important principles and techniques, and applied the approach to the above-described four problem areas.

June 12 Tom Juliano
American Society for Engineering Education, Washington, DC

Free Money: Secrets of Effective Grants for Graduate School

The American Society for Engineering Education (ASEE) manages over 1,400 research fellowships and scholarships totaling over 60 million dollars for both undergraduate and



graduate students for most federal agencies including NSF, DOD, NASA, etc. As the administrator for these fellowships, we are in a unique position to offer advice about these opportunities, how to apply and be awarded these fellowships. Receiving a graduate fellowship significantly increases your potential opportunities in graduate school and beyond.

June 19

David J. Gundlach
NIST Electronics and Electrical Engineering Laboratory, Semiconductor
Electronics Division

Plastic Electronics

Human-scale electronics like flat panel displays and sensor arrays are pervasive in today's society. Cost, size and performance requirements make single crystal



silicon ill-suited for these applications, thus amorphous silicon thin films deposited on thin glass substrates have become the dominant technology for any human-scale electronic applications. Plastic electronics (electronics based on thin films of organic semiconductors) is an attractive alternative to thin film electronics based on inorganic materials like amorphous silicon.

Organic semiconductors have several potential advantages notably their compatibility with low-cost, high-volume solution processing, the ability to chemically-tune their electronic and optical properties, and their ability to be processed at relatively low temperatures. Taken together these properties will enable the fabrication of low-cost, large-area electronics with increased electronic functionality on flexible substrates. In this presentation, Dr. Gundlach discussed the tremendous potential for plastic electronics to impact all aspects of life through revolutions in lighting, sensing, displays and energy harvesting.

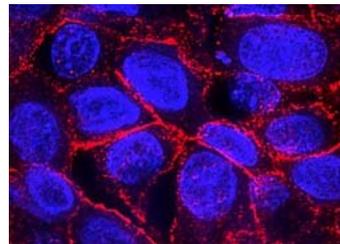
June 26

Michael Amos
NIST Chemical Science and Technology Laboratory

Disease Signatures

The future of biology and medicine depends on the development of technologies and research approaches that embrace the high degree of complexity in biological systems.

Therapeutic or preventative interventions will be based on “disease signatures” – unique descriptors that can be definitive markers of health status – which will be derived from the integration of quantitative and qualitative measurements (biochemical, biophysical and bioelectronic) of hundreds or thousands of biomolecules and/or intermolecular and cellular interactions.



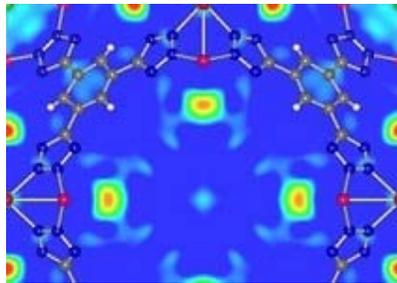
Likewise the next generation of health assessment diagnostic tests will be based on multiplex determinations constituting a unique complex signature rather than single markers of biological activities. The shift to signature analysis in diagnostics will help to enable routine health status monitoring that uses each person's own signatures of wellness and disease as the controls against which to detect pathological changes. This new focus will enable a new comprehensive and integrated approach to wellness that includes prevention of disease, early detection of disease risk and individualized treatment plans for individual patients. The new approach to wellness, in turn, may help control the rising cost of health care, for which spending now consumes nearly one fifth of the U.S. gross national product. This lecture will highlight current needs and future opportunities of this important sector of biosciences.

July 2

Craig Brown
NIST Center for Neutron Research

Probing Hydrogen Storage Materials Using Neutrons

Storing hydrogen molecules in porous media based on a physisorption mechanism is one possible approach to reach the U.S. Department of Energy targets for on-board hydrogen storage. Although the storage capacities of coordination polymers have progressed significantly over recent years, some technological obstacles pose challenges for their future improvement. These include the generally low hydrogen adsorption enthalpy limiting room temperature applications and the lack of



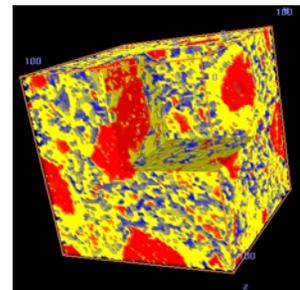
understanding of surface packing density hindering the efficient improvement of hydrogen adsorption uptake. Results of various neutron scattering experiments help to shed light on both of these topics and recent results were presented.

July 10

Dale Benz
NIST Building and Fire Research Laboratory, Materials and Construction Research Division

When Water Meets Cement

Concrete is the second most consumed material on a worldwide basis, after water. The key components of concrete are water and cement (along with sand and stone) and their interactions are responsible for the amazing transition that concrete undergoes, from a viscous suspension into a rigid load-bearing solid. The talk provided overviews of concrete and cement production and then proceeded into a presentation of what happens when water



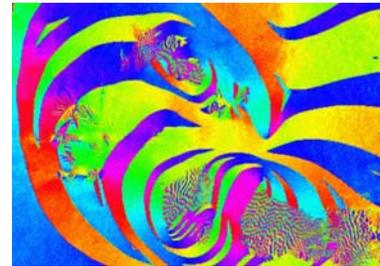
meets cement. Hydration reactions, chemical shrinkage, and autogenous expansions and shrinkages were introduced. The importance of proper curing of concrete was emphasized and the talk finished by considering the long term interactions between water and cement that influence durability and service life.

July 17

Mark Stiles
NIST Center for Nanoscale Science and Technology

Magnetic Materials: More Than What You See Everyday

Electricity, sound, motors, information storage, sensors... Magnetic materials play an important role in these applications and are crucial for many aspects of modern life. Traditional applications of magnetic materials are based on the interaction between the magnetic materials and the electric fields generated by currents.



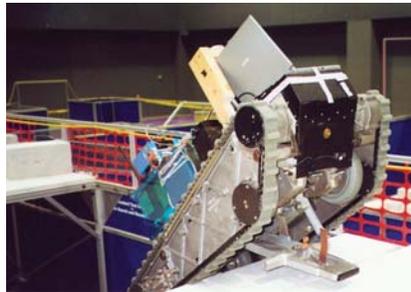
Newer applications are based on the direct interaction between these materials and current. The 2007 Physics Nobel Prize for Giant Magnetoresistance is an example of this newer interaction. In this talk, Dr. Stiles described the interactions between currents and magnetic fields and discussed some of the ways in which this interaction is exploited.

July 23

Elena Messina
NIST Manufacturing Engineering Laboratory, Intelligent Systems Division

Robots – Ready or Not?

Robots hold much promise as tools that will aid humans in a wide variety of missions and applications. They are being developed for military missions, transportation systems, factory automation, health care, and homeland security, to mention a few examples. Yet there are very few means – if any—of objectively and quantifiably determining whether robots are ready to be fielded or how effective they will be in accomplishing a particular job. To address this shortcoming,



NIST is working with end-users and developers to define application-specific requirements for robot performance, devise test methods and metrics for evaluating the performance, and in generation of consensus standards. This talk presented the challenges in developing a measurement science for robotics and provided examples of the process used that abstracts application-specific real world challenges into quantifiable and reproducible tests.

August 5

Final presentations by SURF students moderated by invited guests.

- August 5 Lunch: SURF Directors and special invited guests.
- August 6 Final presentations by SURF students moderated by invited guests.
- August 7 Final presentations by SURF students moderated by invited guests.
- August 8 Last day for SURF students and farewell pizza party.

2008 SURF Summer Activities

Gaithersburg, MD may not be around the world like the the 2008 Beijing Summer Olympics, but it's still difficult when you're in a new city. NIST Gaithersburg SURF students all find themselves in the same boat and thus forge bonds that may last a lifetime. They work together AND play together. In fact, to make life easier they can get it all scheduled using their own forum for social and work-related chatting.

NIST SURF Forum

(For NIST SURF-related chat & info (this is not a U.S. Government website))

Before you Arrive

Travel, Living Arrangements & Money (how to get here, info on roommates, and the all important money)
Meet your Roommates (chat with your new suite mates)

NIST Research and Other Opportunities

Important Meetings & Dates (NIST seminars, tours, special meetings, off-campus visits, socials & more)
Working at NIST (guidelines to the NIST workplace)
Please help... (Solve a problem / find something I need for my project)
Complaints (Post a complaint about NIST or Summerfield – solutions welcomed!)
After the NIST SURF Program (Graduate school options and other career opportunities)

SURF Student Activities

Chat Central (off topic chat, forum games and everything else)
Outdoor Activities (organize hiking, biking, camping trips)
Apartment Life (organize parties, BBQ's and other Summerfield Suite gatherings)
Sports (Organize sports activities at our outside of NIST)
Take a Trip (organize trips to DC, Baltimore, New York, amusement parks & more)
Religion (Find friends of faith)

General Category

General Board (This is the board for general discussions)
Test Zone (Test the forum out here. Posts made in this board will not add to your post count.)

SURF BBQ – NIST Picnic Grove

July 4th in the Nation's Capitol

On the Fourth of July, we pause to remember and celebrate the values of liberty and justice that make our country great, and to be thankful for the remarkable freedoms that we enjoy in the United States of America. The significance of this day has inspired speeches, literary works, and musical compositions. It is also an opportunity for each of us to ponder the meaning of our nation's heritage and to celebrate in our own unique way. Check out how this year's SURFers celebrated the holiday...

2008 SURF T-Shirt Design



What better way to remember your summer at NIST than to design your very own souvenir T-shirt. It may not be the Olympic rings, the world's most recognized symbol, but this year's SURF T-shirt will provide the students with lots of memories. The T-shirt has a symbol for each of the nine organizational units at NIST, the bear that wandered onto the NIST grounds, a tornado that shook up the area during their stay, and the water main break that left many SURFers without the ability to wash their clothes or do other tasks we take for granted, to name a few.

NIST Summer Institute for Middle School Science Teachers



This summer NIST sponsored a workshop for ~17 middle school science teachers from schools in the

Montgomery County area. One of the goals of the two-week workshop was to help the teachers learn more about how to encourage their student's interest in science in the crucial middle school years. Since SURFers were closer to the middle school years than most of the other staff at NIST, they asked for the SURF students to provide insights into the issue. Also the SURFers were involved in interesting projects and learning how to explain what they were doing to others. This made them great examples for the teachers of how scientists work. Who knows, the SURFers may have even got to meet their science teacher from years ago if they went to school in the area – wouldn't that have been cool – in addition to making that teacher proud!!

White House and Capitol Hill Tour

The White House - For two hundred years, the White House has stood as a symbol of the Presidency, the United States government, and the American people. The 2008 SURFers got to see the White House up close and personal on a special tour arranged just for them. Hmm, I wonder if they saw Barney and Miss Beazley running around during their visit.



The White House has a unique and fascinating history. It survived a fire at the hands of the British in 1814 (during the war of 1812) and another fire in the West Wing in 1929, while Herbert Hoover was President. Nonetheless, the exterior stone walls are those first put in place when the White House was constructed two centuries ago.



Presidents can express their individual style in how they decorate some parts of the house and in how they receive the public during their stay. In 1829, a horde of 20,000 Inaugural callers forced President Andrew Jackson to flee to the safety of a hotel while, on the lawn, aides filled washtubs with orange juice and whiskey to lure the mob out of the mud-tracked White House.

There are 132 rooms, 35 bathrooms, and 6 levels in the Residence. There are also 412 doors, 147 windows, 28 fireplaces, 8 staircases, and 3 elevators.

Capitol Hill, aside from being a metonym for the United States Congress, is the largest historic residential neighborhood in Washington D.C., stretching easterly in front of the U.S. Capitol along wide avenues. It is one of the oldest residential communities in Washington, and with roughly 35,000 people in just under two square miles, it is also one of the most densely populated. Capitol Hill's landmarks include not only the United States Capitol, but also the Senate and House office buildings, the Supreme Court, the Library of Congress, the U.S. Marine Barracks, the Washington Navy Yard, and Congressional Cemetery.



Neighbor Helping Neighbor

The honor, spirit and resources of the American people comes forth with neighbors helping neighbors in need — during earthquakes, floods, fires, storms — and also for the deeply personal and often quiet disasters that require a gift of blood. Quietly, without fanfare, SURFers gave the gift of blood during the NIST blood drive.

Pentagon Tour

The Pentagon is virtually a city in itself. Approximately 23,000 employees, both military and civilian, contribute to the planning and execution of the defense of our country.



The Pentagon tours program was established on May 17, 1976 to support the nation's Bicentennial Celebration. Initially, the program was to last through the 4th of July and then be disbanded; however, internal support and public demand were so great that the program has been continued ever since – with a few SURFers adding to those numbers.



SURFer Girl Night at the Cold Stone Creamery

The SURFer “girls” needed someplace to wind down from a hot Washington area summer week and hard work, so they headed to the Cold Stone Creamery for their favorite ice cream indulgence and some “girl” talk.



Artscape 2008 was a free public arts festival in nearby Baltimore, MD. The festival had multiple music stages going non-stop with such greats as Roberta Flack, Joan Jett and the Blackhearts, the

Wailers, Ne-Yo, and the Baltimore Symphony Orchestra, along with visual and performance art. A pretty good deal, even considering the price of gas to Baltimore, but ever conscience of their funds and the environment, the group carpoled.



Where you can you get your start to win the Fox Network contest “So You Think You Can Dance”? Several SURF students took up two NIST staff (not professional dance instructors) on their offer of free dance lessons to learn the

East Coast Swing and Cha Cha. Who knows we just might see a former SURFer on the new season’s show.

Volunteers Wanted – Linear Algebra & Synthetic Worlds

Contrary to popular belief, students do not just *play* video games all day; sometimes that *play* is really a serious scientific experiment. A SURF student and advisor were looking for a few students to help evaluate a software prototype designed to be used for linear algebra. The only requirements were that you needed to be pretty familiar with linear algebra (think high school precalculus), be free during the time slots to participate, and, of course have your advisor’s permission.

SURF Students Hard at Work



MSEL/NCNR SURF students Tiffany Ng and Sindhushree Raghunandan describe their summer research projects to Senator Ben Cardin (left) and Dr. James Turner, NIST Deputy Director



Jacob Schalch tending to the helium cryostat while performing neutron experiments at the NCNR



A group of SURFers touring the CNST Nanofabrication Cleanroom.

SURF Farewell Pizza Party

Every year the SURF Directors treat the students to a farewell pizza party. This year the SURF T-shirt committee made a few dollars profit selling NIST's hottest fashion item – the SURF 2008 T-shirt. Luckily for their fellow SURFers, the T-shirt committee decided to treat everyone to Rita's Ice in three yummy flavors – mint chocolate chip, blueberry, and mango – pizza and dessert, what's not to love.



See ya!

