Draft for Brookhaven Visit

Thank you, Sam. It's a pleasure to be here at Brookhaven this afternoon. I very much appreciate Sam's invitation to this celebration in honor of Jim Simons and Renaissance Technologies. I've enjoyed the opportunity I've had today to meet and talk with many of you. I am looking forward to more such opportunities in the months ahead. It is interesting to visit here where I have memories from the 1980s when Bell Labs was trying to help bring the NSLS into existence, when we were trying to keep the nuclear reactor going. Brookhaven was wonderful then and I hope today, as well.

Jim Simons, I know, has been a great friend of this laboratory for many years, but never more so than in late 2005 and early 2006. That's of course when he and his partners in Renaissance Technologies raised $13 million to enable RHIC to run for 20 weeks in Fiscal Year 2006. This was an extraordinary act of public-spiritedness, generosity, and true dedication to the cause of Brookhaven and of science. And I would like to add my words of appreciation to those of many others who will speak today to Jim and the other members of Renaissance Technologies here today.

When Sam invited me to come up here and join you, he asked if I would say a few words about my initial perspective on DOE and the DOE Office of Science.

The Office of Science is unique within the federal government, and probably unique among government science funding organizations across the world. Over the past six decades--since it began life as the research arm of the U.S. Atomic Energy Commission in 1946--the impact of this Office on science has been disproportionate to its size and its public visibility.

The Office of Science was born of the conviction, formed in the wake of the World War II and the Manhattan Project, that large-scale federal support of fundamental research in the physical sciences would be indispensable to this nation's future security, prosperity, and quality of life.

This was a fundamentally new idea. Before World War II, the U.S. government had supported limited R&D in defense and health. But not on the scale that was now envisioned.

The Atomic Energy Act of 1946 created a fundamentally new kind of science funding organization, our predecessor agency, the AEC Division of Research. At the core of this new organization was a fusion of two commitments--a commitment to intellectually driven and intellectually honest fundamental scientific research, and a commitment to national purpose and mission. This fusion of science and national mission continues to define the character and culture of the DOE Office of Science to this day.

And there's a third characteristic that we also inherited from the Manhattan Project, and that was a new scale of vision--a new, more ambitious conception of what science could accomplish with a large, well-organized mobilization of resources.

Science, national mission, greatness of scale--these three values lie at the core of the unique ethos that defines the DOE Office of Science. And the results of this unique combination have been transformative over the past several decades.

Our most fundamental understanding of the physical world--the Standard Model of particle physics--would have been impossible to test experimentally, and probably to develop in fullness, in the absence of the massive synchrotrons and linear particle accelerators that the DOE Office of Science has pioneered. From the Bevatron at Berkeley Lab in the 1950s to the Tevatron at Fermilab today--the DOE Office of Science has led the way in supporting accelerator science.

And not only did successive advances in our understanding of basic physics lay the groundwork for the emergence of countless new technologies over the decades. The specific work on particle accelerators, on accelerator science, also helped lead to the development of key medical technologies for both diagnosis and treatment of cancer that have improved the lives of millions of Americans.

In more recent decades, we have seen the development of a new generation of accelerator-based advanced light sources that are giving us ever greater power to observe and manipulate matter at the atomic and molecular scales. These light sources have become among the premier tools of today's most advanced basic research in energy, materials science, chemistry, biology, and a host of other fields.

It's no accident, too, that it was the DOE Office of Science that proposed the idea for the Human Genome Project in 1986--at a time when the idea of sequencing 3 billion base pairs of human DNA in any reasonable period of time seemed little short of preposterous to most people. The Human Genome Project grew from the same pioneering spirit and boldness of vision, combined with knowledge of how to organize science on a major scale. The completion of the draft sequence of the human genome was finally announced in the year 2000. Today our DOE Joint Genome Institute is sequencing some 80 billion base pairs of mission-relevant microbe and plant genomes every month. Not all of this is sequencing of the kind needed to reconstruct a whole genome--which usually requires multiple "runs" that are reassembled by supercomputers. But it gives you an idea of how rapidly this technology has advanced. And this sequencing is critical to the work of the three DOE Bioenergy Research Centers, which now lead the world in the area of fundamental research on biofuels.

Who would have imagined in 1986 that the effort to sequence the human genome would have led to technologies that could provide part of the solution to an energy crisis that was to arise twenty years later? DOE science has always had this kind of multidimensional impact.

Just this past April, the Linac Coherent Light Source (LCLS) at SLAC achieved "first light." This was an amazing technical and engineering achievement. This is the brightest source of pulsed x-ray light ever created by human beings on earth. The level of precision involved is mind-boggling. Essentially in a weekend, scientists at SLAC arranged 15 out of the 33 undulators planned for the accelerator and produced a beam of photons with a wavelength of 1.5 angstroms. This was an extraordinary accomplishment.

This is a nearly half-billion dollar project. Few outside the ranks of the accelerator community can appreciate the scale on which scientific insight, technological know-how, engineering skill, construction savvy, and human organizational acumen must be integrated to produce a result of this nature. And SLAC is planning for "first science" at LCLS as early as this fall.

The same spirit, I see, is very much alive at Brookhaven. This past June, DOE sent a team of 30 reviewers here to Brookhaven for a three-day, top-to-bottom review of the National Synchrotron Light Source-II (NSLS-II) project.

The National Synchrotron Light Source-II at Brookhaven is a project of at least equivalent size and complexity to LCLS, just getting underway. Construction has just begun, with help from $150 million in funds from the American Recovery and Reinvestment Act. The total cost of the project is nearly $1 billion.

The reports I received indicated that the project came through this rigorous review very well.

I sometimes wish that more Americans understood and appreciated the complexity of what we do and how much care and how many checks and balances are necessary to make sure it is done right. These rigorous project reviews by our Office of Project Assessment are a major reason why the DOE Office of Science has a track record of bringing in near-billion or billion-dollar scale science construction projects on schedule and on budget.

NSLS-II will be the synchrotron counterpart on the East Coast to our linear accelerator or linac light source on the West Coast.

NSLS-II will be one pillar of Brookhaven's future as a National Laboratory. Another will be the Center for Functional Nanomaterials (CFN), which is bringing a powerful suite of tools to bear on research in nanoscience, which is likely to be critical in our efforts to address our energy challenges in the years ahead--not least because of its contributions to catalysis. Just recently research at CFN announced the discovery of a new catalyst that could eventually lead to ethanol-powered fuel cells, which might be much more practical in the near to medium term than hydrogen-based fuel cells.

And Brookhaven has been host to what still may stand as the physics breakthrough of the decade--the discovery of new form of matter at RHIC in 2005. The surprise of course was that this extremely hot plasma of deconfined quarks and gluons behaved not as a gas, but as a perfect liquid. Recently, I know there has been interest in understanding the strange convergence between the properties of a quark-gluon plasma at 10^{12} Kelvins created at RHIC and ultracold gases of trapped Fermi atoms at 10^{-7} Kelvins. Of course, the latter was the subject of our own Secretary of Energy's Nobel Prize-winning research. This is very exciting physics.

So the DOE Office of Science has every reason to be proud of Brookhaven's many accomplishments to date, and every reason to be anticipating your accomplishments to come.

As I look across our complex and our research programs at both the National Laboratories and universities, I see so much to admire and to be delighted about and proud of. But I'm also aware that like every other Director of this Office, I will have a responsibility to preserve and advance this Office's legacy and to think about the future.

One of the great strengths-- maybe a unique strength--of the Office of Science's research portfolio is its diversification and balance. I like to think of our mission as finding discoveries that change our view of the world or how we live in it. The cross-fertilization between these two approaches has been a key to our progress and our impact. Use-inspired and applied research lives off the intellectual capital accumulated by discovery science. Discovery science is the indispensable wellspring of insight, and has been the ultimate source of major scientific and technological progress through the centuries.

One of the challenges will be to maintain that diversification and balance. This is especially true in a time like the present, when our challenges in mission areas such as energy and climate seem so large and so urgent. The temptation in such an era is to pursue what appear to be near-term fixes on the use-inspired and applied side, when the real solutions to our problems are likely to come from transformational discoveries in the basic realm.

In an era like the present, I believe it is intrinsically easier to define a path forward for more use-inspired research designed to address our mission challenges in areas such as energy and climate. In a certain sense, the mission definition comes from without, from the problems that confront us in the real world. In the case high energy and nuclear physics, there is a more of a looking within. I believe in both fields there will need to be some deep thinking about next steps--about where the most productive paths of discovery are destined to lie. There are in a sense almost too many options, and our resources, even under today's growing budgets for science, will always be finite.

Is there an energy frontier beyond the Large Hadron Collider at CERN that will yield discovery and that can be reached with the resources we have at our disposal? Is there an expanded role for America to play in neutrino science? What role will space play in a future U.S. high energy physics program? Nuclear physics has embarked on the development of a very promising new facility, with the conclusion of our Cooperative Agreement with Michigan State University for the Facility for Rare Isotope Beams. But what lies beyond RHIC and CEBAF (Continuous Electron Beam Accelerator Facility) and the 12 GeV Upgrade at JLAB (Thomas Jefferson National Accelerator Facility)?

We need to be thinking these questions through now and formulating answers that are compelling both to ourselves and to the stakeholders on whom we depend for support.

With the establishment of 46 new Energy Frontier Research Centers (EFRCs) at universities and national laboratories across the country, we are accelerating the very fundamental research that will be needed to provide the breakthroughs essential to revolutionizing our energy economy, reducing our dependence on imported oil, and cutting carbon dioxide emissions. And the Energy Innovation Hubs proposed in the President's FY 2010 Budget Request will bring further strategic resources to bear on our energy and climate problems.

Our strategy has been to magnify and accelerate our efforts through integration--by forging integrated, multidisciplinary scientific groups and teams that each add up to a whole that is more than the sum of its parts. And we have also sought to inspire and mobilize our communities in this great national effort. The response--whether one speaks of the BRCs or the EFRCs--in terms of excitement, energy, and commitment on the part of the scientific community and of researchers--has been overwhelming.

This is a great era for American science. Perhaps never has our nation had more need for the solutions that science can supply. And never have the tools of scientific discovery been so powerful and the possibilities of discovery been so manifold. I feel privileged to be a part of this effort, and I very much look forward to working with you in the years ahead.

Thank you.