Oak Ridge: Science making history

By: D. Ray Smith | Historically Speaking | The Oak Ridger | January 23, 2007

This column will lay the groundwork for the idea of “science making history” in Oak Ridge and the impact we are having on the entire world.

I am convinced that the average citizen of Oak Ridge fails to realize the tremendous world-wide potential impact of many of the things that are considered routine by local Department of Energy officials, contractors and city government officials. We are unique in the world. We are so involved in world affairs and I am afraid that most of us fail to appreciate the full significance of that. So, this column and the following two Historically Speaking columns will be dedicated to increasing our awareness of the world-wide impact of many of the programs at Oak Ridge.

The Spallation Neutron Source, in Oak Ridge, the world’s best neutron science machines

On Friday, Nov. 24, 2006, The Oak Ridger carried a story on the front page explaining that China and University of Tennessee/Oak Ridge researchers will share pollution insights. Here we were told of a recently signed scientific pact that will establish the China-U.S. Joint Research Center for Ecosystem and Environmental Change. This pact will bring together scientists and resources from UT, ORNL and the Chinese Academy of Sciences.

The primary purpose of the collaboration is to help China avoid making mistakes while growing their economy. This is truly a laudable endeavor and certainly holds the potential for worldwide impact. China also recently announced it is seeking a major role in particle physics with a story on Dec. 5, 2006 in The New York Times where it was reported that next fall, the Beijing collider, which is shut down for a major upgrade, will be reborn with the ability to produce 100 times as many collisions it did before.

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And then there is the world wide competition for the International Linear Collider, or I.L.C. The world's physicists have already determined that it will be the “Next Big Thing,” but how many billions it will cost and where it will be built have yet to be decided. Will Oak Ridge enter in that competition? Only time will tell. We are certainly among the world's top centers for scientific research.

The joint China-U.S. research center is but the latest in an astounding series of such events originating and emanating from Oak Ridge with potential for worldwide impact. The Spallation Neutron Source is the most visible development, and arguably the one currently holding the most potential for improving our world (however, many Oak Ridgers have yet to actually see it!).

Yet another ORNL collaboration is with South Korea, where the Korea Atomic Energy Research Institute will work jointly with ORNL to examine technologies for peaceful use of nuclear energy. And there are many more. In all the collaborative efforts, all the parties together are able to produce more results than could be done working separately.

And finally, what about that great collaboration with Oak Ridge High School students and ORNL scientist Dr. Nagiza Samatova that resulted in Scott Horton, Steven Arcangeli and Scott Molony winning what their teacher, Dr. Benita Albert calls “the Nobel Prize for High School,” and Samatova winning $800,000 to continue the work. The whole range, from three students, a teacher and a scientist to China, the country with the largest population in the world — Oak Ridge science is making history!

Other examples of current “science making history” in Oak Ridge are (not listed in any specific order):

1. Supercomputing — ORNL, already ranked 10th in the world, has plans with Cray to build the world's most powerful supercomputer for open (non-classified) scientific research.

2. Center for Nanophase Materials Sciences — a collaborative nanoscience user research facility for the synthesis, characterization, theory/ modeling/ simulation, and design of nanoscale materials. One of five such centers in the Department of Energy.

3. Science and Technology Park near ORNL — “Having a science and technology park enables a stronger partnership between the commercial sector and the laboratory. The close proximity will, ideally, make it easier for technology coming out of the laboratory to be commercialized at a much faster pace. The park also facilitates the private sector's ability to invest in a partnership with the laboratory to solve problems with ORNL's world-class scientific capabilities. The new park is the latest component of a multifaceted tech transfer agenda at the laboratory, and, I think, is a great idea,” said Gerald Boyd.

4. Joint Institute for Biological Sciences — Biophysics is the science of explaining how physical principles drive life's processes. British-born Jeremy Smith, first UT/ORNL Governor's Chair appointee, will pursue his research interests involving understanding biological molecules such as proteins using computer simulation and neutron-scattering experiments. Such is the world-wide nature of planned experiments at this world class joint institute.

5. Joint Institute for Neutron Sciences — This facility will enhance the utility of the Spallation Neutron Source and ORNL's High Flux Isotope Reactor by providing meeting facilities, offices, laboratories, a communication center, and housing for scientists and engineers from universities, industries, and the international community. It will also be a focus for expanding neutron science research and development with the University of Tennessee, other regional universities, and industrial collaborators. It will serve as an interface and economic-development gateway for outside access to ORNL facilities. The goal of this institute is to support the restoration of U.S. leadership in neutron science!

6. Global Nuclear Energy Partnership (GNEP) is a key strategy element in our country's planning toward a resurgence of nuclear power reactors while moving away from a once-through fuel cycle to a recycling of spent nuclear fuel. The Department of Energy has issued two requests for expressions of Interest from

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domestic and international industry regarding the feasibility of accelerating the development and deployment of the commercial-scale Consolidated Fuel Treatment Center and an Advanced Fast Reactor. These projects reduce spent fuel inventories and recycle valuable energy resources, contributing to stable, economical supplies of uranium and cost-effective electricity for the U.S. consumer. Oak Ridge is competing for the location of at least one of these and there is a chance the projects will be co-located.

7. Generation IV — nuclear reactor technologies that could be deployed by 2030 and present significant improvements in economics, safety and reliability and sustainability. Oak Ridge had the first production scale nuclear reactor, the Graphite Reactor, now a national landmark on the historic register, created the Nuclear Reactor School for the Navy, has the High Flux Isotope Reactor, and has had a Molten Salt Reactor (one of the six technologies identified in the technology road map to achieve Gen IV reactors). Oak Ridge has substantial potential for involvement here.

8. ITER (The term first stood for International Thermonuclear Experimental Reactor before that name was dropped and only the “ITER” designation retained) is an international project to design and build an experimental fusion reactor based on the "Tokamak" concept — a magnetically confined fusion reactor. “Iter” also means “the journey” or “the path” in Latin. This project is the world's third most expensive at $12.1 billion after the Manhattan Project and the International Space Station. To be located in Cadarache, France, the ITER is not an end product but a bridge to a future fusion reactor that would produce electricity on a large scale using fusion energy. It is scheduled for completion in 2016 and will have a 20 year operational life span. Oak Ridge is among the many international partners working on fusion energy collaboration that is producing ITER.

9. Biofuels — ORNL has identified switch grass as the model plant species for fuel, better than corn, which is all the rage right now as the prime ingredient of ethanol. Of course the experiment the “Oak Ridge Boys” worked on to win the Siemens competition may well help advance this area of research.

10. Nuclear power plants — After a much-too-long hiatus, nuclear power plants are now coming back. As of 2006, new nuclear power plants are under construction in several countries. In the United States, the first plans since the 1970s are being developed for construction of new nuclear power plants. Oak Ridge experience will be valuable as nuclear power again comes in vogue.

11. American Centrifuge program — United States Enrichment Corporation is building centrifuges intended to replace the gaseous diffusion process for enriching uranium for nuclear power plants. Demonstration and manufacturing of centrifuges is taking place in Oak Ridge at the East Tennessee Technology Park. Soon a production facility will be built on the site of the shutdown Portsmouth Gaseous Diffusion Plant near Piketon, Ohio.

12. Treating out-of-state nuclear waste — In an Associated Press article on Tuesday, Nov. 21, 2006, DOE Oak Ridge Operation's Steve McCracken stated that wastes could be shipped from other federal sites to Oak Ridge for processing in the years ahead. Ultimately, the material to be processed at Oak Ridge will be placed in protective casks and shipped to the underground repository at the Waste Isolation Pilot Plant near Carlsbad, N.M.

13. Uranium Center of Excellence — The Y-12 National Security Complex has been designated the nation's key uranium facility for storing, processing and manufacturing weapons parts to maintain the nations nuclear deterrent.

14. Precision machining and inspection — Y-12's National Prototype Center serves the nation through processing unusual and exotic materials that cannot be done elsewhere — truly the nation's premiere precision machining capability.

15. Modern facilities — New facilities are being constructed at ORNL, SNS, Y-12, ORAU and others.

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16. Nuclear nonproliferation — On a global scale, many activities to limit the spread of nuclear weapons material originate in Oak Ridge. Just recently the largest-ever moves of former Soviet Union weapons grade uranium was accomplished by Oak Ridge National Laboratory personnel.

17. Naval Reactors Fuel supply — Oak Ridge is uniquely able to provide highly enriched uranium for these reactors, powering the Nuclear Navy, a vital element of our nation's defense.

18. Fuel for Canadian nuclear reactors — Y-12 supplies fuel for Canadian nuclear reactors as well as for the Tennessee Valley Authority's nuclear reactors.

19. Y-12 Security — Recognized as best in one of the highest security locations in the world.

20. NNSA and NASA collaboration on Jupiter Icy Moon Orbiter and other space projects at Y-12
As an example of the world impacting items listed above, the following computer link contains an excellent movie introducing the Spallation Neutron Source:
http://www.sns.gov/multimedia/intro_2006.shtml.

All Oak Ridgers should view the above movie to better appreciate the significance of the world-changing impact of these experiments and projects going on in our community. Another way to see the movie and learn about the SNS is to visit the new exhibit in the American Museum of Science and Energy.

We should all be justifiably proud of the past historic accomplishments and of the future history-making events yet to be realized in Oak Ridge — a small town in East Tennessee where science keeps on making history!
Next week we will summarize what the above 20 world- impacting items mean to Oak Ridge.