

HOTLINE

The Princeton Plasma Physics Laboratory is a United States Department of Energy Facility

\$12.5 Million Awarded in NCSX Subcontracts



PPPL Director Rob Goldston (center) signs the subcontracts for the NCSX components fabrication. Joining Goldston at the signing table are NCSX Project Head Hutch Neilson (right) and NCSX Deputy Project Head for Engineering Phil Heitzenroeder.

PPPL has awarded two subcontracts for the fabrication of major components for the National Compact Stellarator Experiment (NCSX), now under construction at the Laboratory. NCSX will explore the physics of an innovative concept for fusion energy production and will advance the understanding of the related basic science. PPPL is building the new experiment in partnership with the USDOE's Oak Ridge National Laboratory (ORNL).

A team led by Energy Industries of Ohio, Inc., of Independence, Ohio, has been selected to manufacture the winding forms upon which unique, modular electromagnetic coils will be mounted. Team members include the C.A. Lawton Company, Pattern Division, of DePerre, Wis.; MetalTek International, Carondelet Division, of Pevely, Mo.; and Major Tool and Machine, Inc., of Indianapolis, Ind. In addition to being part of the winding form team, Major Tool and Machine was awarded a subcontract to manufacture the NCSX vacuum chamber. These components will form the heart of NCSX, which will use a magnetic field

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PPPL's Fisch Named E.O. Lawrence Award Recipient

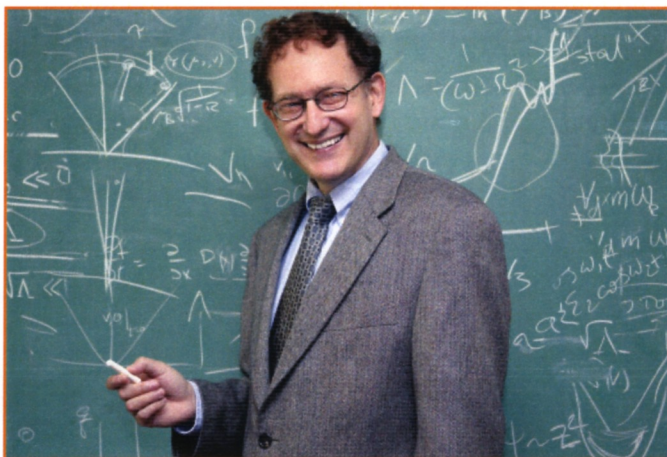
PPPL's Nathaniel Fisch is among seven winners of the 2004 E.O. Lawrence Award. Each winner receives a gold medal, a citation, and \$50,000. The award is given in categories for outstanding contributions in the field of atomic energy, broadly defined.

"We are all enriched by the contributions these researchers have made ranging from engines with no moving parts to better ways to see the stars," said Energy Secretary Spencer Abraham. "These awards, and the research for which they are given, show that DOE could easily be called the Department of Science and Energy." Secretary Abraham announced the recipients in September. The Lawrence Awards will be presented at a ceremony in Washington, D.C., on November 8.

Fisch is receiving the award in the nuclear technology category for his discovery of ways to use plasma waves to produce electric current. These wave-induced currents can enable tokamaks to operate continuously, which is necessary for an economical and practical fusion reactor.

Fisch specializes in theoretical plasma physics with applications to controlled nuclear fusion, plasma devices, lasers, and astrophysics. At Princeton University, Fisch

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Nathaniel Fisch

to confine a plasma fuel. The modular electromagnets will help shape the magnetic field confining the NCSX plasma within the vacuum chamber.

"These are the most challenging and critical components of NCSX, and we are delighted to award these contracts to such superbly qualified industrial subcontractors," said PPPL Director Robert J. Goldston. The key innovative feature of NCSX is its complex shape, designed through advanced computer simulations, that is predicted to be able to support a high-efficiency, fully steady-state fusion system. The complex shape makes construction of its components especially challenging.

Energy Industries' contract is valued at approximately \$8 million and Major Tool's at approximately \$4.5 million. Funded entirely by the USDOE's Office of Science, the construction of NCSX will cost an estimated \$86.3 million. It is scheduled to begin operation in 2008.

NCSX's modular coils are among the most complex, innovative electromagnets ever designed. The 18 winding forms will consist of non-magnetic stainless steel castings with the winding surfaces machined to a tolerance of plus or minus 0.020 inch. The largest will be 110 inches tall. Each will weigh approximately 6,000 pounds. The winding forms will provide the backbone of the modular coil system and will be strong enough to support electromagnetic loads in the range of 7,000 pounds per inch. Energy Industries will manufacture six identical sets, each comprised of three types of intri-

cately shaped forms. Delivery of the first winding form is expected in May, 2005. PPPL engineers will then wind layers of insulated copper conductor around the forms to create the modular coils.

The 25,000-pound NCSX vacuum vessel resembles a twisted doughnut. It will be made of Inconel 625, an alloy that is hard to form, but has high electrical resistivity that will suppress electrical currents that might interfere with plasma confinement. The vessel will be press formed with

0.375-inch walls and have an overall profile tolerance of plus or minus 0.188 inch. It will be fabricated in three identical segments, which will be welded together end-to-end at PPPL during final assembly. The subcontract also includes fabrication of the 90 vacuum vessel ports that will provide plasma heating and diagnostic access. Major Tool will deliver the vessel in the fall of 2005.

The NCSX will create a plasma that is more complex than traditional stellarators, including those now operational in Europe and Japan. NCSX will combine the best features of the traditional stel-

larator with those of the tokamak. The smaller size may lead to a more economical fusion power plant.

The Helically Symmetric eXperiment (HSX) at the University of Wisconsin, Madison, is the only existing stellarator in the U.S. Foreign experiments include the Large Helical Device in Japan and the Wendelstein 7-AS in Germany. The Wendelstein 7X is now under construction in Germany as well. ●



The NCSX vacuum vessel.

UNITED WAY CAMPAIGN AT PPPL — Mark Your Calendars! The PPPL 2004 United Way Campaign meeting for all staff is scheduled for Wednesday, December 8, at 10:30 a.m. in the Auditorium. The event will include a presentation, refreshments, and raffle prizes. The campaign theme this year is, "What Matters." ●

Hotline

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The HOTLINE is issued by the Princeton Plasma Physics Laboratory, a research facility supported by the United States Department of Energy. It is primarily an internal publication. Correspondence and requests to reprint material should be directed to the Editor, PPPL HOTLINE, P.O. Box 451, Princeton, NJ 08543; Interoffice correspondence should be addressed to MS-38, LSB Bldg., C-Site; fax 609-243-2751; telephone 609-243-2757; e-mail pwieser@pppl.gov.

is Professor of Astrophysical Sciences and Director of the Program in Plasma Physics. He also is an Associated Faculty member in the Department of Mechanical and Aerospace Engineering. At PPPL, he is Associate Director for Academic Affairs and Head of the Laboratory's Hall Thruster Experiment.

Pointing to the continuing impact of Fisch's ideas, PPPL Director Rob Goldston said, "Professor Fisch's analyses of techniques to use radio waves to drive electrical currents in plasmas are as elegant and insightful as they are practical. His theoretical work, and close collaboration with the experimental team on the Princeton Large Torus, opened the way for a wide range of experiments and further analyses, and led to a substantial field of research on current-drive in toroidal plasmas. Indeed, sustainment of currents using radio waves may prove to be an essential ingredient in the steady-state operation of fusion power systems." The Princeton Large Torus was an experimental fusion device at PPPL.

Scott Tremaine, Chair of Princeton University's Astrophysical Sciences Department, praised Fisch for his influential role in shaping graduate education in plasma physics.

"For over a decade, Nat has headed the Program in Plasma Physics at Princeton University, which is widely recognized as one of the world's premier graduate programs in plasma physics. Under Nat's guidance, Princeton has trained the generation of extremely talented young researchers who may

transform the dream of controlled fusion energy to reality. Nat is committed to the concept that both universities and national laboratories benefit from close cooperation in research and education in plasma physics," said Tremaine.

Fisch studied electrical engineering and computer science at the Massachusetts Institute of Technology, receiving a B.S. in 1972, an M.S. in 1975, and a Ph.D. in 1978. Fisch is a Fellow of the American Physical Society (APS). He received a Guggenheim Fellowship in 1985, the 1992 APS Award for Excellence in Plasma Physics, and a Department of Energy Bronze Medal for Outstanding Mentor 2002. Fisch is the author or co-author of more than 200 research papers and has been granted nine U.S. patents.

The other winners of this year's Lawrence Award are: Bette Korber, Los Alamos National Laboratory (LANL), Los Alamos, N.M.; Claire Max, University of California, Santa Cruz, and Lawrence Livermore National Laboratory (LLNL), Livermore, Calif.; Fred Mortensen, LANL; Richard J. Saykally, University of California, Berkeley, and Lawrence Berkeley National Laboratory; Ivan Schuller, University of California, San Diego; and, Gregory W. Swift, LANL. Additional information on the winners and their work is available on the web at www.sc.doe.gov.

The Lawrence Award was established in 1959 to honor the memory of the late Dr. Ernest Orlando Lawrence, who invented the cyclotron (a particle accelerator) and after whom two major Energy Department laboratories in Berkeley and Livermore, Calif., are named. The Secretary of Energy makes the final selection of honorees each year. ●

Von Halle Takes Fusion Show to Trenton High



On September 30, PPPL engineer Alvon Halle introduced the topic of fusion and plasmas to a total of about 50 students at Trenton High School. Above is von Halle with a group of the students following the classroom presentation.

America Recycles Day Events Scheduled

Save the Dates — America Recycles Day at PPPL

- **Brown-bag Lunch** — "Reducing Your Energy Consumption at Home" — Wednesday, November 3, MBG Auditorium. Presentation by Tom McGeachen.
- **Lab-wide Office Clean Up** — November 22-24.
- **America Recycles Day Celebration** — Friday, December 3 — MBG Auditorium — "How All PPPL'ers Can Reduce Energy Usage and Trash Generation, Save the Lab \$\$\$\$ and Prevent Pollution," featuring the renowned Chef RE and ChefCYCLE.

In the meantime, pledge to become a better recycler before November 15 and you could win a new Ford Escape Hybrid (children 18 and under could win a mountain bike). Make your pledge at the America Recycles Day 2004 web site at <http://www.americarecyclesday.org/home.html>.

REDUCE, REUSE, RECYCLE & BUY RECYCLED



Name: Ed Synakowski

Position: Deputy Program Director on the National Spherical Torus Experiment (NSTX), with responsibility for the near-term research program. Prior to assuming these duties, he was a spectroscopist on PPPL's Tokamak Fusion Test Reactor (TFTR). He also has collaborated on the DIII-D experiment at General Atomics in San Diego.

Quote: "The die was cast and I knew that science would be in my future when as a fifth-grader I figured out — using a year-old world almanac — where Saturn ought to be in the evening sky. Seeing the rings through my own telescope indelibly impressed upon me that the world is accessible and understandable, and not just something to read about."

Almost two decades later, when I came to PPPL, I found working on TFTR to be an intense and wonderful scientific and personal experience. In some ways, the same powerful feeling of realizing that the world is understandable was re-experienced time and again there for me. The TFTR plasma gave up a few of its secrets as we joined forces with our theorists and pursued some experimental surprises with that fabulously capable device. Now, I am representing and working with the NSTX research team in various forums, and it is a great privilege. It gives me a special opportunity to learn about a very broad spectrum of issues from this remarkably talented group.

My career has given me some wonderful surprises outside of research, including lasting friendships that began 25 years ago when I was an undergrad working in a plasma spectroscopy lab at Johns Hopkins University."

Other interests: "I love playing trombone in several ensembles and groups. Dixie is a hoot, as is a brass quintet and a new British brass band with whom I rehearse. No matter how hard I work on getting the best brass sound possible out of my prized handmade trombone, by far the most applause at a charity dixie gig comes when I stuff the trombone bell with a two-dollar plunger and play the blues.

Bicycling the hills helps clear my head, too, as does not-too-speedy speed skating. My newest hobby is scuba diving. When doing that, I can't be pinged with e-mail. I am excited that I recently became a bona fide certified open water diver, encouraged by my wonderful gal, Ellen. I have the pleasure of spending lots of time with her and her two children, Audrey and Byron, and they seem to like magnets a lot, too." ●

Site Protection Group Exhibits Fire Prevention Materials

In observance of Fire Prevention Week, PPPL's Site Protection Division staff displayed emergency response equipment and handed out fire prevention materials in the LSB Lobby on October 7. The week's theme, "It's Fire Prevention Week: Test Your Smoke Alarms," highlighted the importance of all families installing and maintaining smoke alarms in the home. At the display are, from left, Mike Scafiro, Howard Caruso, Chris Snyder, and Dave Neuman. ●

