

THIS WEEK

JUNE 4-8
**IEEE Symposium on Fusion
Engineering (SOFE)**
Shanghai

WEDNESDAY, JUNE 7
Colloquium

4:15 p.m. ♦ MBG Auditorium

**Data-driven discovery of
dynamical systems in engineering,
physical and biological sciences**

Nathan Kutz, University of Washington

UPCOMING


MONDAY, JUNE 12
SULI & CCI students arrive
JUNE 12-16
SULI one-week course
MBG Auditorium

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27th IEEE Symposium on Fusion Engineering in Shanghai begins

PPPL's Neilson and others played major role organizing event

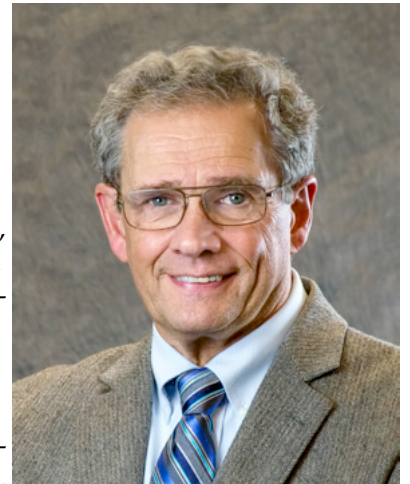
By Jeanne Jackson DeVoe

When the 27th IEEE Symposium on Fusion Engineering (SOFE) begins a four-day conference today in Shanghai, more than 7,000 miles from here, conference goers will have Hutch Neilson and a team of PPPLers to thank for playing a major role in making it happen.

Neilson, the head of Advanced Projects and the head of ITER Fabrication at PPPL, is the chair of the event, which will bring hundreds of engineers and physicists from around the world to Shanghai. Neilson is also the impetus behind moving the conference outside the United States for the biennial event for the first time since 1965.

"I'm very excited," Neilson said. "It's one of the most exciting things I've done. The conference promotes fusion and supports fusion engineering, and it promotes international cooperation. I think this has become an increasingly important conference on the fusion calendar."

Neilson said he pushed for the move to China in part because the Institute of Electrical and Electronics Engineers (IEEE) encouraged conference organizers to move to an international venue, and Neilson had collaborated with Chinese scientists at the Chinese Academy of Science's Institute of Plasma Physics, which co-sponsored the conference. "I thought China was a good choice because we've had growing attendance from China for the last several meetings and we know the fusion program in China is growing rapidly, and there is just a lot of excitement from China," he said.


 Hutch Neilson
(Photo by Elle Starkman)

More than 400 registered

"It's a big job and we set ambitious goals for this conference," Neilson said. Organizers reached the goal of more than 400 registrants with 408 registered for the conference and 500 papers being presented by engineers and physicists from fusion experiments all over the world, including several PPPLers. Among the featured talks is an "NSTX-U

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NSTX-U Recovery Project external committee completes second review

By Jeanne Jackson DeVoe

The National Spherical Torus Experiment-Upgrade (NSTX-U) Recovery Project is poised to begin developing cost and schedule estimates for improvements to the NSTX-U after an external committee completed a second review of major systems of the experiment aimed at ensuring that the experiment operates reliably.

The Extent of Condition (EOC) panel's review of PPPL's examination of seven major systems of the experiment will be part of a detailed corrective action plan PPPL must submit to the U.S. Department of Energy (DOE) by the end of September.

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Trivia and inspiration at PPPL's Invention Discovery Day

By Jeanne Jackson DeVoe

What popular product was invented by The Monkees' Mike Nesbith's mom?

What was the subject of the first patent in the U.S. and when was it issued?

What PPPL inventor has the most patents in the last 10 years?

(Answers at end of story)

Those were a few of the trivia questions at PPPL's first Invention Discovery Day on May 23, which also offered snacks, raffle prizes, information about the patent process, and a dose of inspiration for would-be inventors from three current inventors.

"It's hard work and with all the time you spend putting together inventions, we want you to know that we are here to help you and we encourage you to think about the process," said Laurie Bagley, head of Technology Transfer and Publications, who organized the event.

Bagley said she encourages everyone at PPPL with an idea for an invention to come talk to her even if the idea is not related to his or her work or PPPL's mission. That was the case with Kevin Lamb, an electronics technician, who has two patents pending with Princeton University and is working on a third.

Starting on a whiteboard

Lamb said he was inspired to invent a drone detection system that can pinpoint the location of the drone pilot after he saw a news story about a drone landing on the White House lawn. "I started on a very small white board just jotting down my ideas and pretty soon I needed a larger whiteboard," he said. "I then transferred it to an invention disclosure." He came up with a second invention to identify aggressive or distracted drivers on the road when he noticed an increase in the number of people texting as they drove. "I went back to the whiteboard plotting it out and a year and a half later, I attended a summit on autonomous vehicles."



Kevin Lamb talks about his inventions. *(Photo by Elle Starkman)*

The experience has been very satisfying, Lamb said. "It's an amazing feeling to put on your resume that you have these patents pending," he said. "I hope some of you can do it as well!"

PPPL has some two dozen inventors on staff. Nat Fisch tops the list for the number of inventions with 68, Sam Cohen has 21, Yevgeny Raitses has 18, Charles Gentile has 18, and Richard Majeski has 15.

Starts with a unique idea

The patent process starts with an idea for an invention that is unique and solves a significant problem with possible commercial value, Bagley said. When inventors file an invention



Laurie Bagley, head of Technology Transfer and Publications, discusses inventions at Invention Discovery Day. *(Photo by Elle Starkman)*



Charles Gentile discusses his inventions as fellow inventors Alexandros Gerakis, left, and Kevin Lamb look on. *(Photo by Elle Starkman)*

disclosure, they protect their inventions, which are treated as a trade secret forever or until 18 months after a patent application, Bagley explained.

The three things that must be true for an invention to be patentable are what Bagley calls the N-U-N factors. The invention must be novel, useful, and non-obvious to one skilled in the art.

The timeline from the time an invention disclosure is filed to receiving a patent is three years and it is expensive – it can cost from \$1,000 to \$100,000, Bagley said. But PPPL works with Princeton University to subsidize inventions Princeton considers promising. The patent protects the invention for 20 years from the time of the invention disclosure.

Licensing to companies

Patented inventions can be licensed to companies, which can lead to royalty income. Three inventions that have been licensed at PPPL are Chris Brunkhorst's device to pasteurize eggs using radio frequency waves; Sam Cohen's Princeton field-reversed configuration (PFRC) fusion engine; and the Miniature Integrated Nuclear Detection System (MINDS), by Charlie Gentile, Kenny Silber, and Bill Davis, which detects nuclear materials that could be used in a weapon.

Charles Gentile discussed two of his inventions, the MINDS device and his technique to produce Technetium-99m, the

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Invention Discovery Day

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radio isotope used in two-thirds of nuclear medical diagnostic procedures. “We have plans for other things we might be able to do but right now Technitium-99m looks like it could have a big impact all over the world, especially in third world countries,” Gentile said.

Another inventor in the program, Alexandros Gerakis, said many of his inventions are technologies that help him with his research working with lasers. But one of his inventions outside his research is based on a simple concept: an anti-fogging apparatus for diving or gaming headsets. “I’m a big fan of simple solutions,” Gerakis said. “I’m not always going for the extremely high-tech suitcase.”

Bagley showed a [Tedx talk by Kavita Shukla](#), who received a patent at age 17 for a patent on a product called “FreshPaper,” sheets of paper that keep fruits and vegetables fresh. She treats the paper with an organic tea-based solution based on her Indian grandmothers medicinal spice tea. A decade after receiving the patent, she and a friend founded Fenugreen, and the company has been growing ever since.

Encouraging entrepreneurship

Simple ideas like Shukla’s show that anyone can become an inventor, Bagley said. And Princeton University is

promoting entrepreneurship. “The University is encouraging us to think about becoming entrepreneurs,” Bagley said. “The University’s Technology Licensing office’s mission is to be flexible in drafting agreements to make technology transfer successful.”

Lamb also urged PPPLers to turn their ideas into inventions. “Sometimes you have to put in your own blood, sweat, and tears, but in the long run we all hope it pays off,” he said.

Aileen Pritch, Elle Starkman, Jeanne Jackson DeVoe, Kyle Palmer, Tawana Lewis, and the MINDS team helped organize the program.

[A copy of Bagley’s presentation is available here.](#)

Answers to trivia questions:

Bette Nesmith Graham, a painter and office worker, invented Liquid Paper in 1956.

The subject of the first patent was the process for making potash, the ingredient used in fertilizer. It was issued in 1790 and signed by George Washington.

Charlie Gentile has had the most patented inventions at PPPL in the last 10 years. 📌



A collage of PPPLers having some fun with an Einstein cut-out. (Collage by Elle Starkman)

SOFE begins

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Progress Overview,” by Rajesh Maingi, head of International research and Boundary Physics Coordinator at PPPL. Scott Weidner, the Princeton University assistant vice president of engineering for PPPL, will present a talk on “Non-Fusion Space Projects.”

PPPL has played a central role in many IEEE conferences in the conference’s 52-year history. It led the organization of the conference in Princeton in 1973, Philadelphia in 1982, Atlantic City in 2002, and Chicago in 2011.

Neilson and his fellow organizers have been planning for the conference for the past several months. Due to the 12-hour time difference, Neilson and PPPL administrators Kathleen Lukazik, the registration chair, and Pamela Serai, the publications assistant, often sat in on conference calls with Chinese organizers at 9 or 10 p.m.

Lukazik also worked with exhibitors while continuing to support PPPL’s ITER Fabrication Department. “It’s been very busy because my regular ITER job didn’t go away while all this was going on,” Lukazik said. But, she added, “I’m very excited.”

In addition to the usual exhibitor booths, there are advertising pages in the program for the first time. “It’s going to be really interesting to see how it all plays out with the international collaboration but I feel pretty confident that we have a lot of bases covered,” Serai said. “From what I understand, there is a record number of people attending and a record number of abstract submissions, so we might be setting some new milestones.”

Fusion Technology Award

Charles Neumeyer, the deputy head of engineering and engineering director for the NSTX-U Recovery Project at PPPL, also helped plan the conference. He was the finance chair for the event and chairs the Fusion Technology Standing Committee, which helped organize the event. The committee recognizes outstanding fusion engineers with the annual Fusion Technology Award (awarded to PPPL’s Chuck Kessel in 2015) and the outstanding Student Paper Award.

The conference also offered travel grants for 12 students to attend the conference.

“SOFE conferences are a great gathering of the U.S. fusion community and they provide a great way to share ideas and simply connect on both a personal and professional level,” Neumeyer said. “I’ve always found it to be very beneficial.”

Other PPPL staff who were essential to organizing the conference include Chris Cane, manager of digital strategy and visual communication, who is the webmaster for the conference and created [the SOFE website](#).

PPPL engineer Doug Loesser was chair of Women in Engineering. He helped organize the Women in Engineering reception on June 5. The reception will feature a talk by Jing Dong, associate professor in the National Laboratory of Pattern Recognition in the Chinese Academy of Sciences.

The conference will feature a banquet where the fusion awards will be awarded. Conference goers can also take tours of Shanghai, Tongli, and Hangzhou.

An early start for organizers

Neilson, Lukazik and Serai were scheduled to arrive at the SOFE conference by last Friday afternoon to spend the weekend setting up. They planned to be up at dawn to go over the days events. Lukazik and Serai will staff the registration table, which Lukazik calls “ground zero” of the event since that is where conference goers go for all their information.

The conference also offers mini courses the day before the official start on Sunday, June 4. One of the two courses is on plasma diagnostics and was organized by PPPL physicists Robert Kaita and Brent Stratton. Kaita and Bob Ellis will teach the course. The other course is on plasma-material interactions: fundamentals and applications and was organized by Daniel Andruczyk and Davide Curreli, of the University of Illinois.

There will be presentations by PPPL physicists and engineers on each day of the conference with talks by Chuck Kessel, Bob Kaita, Bob Ellis, Charles Neumeyer, Russ Feder, Luis Delgado-Aparicio, Mario Podesta, Joseph Petrella, Andrei Khodak, and Yuhu Zhai.

Several other PPPLers are presenting posters. They include Soha Aslam, who is the only female engineer and one of the few early-career staff members attending. Aslam is presenting a poster on project management, which she put together with her supervisor, Tim Stevenson, who encouraged her to attend. She also helped prepare the slideshow for the Women in Engineering reception. “I think it will be a very bonding experience because a lot of people who are really passionate about the field and excel in the field come together,” Aslam said. “That’s a good network to know.” 🍷

Thank you to blood donors for making blood drive a success

The Blood Drive held on May 25 was a BIG success. The American Red Cross reported that we had 22 participants and 21 productive units. This was the best blood drive PPPL has had in two years!

Mark your calendars: the Fall Blood Drive is scheduled for Friday, October 6, 2017.

Thank you to those who donated.

—American Red Cross, Occupational Medicine Office and Human Resources

Second EOC review

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“Very successful” meeting

“I think it was very successful,” said Rich Hawryluk, the head of the Recovery Project. “I’m very grateful to the committee. It was an absolutely outstanding committee that worked extremely hard and gave us good technical advice. I also want to thank the PPPL engineers who participated in this. They worked exceptionally hard and did a lot of work preparing for this — answering questions and even performing additional analyses during the meeting.”

The Recovery Project began work in the fall after a failed magnet caused the shutdown of the experiment last summer. Engineers analyzed 12 major systems on NSTX-U in design, verification and validation reviews (DVVRs) from January through April that identified any gaps in the design or construction of the NSTX-U that could pose a risk to the machine. The EOC reviewed the first five major systems in its first review in March and the last seven in the May 15 to 18 review. The EOC investigation was done in parallel with an Extent of Cause investigation that is analyzing the underlying processes and policies that may have led to the coil failure. Les Hill, the head of the Extent of Cause investigation, must also submit a report to the DOE by the end of September.

“Progress addressing concerns”

EOC Chairman Tom Todd, former chief of technology at the Culham Centre for Fusion Energy in England, praised the Recovery Team for its work since the first review in March. “It was clear to us that you’ve taken to heart the things we said in our first EOC and you’ve made progress addressing the major concerns that we had,” Todd said at the conclusion of the four-day review. “We know it’s ongoing and there are lots of things to decide.”

The EOC committee, which was made up of external experts from around the world and the U.S., applauded PPPL’s plan to form a machine protection committee. The new committee will analyze the interaction of various systems of NSTX-U and determine whether anything poses a risk to the experiment. The panel said the committee will help PPPL carry out its strong recommendation for the Lab to improve its strategies

and procedures regarding machine protection before startup. The panel also recommended that PPPL update its document management system and bring some regulations in line with state and national requirements. The Extent of Cause committee will also address these issues.

In its second review, the panel focused on three sets of magnets called the poloidal field coils used to shape the plasma. They are nestled against the center stack at the upper and lower poles of the spherical tokamak, and include the PF1A upper coil, which was the coil that failed, and its twin, the PF1A lower, and two smaller sets of coils, the PF1B and PF1C upper and lower coils. They are located adjacent to each other in the upper and lower regions of the experiment, which Todd has dubbed “the polar regions.”

Coils without mandrels

The committee recommended in March that PPPL engineers change the design of the PF1Bs and PF1Cs to remove the mandrel, the metal spool on which the coils are usually wound, in order to make it easier to do turn-to-turn electrical testing of the coils. At its most recent meeting, the committee recommended that the PF1A coils be constructed without a mandrel or with a split mandrel for the same purpose. This means engineers will have to redesign the PF1A coils. PPPL will construct the coils after the design is completed.

The magnets remained a major focus in the second review because the recommended design changes will affect other components. They will also have to be considered in the bakeout process in which the vacuum vessel is heated to high temperatures in order to eliminate impurities and keep the machine running efficiently.

The PF1B coils, in particular, posed a potential problem during bakeout when NSTX-U was operating. The vacuum vessel’s inner tiles are supposed to be heated to 350 degrees Centigrade during the bakeout. But the PF1B coils were located close enough to the inboard divertor that they could be damaged by the heat.

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Members of the Extent of Condition committee at PPPL, from left: Brian LaBombard, of MIT’s Plasma Science and Fusion Center; Rich Callis, of General Atomics; Ron Parker, emeritus professor at MIT’s Plasma Science and fusion Center; Heinrich Boenig, Los Alamos National Laboratory; Tom Todd, chairman of the committee; Michel Huguet, former head of ITER magnets; Josh King, program manager for Spherical Tokamak, U.S. Department of Energy’s Office of Fusion Energy Sciences, who attended but is not an EOC committee member; Dennis Youchison, of Oak Ridge National Laboratory; Rem Haange, former ITER technical director; Matt Lanctot, program manager for Long Pulse Tokamak Research Division, DOE’s Office of Fusion Energy Sciences, who attended but is not an EOC member; and Arnie Kellman, of General Atomics. (Photo by Elle Starkman)

Second EOC review

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The panel reaffirmed its earlier recommendation to replace all three sets of coils with new coils since they were manufactured identically to the failed PF1A coil. The second EOC committee said that the PF1B coil, in particular, “is essential” to protect the divertor by spreading the strike point of the plasma over a larger area. They noted, however, that having PF1B operational is not required for the initial operation of NSTX-U. The panel also recommended that nearby tiles be arranged in an overlapping pattern called “fish scaling” to better handle the high fluxes.

Recommendations affect bakeout

The ability to heat the vacuum vessel to 350 degrees Centigrade during bakeouts may also be affected by another recommendation by the committee in March: the elimination of coaxial helicity injection (CHI). CHI is a non-inductive method of heating the machine that creates a plasma without a central magnet or solenoid. The committee recommended that CHI be deferred based on its finding that certain design features supporting CHI have been unreliable and could jeopardize the experiment.


Removing one such design feature called the “ceramic break,” which protects NSTX-U components from the direct current used in CHI, would mean eliminating the use of that type of current to heat the machine during bakeouts. The committee recommended the bakeout be accomplished with alternating current from the OH coil in the centerstack. But Todd said the committee recognizes that PPPL engineers will have to analyze whether that option is feasible.

Evaluating motor generator

The panel also recommended that PPPL engineers use a bore-scope to inspect the motor generator that powers the machine, as well as a second motor generator, which has been sidelined due to damaged welds. The panel said that the second generator does not have to be fully repaired before NSTX-U begins operation again if the tests show the first is fully operational.

Other recommendations

- Test the test cell for any “penetrations,” openings that could potentially emit radiation, and fill them in. PPPL has already begun work on assessing penetrations.
- While the committee recognized that the chance of an oxygen deficiency around the test cell is remote, it strongly recommended that the oxygen levels around the test cell be tested as a precaution.
- Several recommendations to replace equipment or spares.

In addition to Todd, committee members were: Dennis Youchison, of Oak Ridge National Laboratory; Brian LaBombard, of MIT’s Plasma Science and Fusion Center; Ron Parker, emeritus professor at MIT’s Plasma Science and Fusion Center; Heinrich Boenig, Los Alamos National Laboratory, retired; Rem Haange, former ITER technical director, retired; Michel Huguette, former head of ITER magnets; Martin Cox, of the Culham Centre for Fusion Energy; David Humphreys, Arnie Kellman, and Rich Callis, of General Atomics. 

COLLOQUIUM

Data-driven discovery of
dynamical systems in engineering,
physical and biological sciences

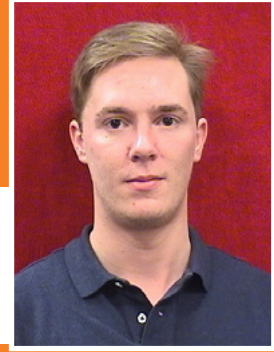
Nathan Kutz
University of Washington

Wednesday, June 7
4:15 p.m., M.B.G. Auditorium, Lyman Spitzer Building

PPPL Welcomes New Employees!



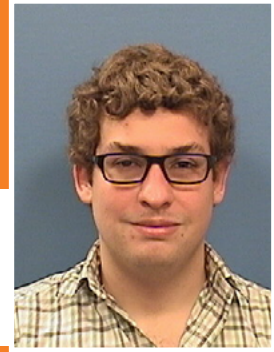
ROBERT BETHKE
Health physics technician
ES&H



MICHAEL COLE
Associate research physicist
Theory



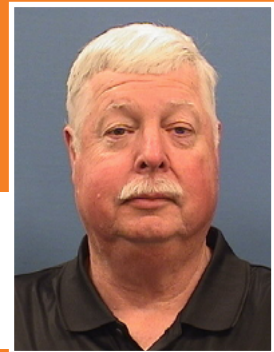
JIARONG FANG
Mechanical analyst, design and
cognizant engineer
Engineering



JONATHAN JARA-ALMONTE
Associate research physicist
Plasma Science & Technology



JESSICA MALO
Quality assurance engineer
Quality Assurance



KENNETH STOCKTON
Senior quality control mechanical/
welding inspector
Quality Assurance

PPPL bids a fond farewell to the following employees:



GEORGE LABIK
Principal engineer
Engineering
34 YEARS



LEWIS MORRIS
Engineering associate
Engineering
37 YEARS



LARRY SUTTON
Senior subcontractor
Business Operations
34 YEARS

Be Safe!

**Pedestrians walk
against the traffic.**

**Cyclists ride
with the traffic.**



PPPL's Transportation Hierarchy

BROCK

NICK PETTI
Chef Manager



BREAKFAST 7 a.m. • 10 a.m.
CONTINENTAL BREAKFAST 10 a.m. • 11:30 a.m.
LUNCH 11:30 a.m. • 1:30 p.m.
SNACK SERVICE until 2:30 p.m.

	Monday June 5	Tuesday June 6	Wednesday June 7	Thursday June 8	Friday June 9
COMMAND PERFORMANCE Chef's Feature	Chicken Cacciatore	BBQ Chicken with Baked Beans and Roasted Corn	Carved Ham over Barley Pilaf with Green Beans	Beef Barbacoa	Pork Tinga Tostada with Rice and Beans
Early Riser	Belgian Waffle Sticks	Huevos Rancheros	Frittata Lorraine	Omelette Florentine with Spinach, Tomato & Mozzarella	Breakfast Tacos
Country Kettle	Chipotle Chicken	Pasta e Fagioli	Turkey Wild Rice	Tomato Lentil	Chicken Tortilla
Deli Special	Smoked Turkey Baguette	Greek Tuna Salad with Pita Chips over Lettuce	Southwest Turkey, Peppers & Cheddar with Jalapeno Ranch Spread	Tomato & Fresh Mozz on Ciabatta with Basil, Red Onion & Arugula	Southwest Roasted Vegetable Wrap with Guacamole
Grill Special	Italian Grilled Cheese	Buffalo Chicken Steak Sandwich with Fries	Pizza Burger	Chicken Zen Sandwich	Chicken Fajita served with Rice and Beans
Panini	Buffalo Shrimp Wrap	Italian Beef with Spinach and Provolone	Bologna Melt	Crab Cake on a Kaiser with Lettuce & Tomato	Baja Chicken Panini with Pepperjack, Pico de Gallo, and Jalapeno Ranch

MENU SUBJECT TO CHANGE WITHOUT NOTICE

HEART HEALTHY

VEGETARIAN OPTION

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DEADLINE for calendar item submissions is noon on WEDNESDAY. Other stories should be submitted no later than noon on TUESDAY.

Comments: commteam@pppl.gov ♦ PPPL WEEKLY is archived on the web at: <http://w3.pppl.gov/communications/weekly/>.