

At PPPL THIS WEEK

THURSDAY, AUGUST 27

Tour Guide Meeting
10 a.m. ♦ MBG Auditorium

UPCOMING

MONDAY, SEPT. 7

Labor Day
Laboratory Closed

Please note: Due to the Labor Day holiday, the next issue of the PPPL Weekly will be Sept. 14. It will resume weekly publication after that date.

WEDNESDAY, SEPT. 9

Clipper Ships Travelogue
12:00 p.m.-1 p.m. ♦ MBG Auditorium
Don McBride

Ice Cream Party
1 p.m. ♦ LSB Lobby
Please join us as we celebrate the First Test Plasma of the NSTX-U.

INSIDE

CD-4 **2**

Facilities Assessments **3**

Tour Guide Meeting **3**

Kees Bol **4**

Tour Guide Volunteers **5**

SULI Poster Session **6**

Clipper Ships Travelogue **8**

Aug. 24 Menu **8**

Aug. 31 and Sept. 7 Menus **9**

A major milestone as \$94 million NSTX-U construction concludes

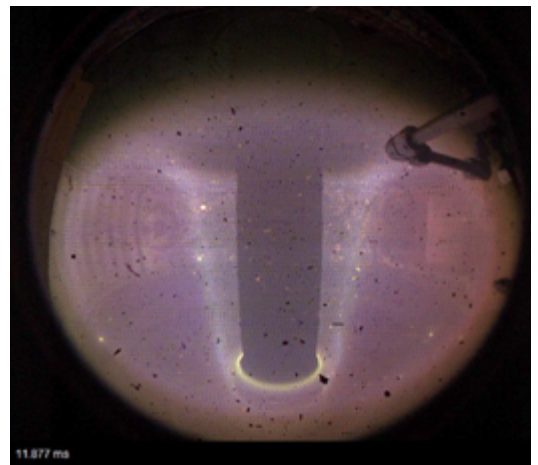
By Jeanne Jackson DeVoe

The National Spherical Torus Experiment Upgrade (NSTX-U) team achieved a major milestone on Aug. 10 when it produced the first test plasma and met U.S. Department of Energy criteria for the start of operations of the experiment after four years of construction on the \$94 million upgrade.

More than 40 engineers, physicists, IT staff, and observers gathered in the NSTX-U Control Room gave three rounds of applause at around 5 p.m. after achieving a 100 kiloamp (100,000 amps) plasma at 4:45 p.m. — twice the 50 kiloamps required to officially complete construction of the NSTX-U project.

“It signifies the end of an extremely successful challenge, which opens the door to a decade or more of exciting research,” said PPPL Director Stewart Prager, who visited the control room just after the team achieved CD-4. “Now we look forward to the team preparing for research operations, which will begin in the fall. It will be the start of the newest fusion facility in the U.S.”

In an email to PPPL staff touting the accomplishment, Prager noted that some 250 staff members from various departments contributed to helping complete the project on time and within budget despite technical challenges.



A test plasma created when NSTX-U achieved CD-4 on Aug. 10.

[continued on page 2](#)

Kees Bol, a scientist on Project Matterhorn, PDX and numerous experiments, dies at 90

By Jeanne Jackson DeVoe

Kees Bol, a physicist who played a part in the history of the Laboratory first as part of Project Matterhorn and then through roles in several crucial experiments at PPPL for three decades, died at his home in Skillman, New Jersey, on Aug. 8 at age 90.

Former colleagues of Bol remembered his quiet professionalism and his role as a mentor in a career that spanned the beginning of the fusion program at PPPL through the 1980s.



Kees Bol

“He was on the cutting edge of developing plasma operating techniques that have been crucial for the tokamak program,” said Richard Hawryluk, head of ITER and Tokamaks, who worked with Bol on the Princeton Large Torus (PLT) and on the Poloidal Divertor Experiment (PDX) in the 1970s and 80s.

When Bol joined Project Matterhorn in 1959, he worked on the Etude stellarator, a four-foot-high race-track stellarator, which was modified in the early 1960s. He continued to work studying oscillations in plasma on the device through the 1960s.

[continued on page 4](#)

CD-4

continued from page 1

Jon Menard, the NSTX-U program director also thanked the NSTX-U team and PPPL staff. "I just want to thank everyone who's worked on this for the last five years," he said. "It's taken a lot of effort to make this happen."

The Engineering Operations team tested the magnetic field coils on NSTX-U the morning of CD-4, bringing them to 25, 50, 75 and 100 percent of the full allowed power before handing the experiment over to the Experimental Research Operations team at around 1:30 p.m. The team, with Devon Battaglia as physics operator and Ray Camp as chief operating engineer, gradually brought the plasma current up from 10 kiloamps to 100 kiloamps.

The control room was hushed as the clock counted down each shot on the huge overhead screen. An audible ticking noise began during the countdown for each shot with a bell ringing when the shot was 10 seconds from completion. The graphs measuring the plasma current from the shots and a "plasma TV" video of the plasma were also shown overhead.

"It's not as easy as turning on a switch," said Masa Ono, the NSTX-U project director. "There are so many knobs that we can turn. We're kind of edging along our way."

"It's kind of like a racecar," said Al Von Halle, head of engineering operations. "You take it out and go slow at first and then try to bring it to its full capability."

After running shots with a small amount of deuterium gas to produce a plasma, the team ran a shot without the gas to compare the results and get a more accurate reading on the plasma current that produced the plasma.

Searching for the recipe

"What we did today, we will do on every plasma discharge," said Battaglia. "There's a little bit of searching for the recipe that we still have to develop more."

The team planned to test the coils for a few days. After that, they will vent the machine for several days and then "bake out" the machine for a few weeks to remove water trapped in the vacuum walls, which will reduce the infusion of impurity particles. Water interferes with plasma production and made it necessary to apply a higher voltage to produce a plasma during the initial shots.

After the bake-out, the team will produce NSTX-U's first research plasma in the fall, using the full capabilities of the



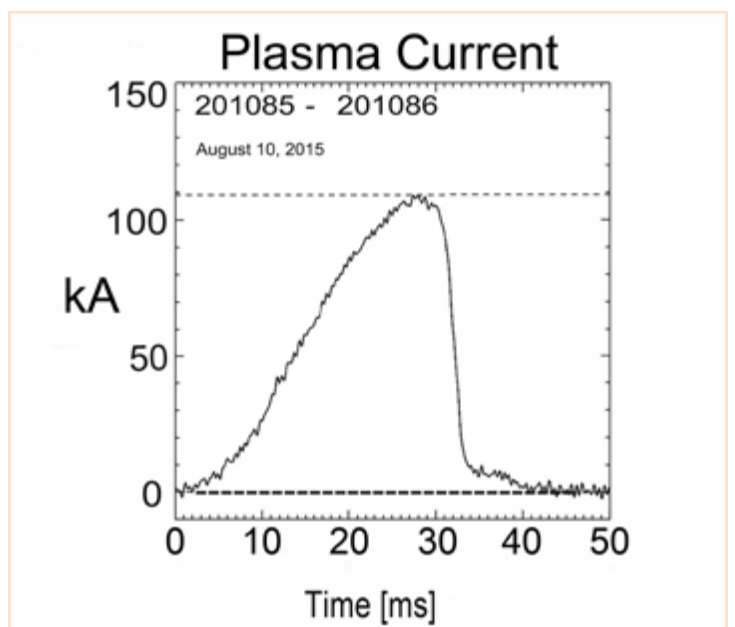
Checking results in the NSTX-U Control Room: from left to right, Greg Tchilinguirian, CODAC; Masa Ono, project director; and physicist Steven Sabbagh.



Ray Camp, on the phone, was chief operating engineer; Stephen DePasquale, center, was chief operating engineer in training; and Devon Battaglia, right, was the physics operator, for CD-4. Behind them are engineers John Dong and Nevelle Greenough. (Photos by Jeanne Jackson DeVoe)

machine, including all of the magnets, as well as the neutral beams and radio frequency waves used to heat the plasma, neither of which were used in the first plasma. There will also be fully functioning diagnostics that will give a clearer picture of the plasma behavior. The media will be invited to cover the first research plasma and a Lab-wide celebration is planned.

[continued on next page](#)



A graph, which was displayed on the overhead screen in the NSTX-U Control Room, shows the plasma current reached 100 kiloamps, twice the amount required to officially complete construction.

CD-4

continued from page 2

NSTX-U will produce much more power for research operations than it did for CD-4, said Stefan Gerhardt, head of research operations. “That thing is supposed to go to 2,000 kiloamps, on that scale, so we’re not done yet but this is a hell of a start,” Gerhardt told the team after CD-4 was achieved.

Many people said NSTX-U was off to a very good start. The controls, magnets, diagnostics, vacuum, and other systems all worked very well. “All of the systems are in much better shape on NSTX-U’s first plasma than they were for NSTX’s first plasma,” said Tim Stevenson, who heads project management and the neutral beam team. “It’s spectacular how much is functioning now compared to when we had first plasma in 1999,” said Stevenson. “This shot was a walk-off, grand slam, home run. That’s as good as it gets.” 🏆



Checking results of the tests on the computer are from left to right: physicists Clayton Myers and Dan Boyer, Masa Ono, Stefan Gerhardt, head of research operations, and Tim Stevenson, head of project management and the neutral beam team.

Team completes facilities assessments



The VFA Survey Team in the C-Site MG Building: From left to right: Mike Bernardo, Joshua Campbell, John Lee and Mike Viola. (Photo by Dolores Stevenson)

Facilities & Site Services has been performing facility condition assessments throughout the Laboratory since July 27. A survey team from VFA, Inc. and Facilities has been conducting non-invasive, visual inspections of all C-Site buildings and all of the buildings’ architectural, mechanical, and electrical systems. A separate team concentrated on mechanical equipment rooms (MERs) on D-Site.

The information gathered will be used to add new data into the DOE Facilities Information Management System (FIMS) database per DOE requirements.

If you have any questions, please contact Martin Donohue (Ext. 3510) or Dolores Stevenson (Ext. 3737).

Thank you to all who supported the assessment effort! 🏆

Tour Guide Meeting Aug. 27 at 10 a.m.

Please come to a tour meeting on Aug. 27 from 10 a.m. to 11 a.m. in the MBG Auditorium, where we’ll have refreshments, give out tee shirts, and discuss some new developments in the tour program. Both experienced and new tour guides are welcome. After we discuss some changes and improvements to the tour program, experienced tour guides will be free to leave at 11 a.m. New tour guides will stay for a tour-training session from 11 a.m. to noon.

Kees Bol

continued from page 1

A move to tokamaks

After Russian scientists performed successful fusion experiments using a donut-shaped vessel called a tokamak, Bol and his colleagues converted the Etude into the first tokamak in the U.S. called “The Test Tok,” in the late 1960s, said Ken Young, a retired PPPL physicist who met Bol as a young scientist at PPPL.

Bol continued working on early tokamaks, including the Symmetric Tokamak (ST Tokamak), which was converted from the Model C stellarator and began operating in 1970, recalls Joel Hosea, head of RF Science and Technology. “When we started out on the ST Tokamak, we knew nothing about tokamaks, except what we read in the Russian papers,” Hosea said. The ST led to the ATC (Adiabatic Toroidal Compressor) in 1972, which was one of the first devices to use neutral beams to heat the plasma, Hosea said.

PPPL scientists, including Bol, were experimenting with various configurations for the tokamaks. The early tokamaks, for example, had an outer copper shell to try to control the plasma but the ATC and the Princeton Large Torus (PLT), which began operating in 1975, used poloidal field coils for that purpose. “Everything we know today was a gradual build-up,” said Hosea. “A lot of work came out of PLT that really set the field at the time.”

Bol went on to work on the Poloidal Divertor Experiment (PDX), built in 1978. He was head of PDX as well as the head of experimental projects in the 1980s. PDX was succeeded by the Princeton Beta Experiment (PBX) in the mid-1980s.

“He was a fine physicist with a deep reserve of knowledge about what was likely to succeed and, very importantly, what was not, based on his long experience with many previous experimental projects at the Laboratory. He was very involved in all aspects of the project, from the engineering to the research program,” said Michael Bell, a former principal research physicist at PPPL, who worked with Bol on PDX. “He was a true gentleman who sought always to put the interests of our field, the laboratory and its staff ahead of his own.”

A “key player”

“He was a key player,” said Hosea. “He was leading the confinement and impurities studies in both stellarators and tokamaks and trying to understand what was controlling confinement with and without neutral beam heating.”



Kees Bol, second from left, at a conference with Soviet scientists in Sukhumi, Georgia in 1975. To his left is Gil Emmert, now a professor emeritus at the University of Wisconsin, and to his right is Brendan McNamara, of the Lawrence Livermore National Laboratory.

“He was one of the world experts at PPPL in the measurement of plasma fluctuations and their connection with plasma loss,” said Dale Meade, a former deputy director of PPPL, who first met Bol in 1966.

Mentoring young scientists

Bol also served as a mentor to young scientists like Young who were just starting out. “He was very nurturing,” Young said. He also took Rob Goldston, a professor of astrophysical sciences at Princeton University and former PPPL director, under his wing when Goldston was a first-year graduate student at PPPL in 1971. “There wasn’t a disingenuous bone in his body,” Goldston said. “His kindness and thoughtfulness about people and about me as an early graduate student made me feel welcome and made me feel I was part of the team in a wonderful way.”

Bol was born in Eindhoven in the Netherlands in 1925 but his family emigrated to Palo Alto California in 1936, where they lived and operated a horse farm. He met his soon-to-be wife, Margaret “Markee” Rose Coles, at one of the first integrated summer camps where he taught horseback riding. The two married in 1947. He studied physics at Stanford University and graduated with honors and at age 26, received his Ph.D. in physics from the university in 1951.

Bol was employed by Sperry Gyroscope Company in Lake Success, New York, on Long Island from 1949 to 1954 during the Cold War but lost his security clearance because the F.B.I. considered his work at the camp a sign of communist leanings and his father had received a newsletter from the Russian embassy, according to his family.

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Kees, seventh from right, and U.S. and Soviet scientists pose for a group picture at the conference.

Kees Bol

continued from page 4

Bol taught physics at Adelphi College on Long Island for two years. He then received a grant from the National Science Foundation to study the waves generated by a beam of electrons passing through a neutralizing background of positive ions and joined the Gordon McKay Lab at Harvard University where he worked for two years until he was recruited to join Project Matterhorn.

“Discipline and scientific rigor”


Bol’s work doing state-of-the-art precision measurements in his previous positions served him well in his work on fusion energy, Hawryluk said. “He brought that kind of discipline and scientific rigor to his work, at a time when our field was still in its infancy,” he said. “He wanted to make sure that whatever he said was accurate. It was great to have someone like that to work with. You knew that when you talked with him about science he wanted you to do your very best and very much supported you.”

“Markee” Coles, who died in 2013, was a guidance counselor at Montgomery High School for several years. The couple lived in Montgomery Township for many years and raised four children: Peter Bol, of Lexington, Massachusetts; Stacy Stahl, of Ledyard, Connecticut; Christina Bol, of Blairstown, New Jersey, and Faith Fish, of Monmouth Junction, New Jersey.

The couple also had a summer cabin in Westmore, Vermont. They enjoyed hiking. Bol volunteered to help maintain the local hiking trails in Vermont.

Bol was born with one full arm and one that ended at the elbow but was remarkably dexterous with one arm, family members and colleagues said. He put the bolts into the Test Tok himself, for example, Young said. In his time off, he remodeled the family house, built a barn, and built furniture for his home. He continued to build furniture for his children even after he retired to Stonebridge.

Bol’s former colleagues say they will fondly remember a man who played a role in PPPL’s history, encouraged early-career scientists and had a passion for the Laboratory’s mission. “The main thing I remember about him was his positive, cheery scientifically-oriented disposition and his kindness to the graduate students,” said Goldston, “as well as his perspective on what we were doing here: the science was beautiful and the energy goal was important and this was a great enterprise to be part of.”

There will be a memorial service for Kees Bol at Stonebridge at Montgomery in Skillman, New Jersey, on Aug. 29 at 2 p.m. 

Tour Guides and Tour Hosts Wanted!

We are looking for engineers and physicists who are willing to donate a couple of hours of their time each month to show off the Laboratory to students, clubs, and local people who are interested in science. Our growing tour program is a great way to educate the community about fusion energy and the Lab’s mission and to let them know about the cutting-edge research taking place at PPPL. We are also looking for hosts to greet visitors, hand out giveaways and make sure the tours run smoothly.

[Please plan to come to our tour meeting on Aug. 27 at 10 a.m.](#)



Please email Jeanne Jackson DeVoe, jjackson@pppl.gov, to volunteer.

Summer interns present research findings in poster session

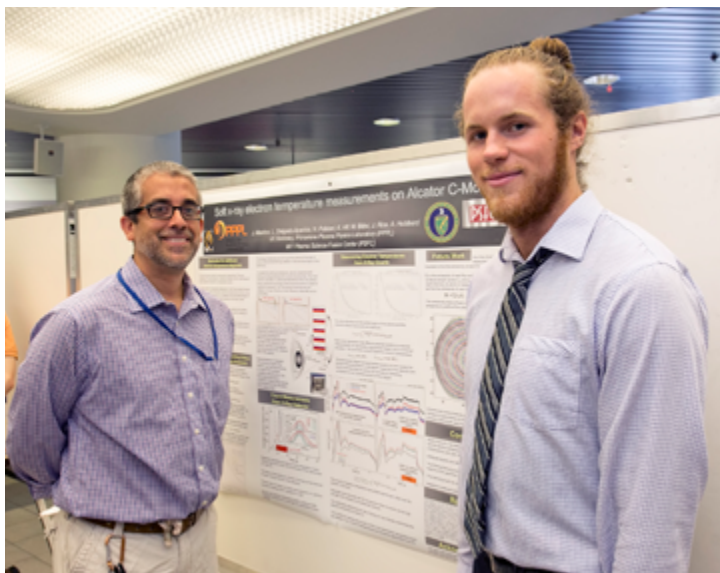
By Raphael Rosen

If you happened to be in the lobby of PPPL's Lyman Spitzer Building on Aug. 12, you would have seen the next generation of top scientists preparing to launch their careers. Twenty-five undergraduates from colleges across the country spent this summer at the Laboratory as interns, working on projects ranging from figuring out how to remotely steer a set of mirrors that will be built into the upcoming ITER fusion machine to studying how nanoparticles grow inside plasmas.

This summer's cohort of interns was part of the U.S. Department of Energy's (DOE) Science Undergraduate Laboratory Internship (SULI) program. Launched in 2004, the SULI program is sponsored and managed by the DOE Office of Science's Office of Workforce Development for Teachers and Scientists, which partners with DOE laboratories across the country to encourage undergraduate students to pursue careers in science, technology, engineering, and mathematics.

At the beginning of the 10-week program, the interns must complete a one-week course in plasma physics. Afterwards, each intern begins working on a research project with a PPPL staff member who acts as a mentor. Mentors are assigned to interns based on the interests listed on the interns' applications, said Deedee Ortiz, Program Administrator in PPPL's Science Education Department. The poster session was the last of three requirements they had to fill. (The other two were writing an abstract suitable for the general public and a research paper.)

Undergraduates, however, weren't the only students interning at PPPL this summer. A group of 10 high school students participated in their own internship program. And like the SULI students, the high schoolers were matched with Laboratory scientists and assigned to research projects, including one that focused on the RGDX – Remote Glow Discharge Experiment – a plasma device that can be controlled remotely over the Internet. In addition to their research, the high school interns met with Princeton University engineering professors to learn more about



Physicist Luis Delgado-Aparicio, left, and Jacob Maddox.

pursuing STEM majors in college. At the end of the summer they then had to write both a research paper and create a poster.

Conversations with the interns revealed deep satisfaction with the SULI program. William McCarthy, a rising senior from Cape Elizabeth, Maine majoring in physics at Massachusetts's Worcester Polytechnic Institute, now plans to study plasma physics in graduate school. "I loved every minute of my internship," he said. For some interns, their experience was the continuation of a long relationship with PPPL. "I had a great time," said Hadar Lazar, a rising senior at the University of Chicago majoring in physics, who has spent four consecutive summers working at PPPL. "I first came here the summer after I finished high school. PPPL has really taken me under its wing."

The high schoolers, too, found the internship very valuable. "We aren't able to experience research like this in high school," said Sweta Subramaniam, a rising senior at Hightstown High School. And their interactions with PPPL staff were just as memorable. "Our mentor, Charlie Gentile,

[continued on next page](#)



Cara Bagley and New Jersey Assemblywoman Donna Simon.


SULI poster session

continued from page 6

put a lot of time and effort into creating a wonderful experience for us,” said Lara Balick, who this spring graduated from Kinnelon High School and plans to attend Dartmouth College this fall.

In addition, two members of the New Jersey General Assembly – Elizabeth Muoio (District 15) and Donna Simon (District 16) – stopped by the poster session to talk with the participants.

While the internship program helps students hone their research skills, it also helps PPPL recruit the next generation of plasma physicists. “Completing a summer internship at PPPL increases the chances that a student will enter a Ph.D. program in general, and a plasma physics program in particular,” said Andrew Zwicker, head of PPPL’s Science Education Department. “This is a crucial component of building our future workforce.”

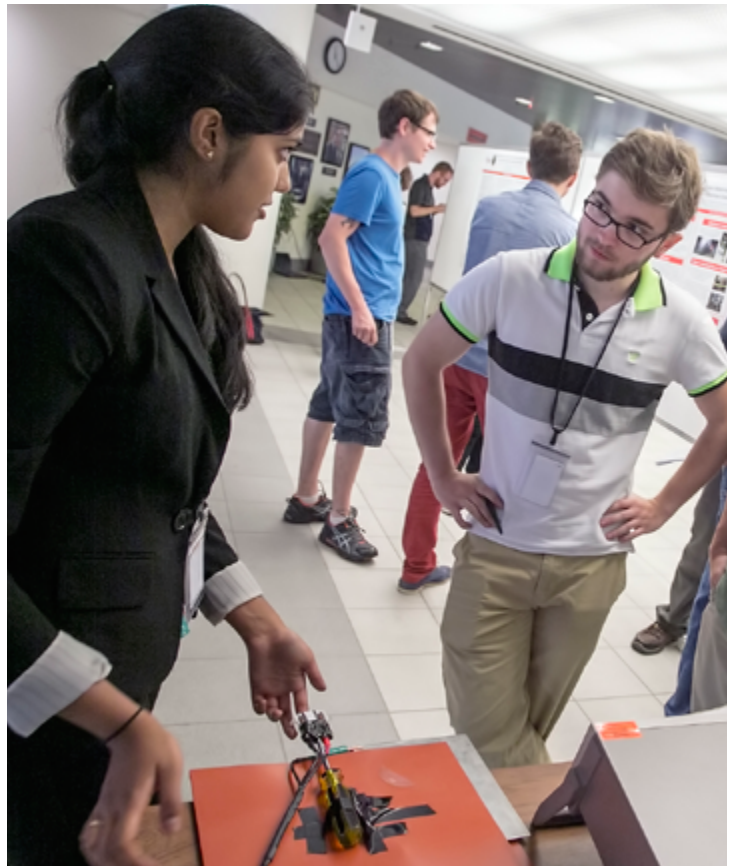
Hopes and expectations for these outstanding students are high. “I truly believe that one day, one of these students will come back to PPPL with a whole new perspective on fusion energy,” said Ortiz. “Then he or she will solve the fusion puzzle and save the world! That’s why this program, and others like it, are so important.” 



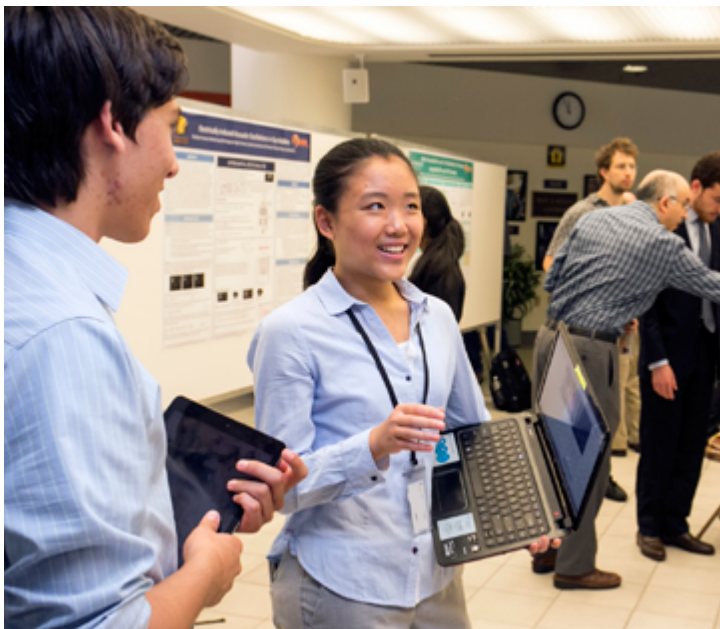
Matthew Lotocki, Zach Kaplan, Michael Knyszek, and Computational Scientist Eliot Feibush.



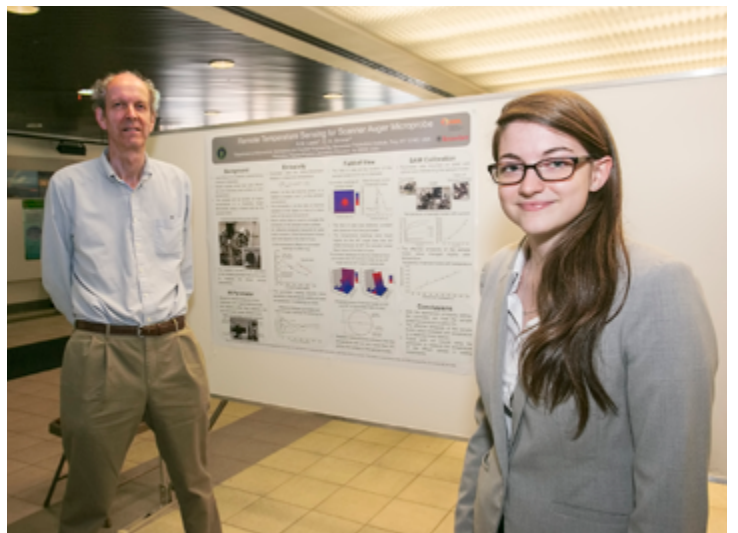
Engineer Charles Gentile, John Dellas, Sweta Subramaniam, Lara Balick, and Daniel Perry.



Sweta Subramaniam and Benjamin Goldman.



Zach Kaplan and Vivian Qiang.



Physicist Charles Skinner and Amanda Lewis.

A travelogue on clipper ships

Don McBride will give a travelogue presentation about the Star Clipper, a four-masted clipper ship that offers cruises in the Caribbean and the Mediterranean, and other clipper ships, on Sept. 9 from noon to 1 p.m. in the MBG Auditorium.



BROCK

MARK GAZO
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 August 24	Tuesday August 25	Wednesday August 26	Thursday August 27	Friday August 28
COMMAND PERFORMANCE Chef's Feature	Chicken Parmesan served with Pasta & Garlic Bread	Roasted Vegetables served over Polenta	COMMAND PERFORMANCE Create Your Own Burrito	Grilled Pork Chop with Smashed Potatoes & Chimichurri Sauce	Rotini Pasta Bolognese served with Garlic Bread
Early Riser	Ham & Cheese Omelet with Home Fries	Asparagus & Cheese Omelet with Home Fries	Corned Beef Hash & 2 Eggs	Sausage Cheddar Bake	Strawberry French Toast
Country Kettle	White Bean with Ham	Gazpacho	Gumbo	Tomato & Spinach with Tortellini	Italian Sausage Bean
Grille Special	Big Mac served with Fries	Pepperoni & Mushroom Cheesesteak	Popcorn Chicken Po' Boy	Pulled BBQ Chicken	Tofu Tacos
Deli Special	Portobello Mushroom on a Pretzel Bun with Fresh Mozzarella, Tomato & Pesto Mayonnaise	3-Foot Italian Hoagie	Grilled Ham, Peppers & Pineapple with Dijon Mustard on Ciabatta Bread	Seafood Salad Croissant	Breaded Chicken Cutlet with Salami, Fresh Mozzarella and Pesto Mayo
Panini	Pulled BBQ Pork on a Soft Bun with Slaw	Cheesy Shrimp & Grits	Country-Fried Chicken Breast on a Soft Roll with Lettuce, Tomato & Mayo	Flatbread with Eggplant, Feta, Red Onion, Tomato and Tzatziki Sauce	Greek Gyro Wrap

MENU SUBJECT TO CHANGE WITHOUT NOTICE

VEGETARIAN OPTION



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 August 31	Tuesday September 1	Wednesday September 2	Thursday September 3	Friday September 4
COMMAND PERFORMANCE Chef's Feature	Chicken Marsala served with Egg Noodles & Vegetable	Eggplant Parmesan served with Pasta & Garlic Bread	Carla's Pasta Bar	Carved Roast Beef with Gravy, Mashed Potatoes & Vegetable	Seafood Pasta Fra Diavolo
Early Riser	Mushroom, Onion & Mozzarella Omelet with Home Fries	Banana Pancakes	Corned Beef Hash & 2 Eggs	Pineapple Coconut Pancakes with Ham Steak	Veggie Egg Burrito
Country Kettle	Broccoli Cheddar	Chicken Zucchini with Shell Pasta	Vegetable Lentil	Beef Barley	Split Pea
Grille Special	Handmade 8 oz. Burger with Choice of Cheese & Potato Salad	Italian Hot Dog	Tuna Melt on Rye	Bacon BBQ Chicken Cheesesteak	Grilled Peanut Butter & Banana on Texas Toast
Deli Special	Veggie Burger with the Works	Liverwurst on Rye	Ham, Turkey & Cheese Club Sandwich with Bacon	Krabby Kake Sandwich	Chicken Cutlet with Fresh Mozzarella, Bruschetta and Pesto on Ciabatta Bread
Panini	Salami, Capicola, Ham & Provolone on French Bread with Tomato & Pesto Mayo	Tilapia Tacos with Pickled Cabbage and Pico de Gallo	Chicken Mushroom Quesadilla	Veggie Quesadilla	Philly Cheesesteak Wrap Panini

	Monday September 7	Tuesday September 8	Wednesday September 9	Thursday September 10	Friday September 11
COMMAND PERFORMANCE Chef's Feature	Labor Day	Ota-Ya Sushi	Fried Flounder with Potato Wedges & Coleslaw	Carved Caribbean Pork Loin served with Mango Salsa & Wild Rice	Baked Ziti with a Garlic Knot
Early Riser		2 Eggs served with Hash Brown Casserole	Raisin Bread French Toast	Chocolate Banana Pancakes	Broccoli Cheddar Breakfast Pita Pizza
Country Kettle		Chicken Rice	Beef Noodle	Tomato Bisque	Manhattan Clam Chowder
Grille Special		Chicken Cheesesteak with the Works	Popcorn Shrimp Po' Boy	Turkey Burger with Avocado and Bacon	Roast Turkey, Avocado & Bacon Grilled on Texas Toast
Deli Special		Egg Salad, Avocado on Whole Grain Bread with Lettuce & Tomato	Sliced Pork on French Bread with Pickled Slaw	Tuna Club with Hard-Cooked Egg, Lettuce & Tomato	Pesto Chicken Salad Croissant
Panini		Fried Fish & Slaw Wrap with Tartar Sauce	Chicken Cheddar Quesadilla	Veggie Nachos	Roast Beef & Cheddar on an Onion Roll

MENU SUBJECT TO CHANGE WITHOUT NOTICE

VEGETARIAN OPTION

WEEKLY

Editor: **Jeanne Jackson DeVoe** ♦ Layout and graphic design: **Kyle Palmer**
Photography: **Elle Starkman** ♦ Science Editor: **John Greenwald** ♦ Webmaster: **Chris Cane**

The PPPL WEEKLY is published by the [PPPL Office of Communications](#) on Mondays throughout the year except for holidays.

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/>.

Due to the Labor Day holiday, the next issue of the PPPL Weekly will be Sept. 14. It will resume weekly publication after that date.