

Planning Underway for New Tokamak at TFTR Site

March Meeting at PPPL

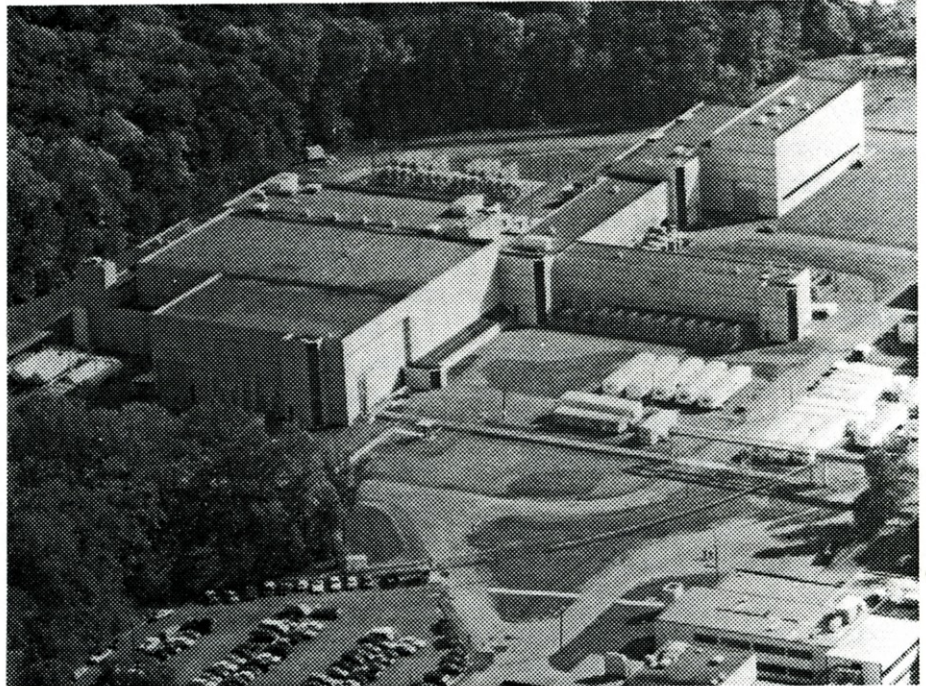
The Fusion Energy Advisory Committee (FEAC) convenes here on March 18 and 19 to answer the question, "What next?" That is, what new tokamak design will be chosen to succeed TFTR, now that BPX (Burning Plasma Experiment) has been set aside for budgetary reasons?

During the March meeting, FEAC members will examine several preconceptual design options for the new machine. They will be advised by the FEAC Panel 2, which is also comparing the device with upgrades of existing facilities.

FEAC was established by Department of Energy (DOE) Secretary James D. Watkins to review the status of fusion projects nationwide. FEAC reports to Dr. William Happer, Director of the Office of Energy Research for DOE and is chaired by Professor Robert W. Conn of the University of California at Los Angeles.

The Committee includes representatives from universities and national laboratories involved in fusion research. PPPL Director Ron Davidson is a FEAC member. Rob Goldston, Head of PPPL Research Council, serves on FEAC Panel 2.

To help identify preconceptual design options for the post-TFTR initiative, last October Davidson established a New Initiatives Task Force, which is chaired by Dr. John Sheffield of the Oak Ridge National Laboratory. The Task Force is comprised of leading technical experts in the fusion community. Representing PPPL is



The Test Cell (center), which now houses TFTR, may be the home of a brand new tokamak by the late 1990's. Decisions made over the next couple of months will determine its design.

Photo: Leigh Photographics

Associate Director for Research Paul Rutherford. The Task Force reports to Davidson.

For the last five months, the Task Force and many other people in the national fusion community have dedicated themselves to planning and designing concepts for new experimental devices that could be built within the ground rules and goals outlined.

Ground Rules

The ground rules recommended by Davidson for the next major tokamak after TFTR, are that:

- it will be a national device located at the present TFTR site;

- it will use many of TFTR's existing auxiliary facilities, including power supplies;
- it will be largely a new device, assembled after the present TFTR is decommissioned; and
- its cost ceiling will be \$400 million in 1992 dollars.

The Advanced Reactor Innovation Evaluation Study (ARIES) has provided guidelines that could be incorporated in the next major tokamak.

The design concepts under consideration are intended to: investigate improvements in the tokamak concept, support the International Thermonuclear Experimental Reactor

Summer Fusion Fellowships

Application Deadline March 16

PPPL's Science Education Program is to administer a National Undergraduate Fellowship Program in Plasma Physics and Fusion Engineering, according to Rush Holt, PPPL's Assistant Director. Through the Program, up to 25 college juniors will be placed in summer positions in fusion research.

The Program, which is under Holt's direction, is funded by the Department of Energy. Nat Fisch is Academic Director, and Diane Carroll is Administrative Director.

The students will spend the week of June 15 to June 19 in an introductory course at PPPL that will cover basic elements of plasma physics,

an introduction to the technology questions being addressed by fusion researchers, and an overview of the worldwide fusion effort. They will then participate in nine weeks of research at one of the universities or laboratories doing fusion research nationwide, including PPPL.

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New Tokamak

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project; and provide a scientific focus to maintain vitality of the national fusion program.

Technical Approaches

Several technical approaches have been investigated to date, according to Rob Goldston, Head of the Core Physics Team for the New Initiative.

Three approaches are: a superconducting tokamak, a tokamak with demountable copper plate coils, and a tokamak with a wound aluminum magnet coil. These devices are all focused on the so-called Steady-State Advanced Tokamak (SSAT) mission.

This mission has two aspects. The first is to develop techniques to extend the tokamak pulse length from present values of a few seconds to the very long pulse or steady-state operation required for a fusion power reactor. The process of developing longer pulse length will involve issues of divertor power and particle handling, noninductive current drive, and disruption avoidance.

The second aspect of the mission is to develop techniques to improve the tokamak concept through enhanced bootstrap current, higher beta, and longer confinement. Recent experimental results from TFTR, JET, and D-III-D point to current profile control as a crucial element in this mission.

Since full current profile control requires pulse lengths greater than a current relaxation time (some 10's of seconds), there is a natural fit between the steady-state and advanced tokamak missions.

In addition to the SSAT-type devices, machines with deuterium-tritium missions are being evaluated. The BPX-AT is a scaled down version of BPX which would address advanced tokamak and burning physics concurrently. BPX-AT has the capability of $Q \sim 5$ for a 10-second pulse or 2 MA for 400-second pulses. The BPX-AT has an estimated cost of \$642 million, less than half that of the full BPX.

Because the FEAC decision will impact strongly on PPPL, the Laboratory Research Council has been monitoring the New Initiatives process carefully. Says Research Council Head Goldston, "The Research Council has been advising Ron Davidson on the best course of action for the Laboratory in this process. We are undertaking activities both in support of the pure SSAT-type device, and of devices with higher-pulsed performance capability. We are also looking at upgrades to TFTR and PBX-M."

National Participation

It is essential to have the broadest possible support and input for the project, according to PPPL Deputy Director Dale Meade, who

is active on the Task Force for Project Organization for the New Initiative. Therefore, Meade explains, national participation via a "teaming model" that would include multi-institutional research is being considered. This model borrows from and extends features used in the BPX and JET approaches.

Because the machine is expected to be built here, PPPL would be the responsible lead laboratory and a key member of a national Council of Partners that would provide strong oversight of the project. Partners would carry significant subsystem responsibilities, and in that role, would subcontract with industry for the design and fabrication of systems, much as was planned for BPX.

Time Table

In order to limit the "gap" between the end of TFTR experiments (scheduled for autumn, 1994) and the start-up of the new tokamak, decisions must be made as expeditiously as possible.

Given a likely April decision on the mission and design concept for the new tokamak, completion of the conceptual design is targeted for January 1993. Project approval would be obtained in FY94, with full construction authorization by FY95. By FY99, it is expected that the new device would be ready to begin operation.

Fellowship Program

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"We are very pleased to have received this grant," said Diane Carroll, "and we expect that the Program will attract good students and give them some exposure to fusion research early in their careers. Our hope is that some of them will go on to graduate school in fusion-related fields. The Program will also provide fusion projects with good assistants for the summer."

According to Carroll, the Program's Governing Committee will assign students to projects proposed by principal researchers at DOE-funded laboratories and members of the University Fusion Association.

Students will receive a stipend of \$4000 and will be reimbursed for housing and travel expenses. Applications are invited from students in engineering, mathematics, computer science, or physics who

are presently in their junior year in a U.S. college or university, and who have taken at least one course in electricity and magnetism beyond introductory physics. Exceptional sophomores will also be considered. The application deadline is March 16.

Application materials are available from Diane Carroll or Robert Redding in the Science Education Program, extension 2106.

Office of ER/WM Administration Established Larson Named Head

Scott Larson has been named the Head of the recently established Office of Environmental Restoration and Waste Management (ER/WM) Administration, reporting to Ed Winkler in the Office of Resource Management. This Office will retain its hazardous materials duties, and Jim Scott will continue as Hazardous Materials Coordinator.

According to PPPL Director Ron Davidson, the Office of ER/WM Administration was established in recognition of the emphasis the Department of Energy (DOE) has placed on these areas and of the need to integrate Laboratory and DOE planning.

The Office will provide a single point of contact for DOE, Chicago Headquarters, and the Princeton Area Office, as well as for Laboratory management. Financial, administrative, and regulatory matters pertaining to environmental clean up and waste management activities will be addressed.

Planning and accountability in the ER/WM areas are two major functions of the Office. For example, a portion of the Laboratory's FY94-98 planning submission has

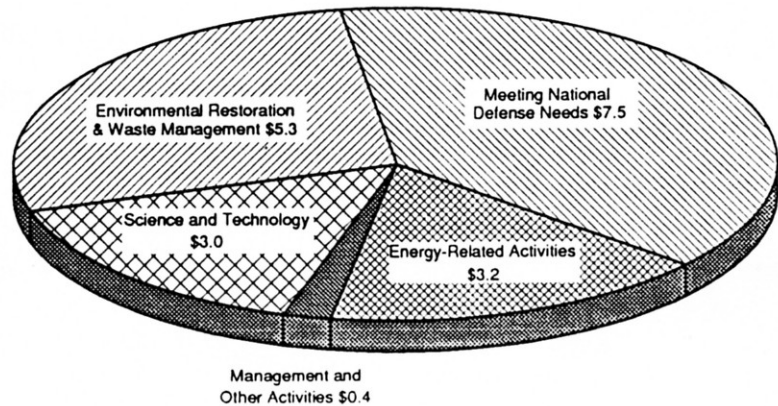
just been completed.

According to Larson, many requests for financial data regarding environmental restoration have already been received. He explains, "Environmental clean up costs at DOE sites have spiraled, and many

governmental agencies want to see data both for planning purposes and to examine whether expenditures are justified." Examples of agencies requesting information are: the U.S. Office of Management and

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DOE Budget Request (Dollars in Billions)



FY 1993 Budget Authority - \$19.4 Billion

PPPL has a new Office of ER/WM Administration, and the above pie chart from February 1992 "DOE This Month" shows why—in the FY93 DOE budget, cleanup is up, defense is down. The \$5.3 billion request for environmental cleanup is an increase of more than \$1 billion from the FY92 estimate. In fact, environmental restoration and waste management is the fastest growing program in DOE, according to Secretary of Energy James D. Watkins in his budget briefing.

ER/WM

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Budget, members of Congress and even Cabinet members.

Another job of the ER/WM Office is to identify funding sources for environmentally related projects (a function similar to that of an office of sponsored research on a university campus). Says Larson, "We can assist Laboratory staff who have an environmentally related project in understanding funding distinctions so that they apply to the appropriate source."

He continues, "Environmental Management funds are distinct from Energy Research funds, and this makes sorting out the appropriate funding pool more difficult."

Not only does the ER/WM Office help sort out appropriate funding sources, it also acts as an advocate to obtain funding support for PPPL projects. An excellent example of the effectiveness of such advocacy is that it has been represented to the Lab that an additional \$750,000 will be made available for the underground storage project.

HOTLINE

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Tai Chi—Gentle, Yet Powerful

How can an exercise or sport be gentle, even soft, and at the same time be a powerful tool for health, relaxation, and self-defense for women and men of all ages? Explore the art of Tai Chi, and you will discover the answer.

About 12 Lab employees have been practicing Tai Chi from noon to 1 p.m. on Monday and Thursday in the M.B.G. auditorium for close to a year and a half. They agree that Tai Chi has the power to create increased calm, focus, and well-being.

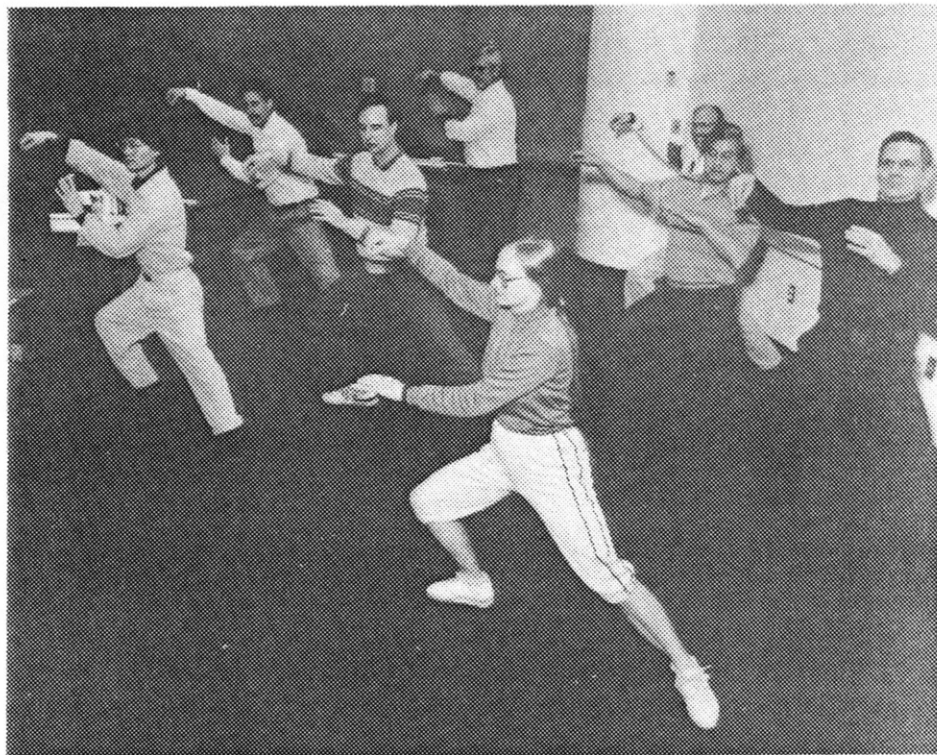
Says Electrical Designer Tom Lupich, "I've found Tai Chi to be a gentle exercise that not only strengthens a broad cross section of one's muscles, but also brings relaxation to body and mind. After doing Tai Chi I feel refreshed. Over time, I believe it also strengthens

physiological systems, yielding a condition of health."

But just what is Tai Chi? Instructor Wonchull Park, Research Physicist, says, "Tai Chi can be described as an exercise, as a soft style of self-defense, as a moving meditation, or as all of these—depending on the practitioner's focus. It was created by Chinese Taoists about 1000 years ago."

To watch, Tai Chi appears to be a dance-like series of slow, graceful movements. Careful attention to each movement and to balance provides focus and concentration. Over time, the practitioner may experience the subtle philosophical depth and spiritual benefits of Tai Chi.

Unlike other oriental martial arts, such as Karate, Tai Kwan Do or Judo, Tai Chi never uses quick,



Tai Chi practitioners concentrate on their form as they move. They are: (front row left to right) Instructor Wonchull Park and Marilee Thompson; (second row) Bill Fallon, George Fleming, and Manuel Peraza; and (third row) Charlie Ancher, Hal Anderson, and Tom Lupich. Not pictured are Wonho Choe, T-K Chu, Norman Fromm, Frank Holloway, and Tom McGeachen.

Photo: Denise Applewhite

hard movements. The secret of self-defense with Tai Chi is to move gently out of the way, causing the opponent's force to work against him rather than you.

Reduce Tension, Increase Concentration

Tai Chi practitioners here at PPPL emphasize that it helps in their job performance by reducing tension. Says Charlie Ancher, Section Head for the Field Coil Power Conversion group in TFTR, "Through Tai Chi I have realized some amazing benefits in handling stress on the job and in my daily personal activities."

Electronics Engineer Hal Anderson observes, "I find that Tai Chi has allowed me to notice when certain locations in my body are tense and to relax these areas."

Graduate student Wonho Choe, says, "Tai Chi has helped me in my work, since it improves my ability to concentrate."

Support for Other Sports

In addition, Tai Chi has helped those who practice here in other

sports, both directly and indirectly. George Fleming, Software Engineer, notes, "With regular practice of Tai Chi my flexibility has improved, which has helped me in other sports. Because I am more relaxed and flexible, my risk of sports injury has also been reduced."

Knee injuries that have already occurred can also be alleviated through Tai Chi, according to the experience of two other PPPL practitioners.

Manuel Peraza, Electrical Designer, says, "I experienced a painful knee injury while mountain climbing. For months the pain never went away until I practiced a new Tai Chi exercise which brought me relief overnight."

Marilee Thompson, Engineering staff, says, "By using Tai Chi techniques while playing tennis, I recently fixed a problem with my knee that I have had since college."

New Class Possible

Instructor Park is well-qualified to teach Tai Chi and is respected by the class. Charlie Ancher observes, "It has been a pleasure

studying under such a learned and capable instructor."

Park teaches the Yang style, which is the usual form of Tai Chi, here at the Lab and teaches the Chen style, which is more self-defense oriented, from his home.

Park's competence is reflected in the fact that he won a silver medal in the 1991 USA Tai Chi Championship and was the Yang style winner of the 1991 Eastern USA Tai Chi Championship.

More Information

To find out more about Tai Chi, call Wonchull Park at 2637. If there is enough interest, he will give a Tai Chi demonstration, and a class for beginners will be formed.

Bill Fallon, Electrical Designer, provides an inspiring thought for those considering Tai Chi. He says, "Relaxation physically and peace spiritually, which improves one's outlook and performance in life—these are the benefits of Tai Chi!"

TRANSITIONS

Births

Congratulations to **Gale Stevens** of the Theory Division and her husband Howard on the birth of their son Alan Lyle, on January 29.

Best wishes to **Lisa Hancock** of the Computer Division and husband David on the arrival of baby boy David on February 1.

Debbie Smith of Information Resource Management and husband Michael welcome new son Kevin Michael born February 15. All the best!

Marriage

Rich Cargill of the Stores Operations Branch and **Fran Jenner** of the Property Administration Branch were wed on Valentine's Day, February 14.

CLASSIFIED

Wanted

Boy scout uniform, size 12 or 14, in good condition. Please call Sara Flohr, at extension 2882.



ESU FIRE SAFETY TIP

Smoke detectors give you early warning in case of fire, so you have time to escape safely. Install at least one smoke detector on every level of your home—and one outside each bedroom. Check the manufacturer's directions and test once a week. Replace any dead batteries immediately.

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Safety Celebration



Laboratory staff celebrated two new records for safety at a party in LOB lobby on Valentine's Day. The Lab has logged more than 1.8 million employee-hours without an occupational injury over a 365 day period—the highest number of hours and the longest time period ever reached at PPPL.

Photo: Dietmar Krause

AIP Style Manual Available

The 1990 edition of the American Institute of Physics (AIP) Style Manual can be purchased for \$10 through Pat Buggs in Room B380. The manual provides guidance in writing, editing, and preparing physics manuscripts for publication.

Correction

In the February 14 edition of **HOTLINE**, Congressman David Skaggs of Colorado, a member of the Energy and Water Subcommittee of the House Appropriations Committee was pictured touring TFTR. In the photo caption, he was incorrectly identified as Richard Skaggs. Our apologies.



1992–1993 Holidays

Get out your calendar and mark these official Princeton University holidays, just so you don't forget!

Memorial Day

Monday, May 25, 1992

Academic Year 1992-93

Independence Day

Friday, July 3, 1992

Labor Day

Monday, September 7, 1992

Thanksgiving

Thursday and Friday

November 26 and 27, 1992

Christmas

Thursday and Friday

December 24 and 25, 1992

New Years

Thursday and Friday

December 31, 1992 and

January 1, 1993

Memorial Day

Monday, May 31, 1993

Optional Holidays

An additional two days at employee's discretion with supervisory approval.