



The Changing Face of Forrestal: Major Growth Underway

By Anthony DeMeo

Many at PPPL will remember a time when the Forrestal Research Campus lay in the midst of a serene countryside. On much of the surrounding land, cows grazed in open fields interspersed among wooded patches. To the east, stretching toward the mainline railway, were the remnants of a chicken farm. To the southeast was the tiny center of Plainsboro Township, not much more than a two-road intersection and a cluster of old buildings.

In the second half of the 1970's, all of this began to change. Princeton University, which over time had acquired much acreage in Plainsboro, devised a means to develop some of the property, while maintaining sufficient control over its usage and insuring adequate greenspace. Thus was born the Princeton Forrestal Center, modeled in part after successful planned communities such as Research Triangle Park in North Carolina and Stanford Industrial Park in California.

Gradually, from the late 70's through the mid-80's, businesses including American Reinsurance, Xerox, Lipo-some (now Elan Pharmaceuticals), Siemens, and others signed on for parcels along College Road East and Research Way, and Merrill Lynch and Bristol-Myers Squibb along Scudders Mill Road. The deals consisted of long-term leases or sales of the land with the right to construct one or more buildings, keeping within restrictions set by the University. For example, the height of the structure and the number of parking spaces were limited. The ratio of floor space to land area could be no greater than 0.25. The companies could use the facilities for their own operations or rent space to others, but occupants had to fall within the categories of research or light industry. No warehouses or factories, please! No smoke, no dust, no noise.

As office buildings appeared, so did residential, retail, and hotel components of the Forrestal planned community. Today, on the west side of Route 1, are the Princeton



PPPL's Tony DeMeo (left) and David Knights, Director of Marketing for Princeton Forrestal Center, look at a drawing of Forrestal.

Landing, the Forrestal Village, and the Princeton Marriott, as well as Windrows at Princeton Forrestal, a full-service retirement community. In addition, a 220-unit apartment complex, Barclay Square at Princeton Forrestal, is currently under construction at the intersection of Mapleton Road and Seminary Drive. Just south of the Village are two new office buildings erected with lightning speed last year. They were fully leased before their construction was completed. Also along Route 1, just south of Scudders Mill Road, is a Courtyard by Marriott with an adjacent restaurant, Ruby Tuesday.

"Princeton Forrestal Center has been win-win for Princeton University and Plainsboro Township. The Center generates a significant amount of income for the University, and while occupying 27 percent of the Township land area, the Center accounts for 52 percent of Plainsboro's tax base," noted David Knights, Director of Marketing for Princeton

Continued on page 2

Forrestal

Continued from page 1

Forrestal Center. Thus, it is not surprising that the University has plans for future development. Buildings and roadways recently completed, or now on the drawing board, will virtually end the distinction between the Forrestal Research Campus and the Princeton Forrestal Center. PPPL will be integrated more closely with its neighbors.

Campus North

Much of the construction will occur along the new Campus Road. On the parcel of land at the north end of the old landing strip, five new buildings, totaling 800,000 square feet, will be built during the next 10 years (see map on pages 4 and 5). Work on the first two will begin this year. The complex will be known as Campus North. The Patrinely Group, which built and owns the two new office buildings across Route 1, will construct the five new buildings.

Wellness Center

Down Campus Road past the site of the Campus North complex is a cleared area to the left which for many years served as the PPPL soccer field. If all goes according to plan, an 80,000-square-foot wellness center will occupy this parcel of land. The Princeton Sports Wellness Group, affiliated with Capital Health Systems (Helene Fuld/Mercer



The new Campus Road, a link between Stellarator and Scudders Mill Roads.



Eileen M. Henthorne, Interim Executive Director of ReCAP, gives a tour of the library storage modules to PPPL staff.

Medical Center) will own and operate the facility, which will be open to all for membership.

The owners stress that the wellness center will not be a gym, even though it will have all the trappings of one, including a pool and personal trainers. The emphasis will be on health maintenance. According to Knights, no dates have been mentioned yet, but the owners have plans to lease space temporarily in New Guggenheim building for start-up.

A and B Sites

The wellness center is the only construction currently planned for the east side of Campus Road. Looking west while traveling further south down the road, changes to the old A and B-site areas become evident. Along Forrestal Road, the old Forrestal Power House and Chem Sciences Building have been remodeled and leased out. But more prominent is the book storage facility known as ReCAP

Hotline

Editor/Writer: Patti Wieser
Photography: Elle Starkman

Graphic Artist/Layout: Gregory Czechowicz

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.



The Research Collection and Preservation Consortium or ReCAP facility at B-site. Presently, it includes offices and three modules, but eventually ReCAP will comprise 16 modular buildings.

(The Research Collection and Preservation Consortium), dedicated on May 20. The Consortium includes Princeton University, Columbia University, and The New York Public Library, all of whom are storing books and films at the facility.

“Both Columbia and NYPL were having difficulty locating land for their repositories, so Princeton, which had land available on the Forrestal Campus, offered to undertake the joint venture,” noted Eileen M. Henthorne, Interim Executive Director of ReCAP. According to Henthorne, Columbia and the NYPL are each providing 43 percent of the capital investment and operating costs, with Princeton’s interest at 14 percent. The space is being divided accordingly.

When fully built out, many years hence, the complex will stretch from its present location at the rear of Sayre Hall to the back of the Chem Sciences, requiring razing of the old Gas Dynamics Building. All totaled, ReCAP will comprise 16 modular buildings, each 210 feet long, 70 feet wide, and 32 feet tall. Each module has a 2.5-million-book capacity. To date, ReCAP administrative offices and three modules have been built.

During the first six months of operation, approximately one million items have been received. At least one and possibly two additional modules will be constructed within the next few years.

Within the modular repositories, bar-coded books belonging to Princeton, Columbia, and NYPL are stored at 50 degrees Fahrenheit and 35 percent relative humidity. The film vault held at 35 degrees Fahrenheit is available for the storage of acetate film. Double refrigerator doors isolate the modules from their surroundings.

The inventory is computerized, so the location of a particular item is readily determined. A staff of 20 performs bar coding, storage, and retrieval of books and film following well-defined procedures. Accession is currently running at about 8,000 items each day, but has been as high as 17,000, according to Henthorne. She also noted that retrieval

als are currently averaging 100 daily, but are expected to climb to 700 when all three modules are at full capacity. When retrieved, books may be shipped out to requesters, or pages within the book copied to a computer file and e-mailed to a requester. Some books may only be viewed at the repository, which has a separate reading room for this purpose.

New Roads

While ReCAP is not expected to generate much traffic in and out of Forrestal Campus, the North Campus complex and other new buildings most certainly will. Earlier this year, PPPL employees learned that the portion of Stellarator Road running parallel to Route 1 will become one-way northbound. PPPL employees will be able to leave via Campus Road or by means of the north gate directly onto Route 1. However, a new entrance/exit on the northbound side of Route 1 will open in about two years. In conjunction with this, the existing exit on to northbound Route 1 at the old guard booth will be removed. Stellarator Road will be a two-way thoroughfare north of the new entrance/exit, but will remain one-way to its south (see map on pages 4 and 5). At the present time, there are no plans to eliminate the existing north gate.

According to Knights, the Stellarator Road changes and the new entrance/exit on the northbound side of Route 1 are designed to reduce the volume of traffic through the Sayre Road and Route 1 interchange.

Another project in the making will go further by allowing traffic in and out of the Campus at its eastern end.

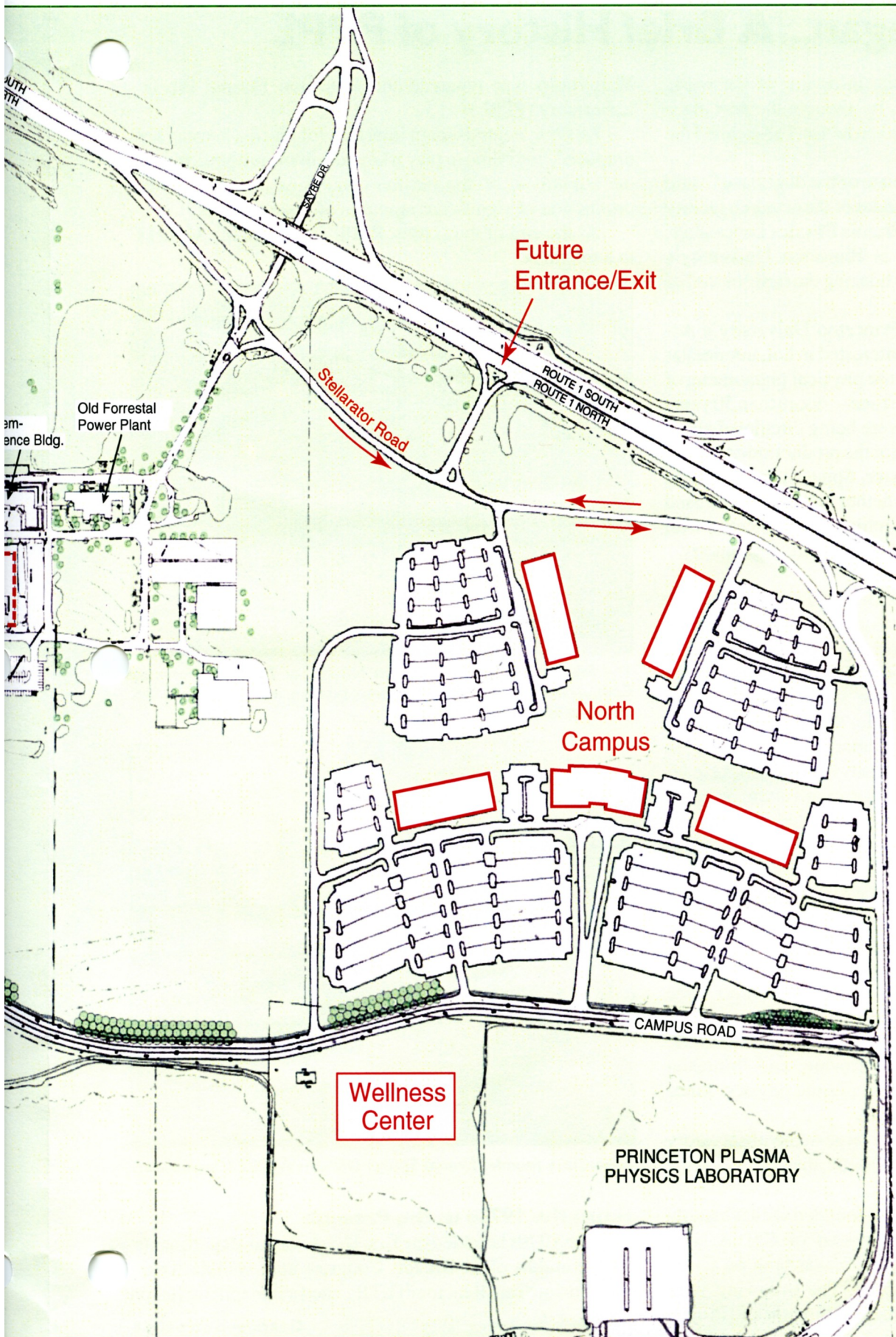
Currently on the drawing board is a thoroughfare that would provide the Laboratory with a direct connection to College Road. The proposed road would start near the old TFTR construction entrance on College Road East and end just outside the C-Site guard booth. The new roadway would, in essence, link College Road East to the new Campus Road, thus completing the integration of the Forrestal Research Campus and the Princeton Forrestal Center. ●



PPPL’s John Luckie looks at how materials are stored at ReCAP.

The Changing Face of Forrester





How It All Began...A Brief History of PPPL

It was very hush-hush. And the instigator of the work, astrophysicist Lyman Spitzer, Jr., thought the best place to conduct it would be in the “chicken house,” also called the “Rabbit Hutch.”

“It was either the chicken house or the doghouse,” said Spitzer in a 1980s interview. Founder of the research facility that evolved into the Princeton Plasma Physics Laboratory, he was referring to structures at Princeton University’s Forrestal Campus considered for housing the first controlled fusion experiments in the U.S.

Spitzer, then Chairman of Princeton University’s Astronomy Department, had been interested in hot, interstellar gases for many years, as well as the physical phenomena of thermonuclear explosions. At the time — more than 50 years ago — unsubstantiated reports were being circulated about fusion experiments in Argentina for the production of power.

An avid mountaineer and skier, Spitzer went skiing in Aspen, where he contemplated whether fusion could be used as a potential energy source. He returned to Princeton with the idea of magnetic confinement in a figure-8 geometry.

Princeton’s Controlled Fusion Effort is Born

In 1951, the Atomic Energy Commission approved the top-secret research, and Spitzer christened the work, “Project Matterhorn,” comparing the difficulty and challenges ahead to ascending a mountain. The first stellarator — or star generator as coined by physicist John Wheeler — was built at the James Forrestal Research Center. The land had been newly acquired by Princeton University from the Rockefeller Institute for Medical Research. The Rabbit Hutch, or Metal Building, where Rockefeller had conducted medical research, was chosen as the best place to locate the classified project. The structure at B-site that became known as the Matterhorn Building no longer stands; all that remains is a piece of level ground.

Several small-scale experimental models of stellarators were built there in the 1950s, beginning with the Model A Stellarator. Constructed by Spitzer and his co-workers in the early 1950s, it operated in a figure 8.

In 1958 fusion research was declassified. In addition, the field of plasma physics was growing, and Princeton awarded the first doctoral degree in plasma physics. Since then, nearly 200 have been awarded.

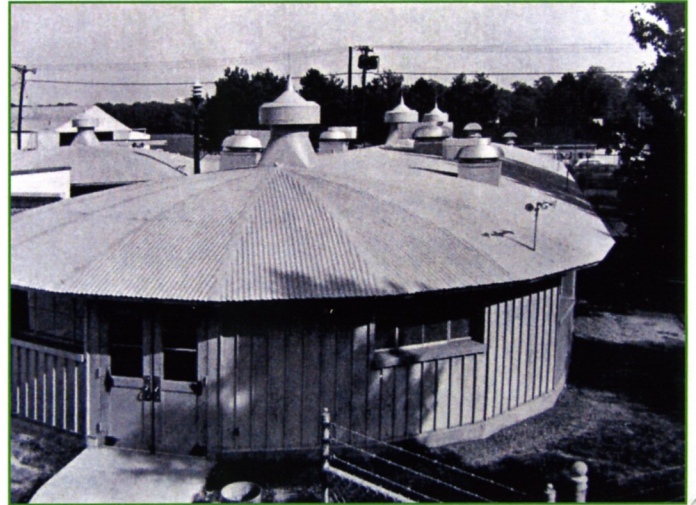
Spitzer, who also conceived a large-scale observatory that became the Hubble Space Telescope, died in 1997 at the age of 82.

By 1960, the laboratory that he founded with a handful of people, had grown to include a staff of 400. A large modern laboratory and office complex was built on C-site and housed the Model C Stellarator. The following year, Melvin B. Gottlieb succeeded Spitzer as director and Project

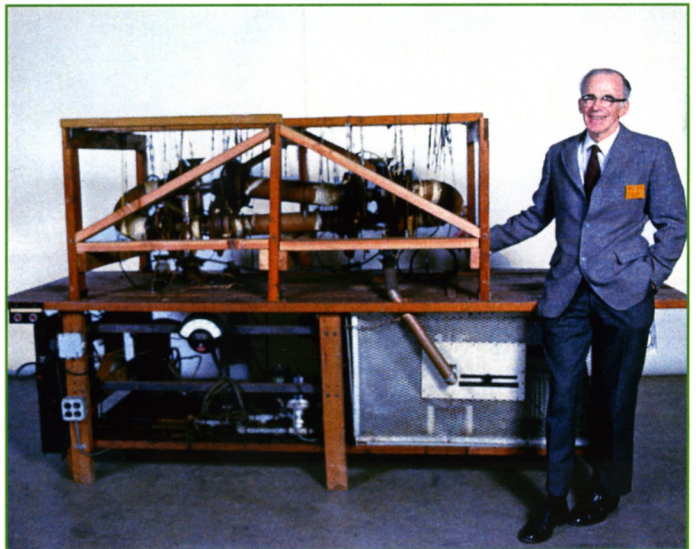
Matterhorn was renamed the Princeton Plasma Physics Laboratory (PPPL).

In 1964, neutral-beam injection for plasma heating was proposed, and came to play a key role in the progress toward the attainment of the plasma conditions required for the production of significant amounts of fusion power.

At the end of the sixties, PPPL converted the Model C to a tokamak.



The Project Matterhorn “Rabbit Hutch” at B-site on Forrestal Campus during the 1950s. The metal building housed the first U.S. fusion experiments.



Laboratory founder Lyman Spitzer with the Model A Stellarator.

From the 1970s to the Present

The 1970s heralded the first U.S. tokamak experiments. By the middle of the decade, Congress approved the Tokamak Fusion Test Reactor (TFTR), the first magnetic fusion

Continued on page 8

Book Marks 50th Year of Forrestal Campus

By Ruth Stevens

Fifty years ago this month, 450 people gathered in Plainsboro to dedicate Princeton's new James Forrestal Research Center. The acquisition of the 825-acre complex on U.S. 1 marked a critical juncture in the University's history, enabling it to become a leader in government-sponsored research.

The story of the people and events behind what is now known as the Forrestal Campus is chronicled in a new book, "Princeton's James Forrestal Campus: 50 Years of Sponsored Research," written by J.I. "Jim" Merritt and published by Princeton University. The book was printed in honor of the 50th anniversary of the campus, which began operating in the fall of 1951 and was dedicated on May 17, 1952.

Merritt said that Seymour Bogdonoff, the Robert Porter Patterson Professor of Aeronautical Engineering Emeritus, came to the University administration about four years ago with concerns about the Forrestal legacy. "He felt that many people didn't know what had gone on out at Forrestal and how important Forrestal had been to the University's research agenda over the years," Merritt said. "He was worried this history was going to be lost."

Merritt, a 1966 Princeton graduate, worked at the University for 24 years in a variety of administrative positions, including serving as a press officer in the Office of Communications. He was editor of the Princeton Alumni Weekly from 1989 to 1999. Over the course of his career, he had written many stories about the Forrestal Campus and science and engineering research at the University.

With the support of Robert Durkee, vice president for public affairs, Merritt began working with Bogdonoff on the Forrestal book in 1998. In addition to conducting interviews with Bogdonoff, who had been a faculty member since the 1940s, Merritt met with other early members of the aeronautical engineering department, did research in the University archives and read the memoir of Courtland Perkins, the second chair of the department.

The Man Behind the Name

The book begins with a profile of Forrestal, a 1915 Princeton graduate who was a successful investment banker on Wall Street for many years before pursuing a second career in government service. A Navy flier during World War I, he was named assistant to President Franklin Roosevelt in June of 1940 and undersecretary of the Navy two months later. In May of 1944, he became secretary of the Navy.

Following World War II, Forrestal played a major role in the government reorganization outlined in the National Security Act of 1947. The act created a National Security Council and put the three military branches under one secretary of defense, a position that Forrestal became the first person to

hold. He served for 19 months until March of 1949, when he had a mental breakdown. Forrestal committed suicide on May 22, 1949, by jumping out of a window at Bethesda Naval Hospital.

Despite his troubles in later years, Forrestal was viewed as a "man of conviction and achievement," according to the book. His creation of the Office of Naval Research in 1946 is considered by many one of his key accomplishments. Part of the office's mission involved providing grants to universities for basic and applied research.

"James Forrestal invented the Office of Naval Research — it got us started here at Princeton and is still the only item in the Navy's budget mandated by Congress," Bogdonoff told Merritt for the book. "Every research university ought to pay homage to him."

The book describes how Princeton's Department of Aeronautical Engineering began taking off in 1941 under the leadership of its first chair, Daniel Sayre. The faculty was expanding, enrollment was climbing and the department was building cinderblock laboratories below Palmer Stadium to accommodate research initiatives.

In 1948, the Guggenheim Foundation selected Princeton as one of two sites for its new Guggenheim Jet Propulsion Centers (the other was at Cal Tech), and the Air Force and Navy awarded the department a contract to produce a 12-volume series on high-speed aerodynamics and jet propulsion.

Serendipitous Sale

The department was quickly outgrowing its facilities. At about the same time, the Rockefeller Institute for Medical Research had decided to relocate from its U.S. 1 campus to New York City. Laurance Rockefeller, a member of the class of 1932 and of the department's advisory council, offered to help Sayre and the University negotiate with his family's foundation for the property.

"Like life in general, so much depended on timing and people being in the right place," Merritt said. "Sayre was tremendously important — he just had an instinct for this kind of thing. He was a very entrepreneurial guy."

Rockefeller and Sayre raised the \$1.5 to \$2 million needed to purchase and renovate the facilities, and the transaction was completed in early 1951. "A buzz of publicity followed announcement of the Rockefeller-Princeton deal," writes Merritt in the book. "A reporter for the New York Herald Tribune, noting that with a stroke of a pen the University had more than doubled the size of its land holdings, called it 'the second Louisiana Purchase.'"

Continued on page 8

Book

Continued from page 7

Although there was some controversy about naming the center after Forrestal because he had committed suicide, Rockefeller insisted on it and prevailed, according to the book. In addition to serving as the home of Princeton's aerospace and mechanical sciences research, the campus was the headquarters for Project Matterhorn, a classified initiative funded by the U.S. government that explored the use of fusion in building the first hydrogen bomb.

Concurrently, scientists were looking into harnessing fusion as a peacetime energy source. They were working with extremely hot ionized gasses, or plasmas, which are necessary for a fusion reaction. In 1958, Project Matterhorn was declassified and work continued under what became known as the Princeton Plasma Physics Laboratory.

Scientists built an immense device, the Tokamak Fusion Test Reactor, for their experiments. At its height in the 1980s, the fusion effort on the Forrestal Campus employed more than 1,000 people and occupied some 600,000 square feet of space, according to the book.

"Project Matterhorn was a top-secret operation," Merritt said. "That couldn't have happened without the isolation of Forrestal. As Matterhorn evolved into the PPPL, that couldn't have happened without the space that was needed because it became such a huge project. So it turned out that the acquisition of this land was very far-sighted on the University's part — I don't think anybody realized how far-

sighted at the time." The book also describes the construction and operation of the Princeton-Penn Accelerator on the Forrestal Campus. As its name implies, the state-of-the-art atom smasher was operated jointly by Princeton and the University of Pennsylvania. According to the book, the \$5.2 million operating budget of the Princeton-Penn Accelerator in the 1964 fiscal year approached the entire instruction budget for the University. The Plasma Physics Lab's budget for that year, at \$7.2 million, exceeded it.

The book goes on to describe various other kinds of research conducted on the Forrestal Campus — from efforts that contributed to the successful first lunar landing to work on understanding animal hearing. It also discusses the continuing government-funded work of three units on the property, the Geophysical Fluid Dynamics Lab, the Plasma Physics Lab and the Department of Mechanical and Aeronautical Engineering's Gas Dynamics Lab.

In addition, the book chronicles the venture the University undertook in 1973 with the Princeton Forrestal Center. The goal of the project was to influence the quality of development in the surrounding area and to generate income for the University's educational objectives. The University acquired additional land to bring its holdings in the area to 1,600 acres. The 76-page book, which is illustrated with historical photographs, is available for \$10 from the Office of Communications at the University. ●

This article was published in the May 20 edition of the Princeton Weekly Bulletin.

History

Continued from page 6

device in the world to conduct experiments with a 50/50 mixture of deuterium-tritium (D-T). In late 1975, experiments on the Princeton Large Torus began, and during the summer of 1978 the machine set a world-record ion temperature of 60 million degrees centigrade using neutral-beam heating.

In 1981, Harold P. Furth succeeded Melvin Gottlieb as director, and on Christmas Eve of 1982, TFTR produced its first plasma. In 1986, neutral-beam heating experiments on TFTR produced new world-record ion temperatures of approximately 200 million degrees centigrade — more than 10 times the temperature at the center of the Sun.

In the 1990s, TFTR set a string of world records. In 1990, the machine produced ion temperatures of 400 million degrees centigrade and 60,000 watts of fusion power. In 1993, TFTR achieved a world-record 6.3 million watts of fusion power in the world's first magnetic fusion experiments with a 50/50 mixture of D-T. In 1994, the machine produced a new world record of 9.2 million watts of fusion power, and seven months later broke its own record by

producing 10.7 million watts of fusion power. The next year, TFTR achieved a world record temperature of 510 million degrees celsius.

During this decade, Ronald Davidson became the fourth director of the Laboratory (1991), followed by Rob Goldston in 1997, the same year experiments on TFTR concluded. By 1999, the construction of the National Spherical Torus Experiment (NSTX) was completed and the machine created its first plasma.

Presently, PPPL is on 72 acres of the Forrestal Campus and employs 500 people, not including about 90 limited duration employees and 30 subcontractors, 35 graduate students, and a varying number of visiting research staff.

And new research is on the boards based on historic ideas. Stellarators are back, thanks to major advancements in computing. Congress is presently considering funding for the National Compact Stellarator Experiment (NCSX) to be sited at PPPL. ●

Compiled and edited by Patti Wieser. Sources: Earl Tanner's informal histories of the Lab and Princeton Alumni Weekly.