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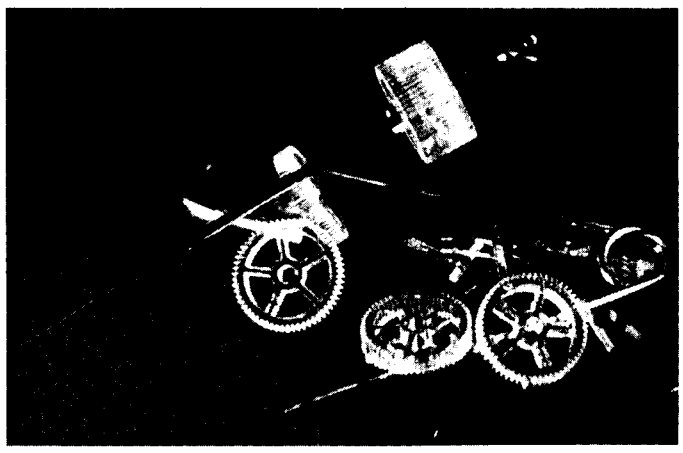
BROOKHAVEN NATIONAL LABORATORY

At NSLS: From 'Big Machine' to Tiny, Precision-Machined Parts

Imagine a simple electromechanical watch made of parts machined with such precision that it would last three times longer than a conventional watch before requiring battery renewal.

Such a watch is only a small example of the advantages expected from a new machining technique now being developed at BNL's National Synchrotron Light Source (NSLS).

Drawing on lithographic methods similar to those used by the microelectronics industry to make such micron-size mechanical components as motors the size of a pinhead, tiny medical instruments to facilitate eye surgery and accelerometers to trigger the release of air bags, the BNL machining technique produces mechanical components that are several centimeters in size but match the precision of micromachines.



A sewing needle and a safety pin provide the scale reference for a variety of miniature gears produced at the National Synchrotron Light Source using a new precision-machining technique developed by BNL and University of Wisconsin at Madison researchers.

Peter Siddons (standing) and Erik Johnson, both from the National Synchrotron Light Source Department, use a scanning electron microscope to examine a test object they produced using their new precision machining technique.

Photo above by Peter Horton; photos right and bottom by Roger Stoutenburgh

Revolutionary Technology

"This combination of large scale and high precision has no parallel in industrial processing," said NSLS physicist Erik Johnson. "Successful development of this idea into a full manufacturing process could give U.S. industry a real advantage in the precision-machining area."

Added physicist Peter Siddons, NSLS, "This new technology, if carried through to production scale, would be revolutionary, allowing three-dimensional objects to be machined with submicron precision."

At beam line X27 at the NSLS, Johnson and Siddons, in collaboration with Henry Guckel of the University of Wisconsin at Madison, have produced test objects, such as gears with dimensions of about one centimeter and square holes, which measure one millimeter by one millimeter by ten centimeters, without sacrificing precision. This new machining technique opens the door to new applications, such as high-precision transducers and miniature optical devices.

A New Kind of Lithography

Micromachines are fabricated based on lithography that uses ultraviolet light or low-energy x-rays to pass through a series of thin masks that hold the detailed pattern of the microelectronic circuits in the devices. Subsequent processing transfers the pattern onto silicon.

The new precision-machining method relies on lithography with a new twist: The use of high-energy x-rays to make the exposure.

"We use x-rays with a peak energy of 20 kilo electron volts," Siddons said. "Since x-rays at this energy can penetrate thick structures, relatively large objects can be fabricated, without any loss of precision."

In this new process, the x-rays pass through a material sensitive to them, usually PMMA, a type of Plexiglass. Areas of the material that have been exposed to x-rays can be dissolved away, while the other areas remain.

Since PMMA is not an ideal engineering material, the remaining structure is used as a mold for depositing metal electrolytically. The resulting metal structure may be used as is, or it may become a mold for replicating parts in plastic.

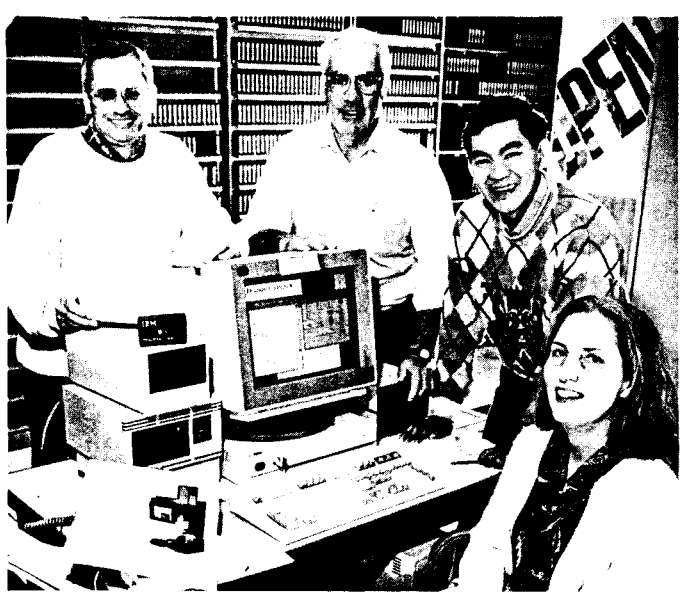
NSLS Research Advantages

Siddons said the NSLS is ideal for this work because it has an optimum range of x-ray energies, a small x-ray source, and an exposure station close to the source point, which makes possible high-intensity x-rays, short exposures and high resolution. Also, other important resources are available at BNL for examining the precision machines once they are produced, such as precision optical measurements, x-ray microprobes and other spectroscopic techniques for materials characterization.

"Our initial experiments have been very successful," Siddons concluded, "but there are still many details that need to be understood before the process can be used in routine production. Still, it is clear that there is plenty of potential for exciting new devices to come out of this technology."

— Diane Greenberg

How Ya Gonna Keep 'Em Down on the PC After They've Seen the Compute Farm?



Standing by Eieio, the computer that manages the Compute Farm, are: (from left) Andrew Como, Edward McFadden, Toan Nguyen and Susan Sevian, all of the System Support Services group in the Computing & Communications Division.

Ed McFadden had a farm,
E-I-E-I-O . . .
And on that farm,
He has an IBM RISC System/6000 model 590,
E-I-E-I-O . . .

Obviously, Ed McFadden of the Computing & Communications Division (CCD) is not your typical farmer — and his farm doesn't grow small potatoes.

The farm that McFadden oversees and Andrew Como maintains is called the CCD Compute Farm. Instead of crops, McFadden plants "seed machines" — some of the newest and most powerful computers that manufacturers have to offer, which have been loaned free of charge for use by anyone at the Lab who needs the computing power of these high-performance, UNIX-based machines.

The latest seed to be planted in the Compute Farm is the IBM RISC System/6000 model 590 (RS/6000 590)— which is not only IBM's most powerful RISC machine, but the most powerful computer on the farm to date.

With 130 megaflops of computing power and 128 megabytes of memory, the RS/6000 590 allows for up to eight operations and six instructions per computer clock cycle — outdistancing its closest rivals, as well as all other RS/6000 models.

Planted in the compute farm on February 2, the RS/6000 590 will remain rooted there for at least three more months, complementing the farm's other seed machines (see chart).

For the future, Cray Research has expressed interest in introducing its parallel vector processor to the BNL scientific community. One of the machines being considered for a loan is the Cray EL92, a UNIX workstation with two central processing units (CPUs) and 130 megaflops per CPU, which delivers Cray Y-MP and C90 binary capability.

"Given the wide variety of vendors and UNIX workstations, it is difficult and expensive for users to keep up with the constantly changing technology," explains Susan Sevian, who leads CCD's System Support Services (SSS) group. "So, the Compute Farm is a way that CCD can help."

Besides giving users a chance to test-drive the latest workstations before investing in one, the Compute Farm is another way "for CCD to fulfill its mission of providing support to the distributed computing environment at BNL," says CCD Head Mark Weisenberg.

Specifically, the Compute Farm provides contingency computing,

(continued on page 3)

Coming Up

Physicist Paul O'Connor, Instrumentation Division, will deliver the next Brookhaven Lecture on Wednesday, March 16. His talk on "Chips off an Old Block: Custom-Integrated Circuits for Science" will begin at 4 p.m. in Berkner Hall.

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The critically acclaimed Verdi Quartet will perform the last concert of the 1993-94 BERA Concert series on Thursday, March 17, at 8 p.m., in Berkner Hall. The originally scheduled Fresk Quartet had to cancel its appearance that evening due to the illness of one of its members.

Purchase tickets at the door for $14 general admission, $9 for students and people over 65, and $5 for youths under 18.

Help Science Defeat Disease — Volunteer for PET Research!

The ad appears every once in a while in the *Brookhaven Bulletin*, unobtrusively taking up an inch or so of space with its matter-of-fact request. "Volunteers Needed," it reads, "for participation in brain-imaging studies. A fee will be paid."

But what happens when prospective volunteers respond to the ad? The *Bulletin* asked Naomi Pappas, Medical Department, who coordinates the volunteers for studies at the Positron Emission Tomography (PET) facility of the Chemistry Department.

Volunteers, she explained, are needed to act as controls for brain-scan studies of various brain-related illnesses, including alcohol and cocaine abuse, Alzheimer's disease and Parkinson's disease.

Controls are the "normal" subjects whose brain scans provide a reference point for the PET scientists when they examine the brain scans of patients, many of whom are from the Northport Veterans Administration Hospital or the New York University Medical Center. The scanning itself tracks the activity of neurotransmitters, chemicals that act as messengers between the brain's nerve cells, and provides quantitative measurements of brain metabolism.

By volunteering for the studies, Pappas explained, BNLers and others help scientists in their quest to understand and treat debilitating diseases.

"Some of the studies have a lot of value for finding out how to treat alcohol and cocaine abuse, and what is done to the brain by abuse," Pappas said. "Through others, we have learned things about medications for Parkinson's disease that have yielded better treatment."

And, apart from getting a good feeling, volunteers are paid $100 for each day they participate in the study.

So if you were to call Pappas to volunteer, what would happen? First, she said, she explains to callers that PET scanning involves a small dose of a radioactive isotope of an element such as carbon or fluorine, which is administered by way of a catheter in the arm. The isotope is made in Chemistry's Cyclotron, and emits a low level of radiation only long enough to complete a scan. The entire dose is equivalent to that received in a set of chest x-rays or a diagnostic hospital procedure.

Roger Stoutenburgh

At BNL's Positron Emission Tomography facility, nurse Joyce Vail and orderly Theodore Johnson prepare a volunteer for scanning as (rear, from left) physician Gene-Jack Wang, medical associate Naomi Pappas and technician Don Warner look on from the control room.

Because the study involves humans, radiation and sometimes small doses of prescription drugs, the doctors, nurses, technicians and scientists at PET take extra care to ensure the safety of volunteers and patients.

Their actions are overseen by others who also have safety in mind, including BNL's Human Study Review Committee, as well as the agencies that fund the research. And each volunteer or patient must read, understand and sign consent forms. The details are explained to them by a physician.

Because the studies' results depend on accuracy and uniformity, Pappas continued, prospective volunteers are carefully chosen and prepared. Once that is done, the volunteer is scheduled for his or her appointment, with the supervisor's approval if the volunteer is from BNL. When the date arrives, Chemistry technicians first custom-make a head holder that conforms to the shape of the volunteer's head and will help keep it from moving during the scan.

Next comes a preliminary scan. With a doctor, one or two nurses and other staff on hand at all times, the volunteer's head is marked with a temporary marker that helps the PET staff line it up in the correct position to be scanned. Sometimes, Pappas said, BNL volunteers go back to work between the two scans, still wearing their purple line markings.

Right before the PET scan, a short-lived isotope is produced on one of the Chemistry Department cyclotrons. Chemists work rapidly to incorporate the isotope into a radiotracer, which tracks a particular biochemical process or follows the distribution of a drug in the body.

Once the tracer is ready, it's time for the real PET scan. The intravenous line and blood catheter are inserted in the volunteer's arm, and he or she is positioned, lying down, with his or her head immobilized in the custom holder. As the isotope seeks out the relevant parts of the brain, technicians in the control room start the scan, which is done in a donut-shaped scanning ring.

Pappas emphasized the staff's attention to volunteers' comfort and safety. "The nurses and physicians are excellent, and many patients and volunteers comment on how well they're treated [see sidebar]," she said. "We explain to people, as we're proceeding, what will be happening."

Scans can take anywhere from 20 to 90 minutes, Pappas said, after which the IV lines and purple markings are removed, and the volunteer gets a hearty lunch from the Cafeteria. Any remaining isotope decays quickly, and only an infrequent small bruise from the IVs may show that the person has been scanned.

Many volunteers return to the PET center for another PET study, Pappas said, and others refuse to take the volunteer fee. But in all cases, volunteers know that they have contributed to important medical research that will help others.

So, if you're a man or woman over 20 years of age, or an identical twin over 18, and your supervisor can spare you for a day, give Naomi Pappas a call at Ext. 2694 and become a PET volunteer. — Kara Villamil

A Volunteer's View

In addition to calling for paid volunteers through the Bulletin, the PET researchers have done so through collaborators at the Northport Veterans Administration Hospital. That's how Corey Aaron Burkes III of Cambria Heights happened to become a volunteer in January, an experience he found very positive, as he related in this letter to the Editor:

January 23, 1994

How could I resist? An unpublished writer, just starting out, with a wife, child and creditors to feed allows few options. . . . My place was behind a word processor, even if it didn't immediately put food on the plate. Neither would a temporary lab experiment, but I've always sought opportunities to research for future manuscripts, and a little money on the side wouldn't hurt.

. . . Dr. Gwenn S. Smith returned my call and recited the process of the research, step by step, using terminology as foreign to me as Latin scriptures. . . . Originally, I only recognized scary key worlds such as isotope, radioactive, intravenous and CAT scan. To my surprise, Dr. Smith didn't hesitate to reiterate in simpler terms, allowing me to grasp the situation effectively.

I was to participate in a study to measure changes in the amount of a specific chemical in the brain. This would be accomplished by injecting a drug called Raclopride in a vein, while the brain was scanned carefully for a little over an hour. From my other arm, they would extract blood samples to evaluate the amount of radioactivity in the blood. All this would help in the study and eventual cure of schizophrenic patients.

. . . A couple of days after the initial paperwork and a brief evaluation to see if I would be a suitable subject, Dr. Smith picked me up . . . and escorted me to Brookhaven. All the way, she detailed each portion of the upcoming study, answering any questions I had.

[At Brookhaven], I was introduced to Dr. Smith's collaborators: Jonathan Brodie, Theodore Johnson, Noelwah Netusil, Naomi Pappas and Donald Warner. Each immediately made me feel as if I had never left home. Any question I had was carefully listened to and answered in words I could relate to. By no means were they ever condescending. . . . for the duration of my visit, they professionally equalized medical jargon with "common level" descriptions so I never missed one part of what was going on.

Dr. Smith returned me to my home . . . with a few reprints of paperwork I signed, a Polaroid photo of the chemical reaction in my brain, copies of articles relating to the study and a wellspring of experience I had never been exposed to before. Outside of that, Dr. Smith turned out to be a nice, new friend.

. . . It is two weeks since I met these wonderful people. . . . They made me feel important and managed every effort to see that my safety was truly job #1, from bringing in Stephen Vitkun, a very prestigious anesthetist, to seeing what I would like to eat after the research was complete.

I'm writing to commend [them] for treating me with respect, professionalism and getting me involved in their exciting, productive work.... They made me regret coming for the money. . . . When you think of what they are doing and how it may bring a great deal of suffering to an end, I believe we will have a solution to neuropsychiatric disorders in due time. A lesson can be learned from this team. . . . Thank you to each one.

In Memoriam

Richard Seebeck, a technical research associate and supervisor in the Chemistry Department's Electronics Shop, died on February 17. He was 54.

Hired as an intermediate technician in Chemistry on September 1, 1961, Seebeck had earlier held two temporary positions as a laboratory assistant in the then Nuclear Engineering Department during 1958 and 1959. He was promoted through the years to his final position in September 1989.

Said Chemistry Department Chairman Norman Sutin, "Almost every laboratory in the Chemistry Department has some circuitry that Dick either designed or built. These serve both as reminders and tributes to him. He will be very much missed."

Jim Cumming, Seebeck's supervisor, added, "Research in our department requires electronics support in diverse areas, ranging from design and construction of specialized equipment to routine maintenance and repairs. Over the years, I came to depend on Dick to interface smoothly with individual staff members, to identify their needs, develop solutions and guide the timely flow of work in our Electronics Shop. His proficiency led to his being assigned as the supervisor of that shop in 1992. We will miss not only his professional contributions, but also his personal presence, which served to brighten our department."

A resident of Jamesport, Richard Seebeck is survived by his wife Georgianna, sons Richard Jr. and Eric, who is employed in BNL's Safety & Environmental Protection Division, and grandson Richard III.

Snow Sculptors

The sculptors of the "A-Pairently Happy Snow Pair" that a-paired in the Bulletin of February 18 have been identified. They are Carin Ashjian, Craig Neill, Jeff Yablon and Sharon Zuhoski, all of the Department of Applied Science.

Note to Employees:
Attendance at lectures, meetings and other special programs held during normal working hours is subject to supervisory concurrence.

Learn to Lindy, Pick a Polka

With its early class almost full, the BNL Dance Club is forming a second class for beginners to learn to lindy and polka. The class will be held from 6:30 to 7:30 p.m. for eight Wednesdays, beginning March 23, and will be taught by the club's instructors, Giny Rae and Peter Sciurca, who are Empire State Ballroom champions.

A minimum of 44 people is needed to run the class, and the cost per person will be $20. BNL employees, retirees and those employed by on-site contractors, plus their spouses, dance partners and friends are all welcome.

To register, call Marsha Belford, club president, Ext. 5053, by Friday, March 18.

Focus on Jones: One-Woman Art Show

With clear-cut, powerful oils, subtly nuanced drawings and a colorful haziness of monoprints, Helen Smith Jones demonstrates the versatility of her creative vision in a one-woman art exhibition that starts this Sunday.

Entitled "In and Out of Focus," the exhibition will run at the Unitarian Bay Gallery, Browns Lane, Bellport, from 2 to 5 p.m. on the Sundays of March 6, 13, 20 and 27, with an opening reception on March 6.

"And it all began with a BNL Employee Art Show!" said Jones, who is a senior technical secretary in the Instrumentation Division.

So many people told Jones how much they'd enjoyed seeing *Pop*, the oil portrait of her father that she had entered in the 1988 show sponsored by the BERA Art Society, that she entered it in the South Bay Art Association's Memorial Weekend Show the next spring. There, the painting took first place in its category and was also voted most popular in show.

Along with the other ribbon-winning artists' works, *Pop* was displayed in the Hauppauge office of Patrick Halpin, the Suffolk County Executive at that time. And, soon afterwards, Jones was invited by the Unitarian Bay Gallery to give a show of her own.

"Since then," Jones said, "I have spent all my spare time producing enough work to be shown." Also, for the past two months, she has used a vacation day each week to finish her work and arrange for framing. "I have been very lucky in that everyone in my division has been extremely cooperative with this schedule," she said.

Roger Stoutenburgh

Helen Smith Jones with some of her work.

At BNL, Jones uses her artistic talent not only to create the posters and programs for the Art Society shows, but also, to design a new desktop publication, *Pulse*, for the Instrumentation Division, and, most recently, an innovative poster for a conference on laser light instrumentation. — Liz Seubert

Disney Openings Still Available

There are still openings for the BERA-sponsored, seven-day, six-night trip to Disney World in Florida, September 28 to October 4.

The discounted group-package rates per person are as follows:

4 adults/rm.	$798	child age 10-17*	$592
3 adults/rm	$840	child age 3-9*	$536
2 adults/rm	$925	child age 2	$316
1 adult/rm.	$1,257	child under 2	no cost

**Rates for ages 3-17 are applicable only when children occupy room with adult (s); maximum five per room, six with child under 3.*

Reservations are now being taken on a first-come, first-served basis. To reserve your space, contact Recreation Supervisor M. Kay Dellimore, Ext. 2873, Bldg. 185. A deposit of $100 per person is required.

The trip rates include: round-trip airfare between Islip and Orlando via USAir, six nights at Disney's Dixie Landings Resort, unlimited admission and use of attractions, and much more!

For more details, call Dellimore or Andrea Dehler, Ext. 3347.

Bowling

Red/Green League

R. Mackinnon bowled a 236/225/641 scratch series, M. Guacci 236/604 scratch, J. Goode 219, H. Dawson 212, K. Asselta 203/202, K. Koebel 201, E. Larsen 201, R. Raynis 201, R. Wiseman 201.

Purple League

Norm Besemer 232, Ben Belligan 227/215/629 scratch series, Manny Dador 215/213/620 scratch, Maria Yanez 196 and the 4/6/7/10 split, Tirre Farmer 195, Linda Farmer 193, Maryann Reynolds 186/170, Phyllis Fewell 181.

Film badges will be changed tomorrow. Please place your badge in its assigned rack space before leaving work today.

Raft Trip Sign-Up

For the umpteenth consecutive year, the BERA Whitewater Rafting Club is organizing its annual raft trip. This year's rafting will be in West Virginia on the Gauley River, a world-class river with a rating of class IV to V+ on a scale of I to VI (highest).

The trip will take place September 23-25, with one day for rafting and two days for travel. Participants must be a minimum of 16 years old and, although experience is not required, it is recommended. The price of the trip includes two nights of hotels, rafting, one breakfast, a lunch on the river and a steak dinner following the rafting.

The BERA Whitewater Rafting Club's 1991 trip on the Gauley River was fun for all. Sign up now for this year's trip.

The two rafting options are: 5-6 hours on the Upper Gauley, or 8-9 hours on both the Upper and Lower Gauley — the Gauley Express. Bus transportation to West Virginia will be available, first come, first served.

Per person costs for the trip are based on double occupancy, and roommates can be arranged: Upper Gauley $210; Gauley Express $275; bus $50.

To make a reservation, send a $50 deposit to Sue Norton, Bldg. 830M, by March 15. For more information, call Norton, Ext. 3492; Ken Sutter, Ext. 4514; or Wally Hughes, Ext. 4669.

Compute Farm (cont'd)

which users can call upon when their computing jobs are more than their desktop workstations or other on-site computers can handle at the time. Users can also employ Compute Farm machines to debug programs written to run on large, off-site supercomputers because time on those larger computers is more limited and expensive.

Besides all this, CCD is attempting to gauge its users' needs, in terms of computer architecture, power and usage frequency.

"The computer vendors like the Compute Farm because it is a showcase for their latest top-of-the-line machines, and because it allows users to test computer hardware and software that they may not have considered before," adds McFadden.

The 100 registered users work the Compute Farm using what is called the Dynamic Network Queuing System (DNQS), a program developed at McGill University that allocates the farm's resources. Installed on users' workstations, DNQS farms out computing jobs among the farm's computers so that "users don't have to know too much about about which computer is doing their job," says Sevian.

Based on requests from users of the Compute Farm, Toan Nguyen, a former SERS student who now works within SSS, significantly modified DNQS to meet the needs of the BNL scientific community. As a result of the success of this program, CCD has installed DNQS on smaller farms around site.

Top user of the Compute Farm is Harold Kirk, Physics, who runs a program simulating the electrons emitted from the radio-frequency (rf) gun used as the electron-beam source at the Accelerator Test Facility (ATF).

"We are interested in producing the brightest beam possible," explains Kirk, "And our results running a beam-dynamics code called PARMELA have been very encouraging: In simulations, we have been able to obtain better emittances than we have actually obtained so far." These results are being used to build a new rf gun and injection system at the ATF.

According to Kirk, one of the values of Compute Farm is its ability to process batches of information quickly. Comments Kirk, "I submit a job, go away, come back and it's done. Based on the last run, I change the parameters and resubmit the job. My alternative is to run the job on the VAX cluster, but my jobs run faster using the Compute Farm."

Another one of the Compute Farm's top-ten users is Carmen Benkovitz, Department of Applied Science. "We use the Compute Farm sporadically, mostly to debug and do short runs of a tropospheric sulfate transportation and transport code — and our experience has generally been very positive," says Benkovitz, who uses a Cray supercomputer at Lawrence Livermore Laboratory for production runs of the code. "The Compute Farm is a good resource because it wouldn't be practical for us to use our SUN workstations, and our time on the Cray is limited."

According to Sevian, statistics gathered on the Compute Farm's usage are analyzed monthly. "This way, we know which machines are most popular, so this helps us make the most valid decisions about future computer purchases," she says.

To use the Compute Farm contact McFadden, Ext. 4188, or E-mail emc@ax61.bnl.gov. "Computer vendors continue to express interest in planting their newest and most powerful workstations in our Compute Farm, so stay tuned for expansions and improvements," concludes McFadden. — Marsha Belford

Seed Machines in CCD Compute Farm

Vendor	CPUs	Model number	Megabytes	Megaflops
HP	2	9000/735	160	50
IBM	8*	370, 560, 580, 590	64 to 256	25 to 130
SGI	4	4400 Challenge L	256	160
SUN	1**	Spark 10/41	96	18

* 5 owned by BNL, ** owned by BNL

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Cooking Exchange

The BERA Cooking Exchange will hold its next monthly meeting on Thursday, March 10, at 11:45 a.m., in the Recreation Building. All are welcome come to sample a variety of tasty dishes and meet new friends. A donation of $2 per adult is requested, and baby-sitting will be provided for $1 per child. For more information, call Megumi Akiba, Ext. 1061.

Rifle & Pistol Club

The next scheduled meeting of the Rifle & Pistol Club will be Wednesday, March 9, in Bldg. 911, Room 202, starting at noon. Anyone interested in club activities, call Otto Jacobi, Ext. 3471.

Equipment Demo

Contech Instrumentation will sponsor two 1-hour technical symposiums, "DSP Solutions," on Wednesday, March 9, at 10 a.m. and 2 p.m., in Berkner Hall.

Each symposium will be presented by Mario Schiavone of Pentek, who will show Pentek's latest in DSP, data acquisition, I/O and software-development products.

To reserve a seat, call Contech, (908) 560-0702.

Basketball

Games of February 17

Scram 46		Knicks 44	
Tim Powers	19	Greg Mack	14
Al Boerner	10	Rich Domenech	10
Victor Cassella	4	Chris Ingoglia	7
Ken Johnson	4	Ed Gregory	5
Steve Nappi	4	Dan Delgado	4
John Skonieczny	3	Al Langhorn	2
John Duggan	2	Tom Snow	2

Three-point shots: Powers (3), Boerner, Domenech, Ingoglia

Magic 62		Deep Six 49	
Terrence Buck	20	Tracy Fountaine	14
Troy Mayo	13	Neil Tyler	12
Raymond Jackson	9	Brian Hobson	8
Jim Garrison	6	Charles Kirkland	5
Neil Donahue	5	Tony McGill	5
Mitchell Williams	5	Dwayne Eleazer	3
James Rank	2	Ed Taylor	2
Carlos Victoria	2		

Three-point shots: Hobson (2), Fountaine, McGill, Williams

Games of February 24

Magic 82		Knicks 53	
Terrence Buck	21	Rich Domenech	19
Troy Mayo	15	Chris Ingoglia	10
Mitch Williams	12	Greg Mack	10
James Rank	9	Dan Delgado	6
Neil Donahue	8	Ed Gregory	5
Derrick Hoggard	7	Mike Parks	3
Raymond Jackson	5		
Jim Garrison	3		
Patrick Browne	2		

Three-point shots: Domenech (5), Williams (2), Ingoglia, Mayo, Buck, Garrison, Gregory

Runaways 79		Scram 65	
Ed Meier	21	Tim Powers	19
Pete Ratzke	20	John Skonieczny	16
Jerry Gaeta	18	John Duggan	12
Jim Desmond	16	Victor Cassella	10
Chris Saxen	4	Steve Nappi	6
		Alan Jones	2

Three-point shots: Powers (3), Meier (2), Gaeta

Cafeteria Menu

Monday, March 7	
Soup: Chicken noodle	.80/1.10
A la Carte: London broil w/mushrooms	3.65
Fitness: Tortellini & meatball Parmesan	3.35
Deli: Pastrami sandwich	2.95
Grill: Reuben platter	2.95
Salad: Chicken & cantalope	
Tuesday, March 8	
Soup: Cream of mushroom	.80/1.10
A la Carte: Dijon chicken w/mushroom	3.65
Fitness: Pasta w/marinara sauce	3.20
Deli: Roast beef sandwich au jus	2.95
Grill: Western omelet w/fries	2.35
Salad: Seafood chef's	
Wednesday, March 9	
Soup: Bavarian lentil	.80/1.10
A la Carte: Herb-crusted pork loin	3.65
Fitness: Tomato-broccoli casserole	3.25
Deli: Virginia ham sandwich	2.95
Grill: Italian cheesesteak	2.95
Salad: Mixed fruit	
Thursday, March 10	
Soup: Cream of spinach	.80/1.10
A la Carte: Italian steak pizziola	3.75
Fitness: Tarragon-lime chicken	3.50
Deli: Corned beef sandwich	2.95
Grill: Ham & broccoli	2.75
Salad: Green goddess	
Friday, March 11	
Soup: Boston seafood chowder	.80/1.10
A la Carte: Display cooking—Oriental entree	
Fitness: Saffron flounder & mussels	4.25
Deli: Roast turkey sandwich w/gravy	2.95
Grill: Fried shrimp boat	3.25
Salad: Chilled turkey	

Volleyball

Standings as of February 16

Open League		League I	
Me and the Boys	36-18	Rude Dogs	46-8
GTEAM	36-18	Upfagrabs	34-20
The Roofing Co.	34-20	Network News	28-26
Far Side	24-30	Underdogs	18-36
Penetrating Vollies	5-49	Fornossing	9-45

League 1		League 3	
Safe Sets	38-7	Jolly Vollies	31-14
Nuts & Bolts	29-16	Silver Bullets	30-15
Mon. Night Live	29-16	Take Five	28-17
Net Wits	28-17	Slow Hands	23-22
Fossils	25-20	High Volley'em	14-31
Spiked Punch	14-31	Upton Ups	9-36
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Arrivals & Departures

Arrivals

Jonathan R. Kotcher ..... Physics
Cathleen B. Lavelle ..... Adv. Tech.
Hong Li ..... Biology
George C. Pappas ..... AGS
Laurie M. Pearl ..... Comp. & Comm.

Departures

This list includes all employees who have terminated from the Lab, including retirees:

Gary J. Heyman ..... Plant Eng.
Edward C. Jackle ..... Cent. Shops
Gary J. Kaczmarczyk ..... Plant Eng.
Salvatore N. Morano ..... Biology
Phillip Thomason ..... Plant Eng.

Classified Advertisements

Placement Notices

The Laboratory's placement policy is to select the best-qualified candidate for an available position. Consideration is given to candidates in the following order: (1) present employees within the department/division and/or appropriate bargaining unit, with preference for those within the immediate work group; (2) present employees within the Laboratory; and (3) outside applicants. In keeping with the Affirmative Action plan, selections are made without regard to age, race, color, religion, national origin, sex, handicap or veteran status.

Each week, the Personnel Division lists new placement notices. The purpose of these listings is, first, to give employees an opportunity to request consideration for themselves through Personnel, and second, for general recruiting under open recruitment. Because of the priority policy stated above, each listing does not necessarily represent an opportunity for all people.

Except when operational needs require otherwise, positions will be open for one week after publication.

For more information, contact the Employment Manager, Ext. 2882, or call the JOBLINE, Ext. 7744 (282-7744), for a complete listing of all openings.

SCIENTIFIC RECRUITMENT - Doctorate normally required. Candidates may apply directly to the department representative named.

SCIENTIST - Trained in physics or chemical physics, with a specialization in nuclear-materials detection and measurement within the context of arms-control and safeguards programs. Ability to obtain and maintain a U.S. Department of Energy security clearance is required. Contact: Joseph Indusi or James Lemley, Department of Advanced Technology.

POSTDOCTORAL RESEARCH ASSOCIATE - Trained in chemistry or related discipline to join a team engaged in interdisciplinary geochemical and environmental research. Requires use of synchrotron radiation-based x-ray absorption spectroscopy as an analytical tool for determining chemical species in study samples. Knowledge of geochemistry and environmental chemistry is highly desirable. Contact: Murthy Vairavamurthy, Department of Applied Science.

Motor Vehicles & Supplies

92 PROWLER CAMPING TRAILER - 24', sleeps 6, cac, microwave, awning, stereo, rubber roof, cable TV, used 4 times, $12,000. Bill, Ext. 2762 or 665-3782.

92 CAVALIER - 16k mi., a/t, ac, am/fm cass., anti-lock brakes, p/l, $8,900. John, 821-6587.

92 MAZDA 929 - lux. sedan, full power, all options, 16k mi., $1,500 + bal. of lease; '89 Hyundai Sonata, 60k mi., new tires/exhaust, ask. $3,500. Frank or Jo, 737-1636.

91 CAPRI - red convertible, 37k mi., loaded, anti-theft, a/t, ac, p/w, p/l, gar., excel. cond., $7,500. Jan, 751-6734.

88 ISUZU TROOPER LS/GS - ac, am/fm stereo cass., p/s, p/b, 68k mi., excel., $6,800. Donna, 924-5062.

88 FORD ESCORT GL - 62k mi., ac, a/t, $2,500 neg. Ramesh, Ext. 3267.

87 BLAZER S-10 - wrecked, sell whole or parts, motor, tranny, tires & rims, interior, etc. Fred, Ext. 5319.

86 HONDA ACCORD - 4-dr., front-end damage, good for parts, $300 or best offer. Reg, 979-2936.

85 FORD LTD - ac, am/fm, asking $800. Aharon, 821-6856.

85 FORD TEMPO - good station car, $600 neg. Ed Sierra, Ext. 4080.

85 OLDSMOBILE CALAIS - blue, $1,000. Ext. 1229.

83 AUDI 5000 - 4-dr., $2,200. M.A. Bender, Ext. 3570.

82 NISSAN MAXIMA - many new parts inc. tires, muffler, trans., good cond., $2,000 neg. Marie, Ext. 2868.

81 AUDI 5000S - runs, good cond., sunroof, high mileage, $1,200 firm. Chas, Ext. 5462.

The Brookhaven Bulletin is printed on paper containing at least 50 percent recycled materials, with 10 percent post-consumer waste.

81 PONTIAC TRANS AM - 4-spd., Hurst trans., good body, engine needs work, $800 neg. Brian, 331-9826.

81 GMC CIERA TRUCK - 2500 series, 4wd, $10,000 invested, sacrifice, $5,500 neg. Kris, 581-8438.

77 VET STINGRAY - white, T-top, 350 eng., Kenwood stereo, excel. cond., $6,500. Norman, Ext. 2705.

73 VW THING - need restoration, $300. Ext. 3751 or 589-5490.

TRANSFER CASE - Chevy model 203, w/201 ratio, excel. cond., $175 neg. Frank, Ext. 2343 or 732-5950.

LIGHT BAR - chrome, fits top of full & mid-sized pickup trucks, $25. 924-6918.

TOOLBOX - small pickup toolbox, used 3 mos., $75. John, 821-6587.

Boats & Marine Supplies

22' CATALINA SLOOP - 1982, 7.5-h.p. Honda outboard, extras, excel. cond., $5,000. Gary, Ext. 3751 or 589-5490.

15' BAYLINER - 1986, 50-h.p. Force, low hrs., Escort trailer, $1,590. Mike, Ext. 4789.

Furnishings & Appliances

AIR CONDITIONER - Friedrick, 8,000 Btu, excel., $250 or best offer. Ellie, Ext. 3395 or Ken, 325-1537.

COUCH - green, 42" wide, 2 yrs. old, mint cond., $350, ; microwave, 1 yr. old, excel. cond., $50; stereo, $50; end table, $25; chair w/slipcover, $50. 584-7672.

GAS RANGE - 30", bottled gas, good, $50. 924-6751.

LAMPS - brass, like new, $15/ea. Ramesh, Ext. 3267.

LIVING ROOM SET -sofa bed, 2 recliners, 2 end tables, coffee table, lamp stand, Colonial, good cond., $500. Tom, Ext. 5265.

LIVING ROOM - sofa, loveseat, chair, Formica coffee table, 2 end tables, good cond., $150. Jim C., Ext. 4150.

RECLINER - mauve, 2 mo. old, orig. $350, sell for $225 or best offer. 581-5040 after 5 p.m.

REFRIGERATOR - Whirlpool, no-frost freezer, 16.3 cu. ft., good cond., asking $250. Paul, Ext. 7507.

VACUUM - Panasonic, upright, $45; child's rocker, $20; Bissel rug shampooer, $45; student's desk, $30; pink lamp, $10. Kathy, 744-2203.

WASHER - Westinghouse, large-capacity, 3 wash cycles, 5 wash-rinse combinations, white w/black trim, $50. Paul, Ext. 5287.

Tools, House & Garden

LUMBER - 2'x6' vee-joint, tongue & groove, thirty-six 12', $4/ea. 744-5096.

SPRUCE & DOUGLAS FIR TREES - B&B, sheared, 4' to 6' tall, $25-$45 ea., depending upon quantity. Tom, Ext. 4507 or 878-1060.

Sports, Hobbies & Pets

BANJO - 5-string, 3 learning books, 1 album, 3 videotapes, hard-shell case, $380. Jeff, 821-6867.

BASS GUITAR - Memphis case, Pratice amp., orig. $275, best offer. Ext. 7861.

BIKE - Dyno dirt bike, like new, orig. $280, sell for $160. 928-3756 after 5 p.m.

BOWLING BALL - 12-lb., $15. Judy, Ext. 2590.

DARKROOM EQUIPMENT - b&w, enlarger, tanks, reels, trays, etc.; ski boots, women's size 7, white, rear entry. Maj Britt, Ext. 2384.

FISH TANK - saltwater, 29-gal., complete setup, $200. Jim C., Ext. 4150.

GUITAR - Fender Strat, 1984 anniversary issue, active EMG pickps, ruby red, gold trim, Kahler bridge, tweed case, $665. Tim, Ext. 2005 or 331-4683.

LACROSSE STICK - STX Dominator, 1 yr. old, hardly used, great cond., asking $60. Alex, 929-5945.

Audio, Video & Computer

CAMCORDER - Magnavox, full-size, 8 lux, excel. cond., $350 firm. Chas, Ext. 5462.

CAMCORDER - Hitachi, S-VHS, many features, like new, orig. $1,200, sell for $695. L. Arnold, Ext. 5462.

COMPUTER - Abest 286, 12 MHz, 40 meg HD, 1 meg ram, 3½" drive, two 5¼" drives, 14" monitor, $550 or best offer. Cheryl, Ext. 2272 or 732-7634.

COMPUTER - Atari ST 1040, HD, games, etc., $110 or best offer. Thomas, 744-6148 after 3 p.m.

COMPUTERS - 2 Commodore C-64, three 1541 disk drives, Star Micronics printer, color monitor, programs, etc., $200 neg. Bill, 281-6498.

COMPUTER - Commodore, disk drive, 13" color mon., lots of disks, games, etc., $175. Joe, Ext. 4661.

MIXING BOARD - Teac model 2A, $100; XIAD model 1020 preamp, $100; cordless telephone, Sony SPP-75, used 2 mos., orig. box, $70. Jim C., Ext. 4150.

NINTENDO TAPES - approx. 1 yr. old. Chris, 399-1995.

NINTENDO - 4 games, controller, gun, power pad, $70. 928-3756.

PRINTER - Star SG10, 9-pin, w/manual, $75. Bill, Ext. 2807 or pager 4131.

SEGA MASTER SYSTEM - w/15 games, controller, gun, $115. 928-3756.

Miscellaneous

BRACELET - 14k gold, pather link; 14k gold & diamond necklace. Linda, Ext. 7187.

CAR SEAT - good cond., $20. O. Booker, Ext. 3082 or 727-5912.

FUR COAT - natural ranch mink, tuxedo trim, fox fur sleeves, size 10, brown, $500 firm. Chas, Ext. 5462.

PLAYPEN - Century, $45; Fisher Price bathtub, $8; Sesame St. playgym, $8; quartz heater, $25. Chris, 744-6874.

TICKETS - *Dialogues of the Carmelites*, 3/19, Met Opera, $22/ea. Stas, Ext. 7849 or 821-0459 eves.

TRIP FOR TWO - 4-day stay at the Hilton Hotel in Ft. Lauderdale, cruise to Freeport w/overnight stay, $200/ea. Mike, Ext. 2242.

Free

BEAGLE - neut. male, all shots, very friendly but my German Shepherd doesn't like him. Russ, Ext. 7759.

Found

LICENSE PLATE - PJH 142, NY. Kara, Ext. 5658.

Wanted

APT. OR HOUSE - for a couple & 3½-yr.-old child, nonsmoker, no pets. Ext. 3889.

DISCS - for Commodore 64, business, home, word processor, games, etc., pre-programmed, cheap, will pick up. Bill, 281-6498.

FISH - looking for healthy, inexpensive, tropical, saltwater fish. Jim, Ext. 4617.

GERMAN-SPEAKING BABY-SITTER - Stas, Ext. 7849 or 821-0459 eves.

JUNK CARS - I will tow. Mike, Ext. 4028.

LASERJET - HP or LaserJet II or LaserJet III in good working cond., reasonably priced. Diane, 821-5867.

LIGHTED HOOD - for ten-gallon fish tank. Chas, Ext. 5462.

OUTBOARD ENGINE - 10-15 h.p., decent cond. 924-6751.

RADIO - CD, cassette player for good price. Marie, Ext. 2868.

SKIERS - to ski Windham 3/9, $43 for bus and lift, send payment to Augie Hoffman, Bldg. 510C.

TANNING BED - and/or face tanning machine, reasonable. Mike, Ext. 4028.

TV - Poul, Ext. 4378 or 347-7068.

Services

*Services are listed in the first **Bulletin** of every month as a courtesy to BNL employees. They are neither screened nor recommended by the Bulletin. Services forms are available in the **Bulletin** lobby, Bldg. 134.*

ANIMAL-SITTER - animal-loving 10-yr.-old will treat pets like my own while you're away. Kate, 929-5945.

ARCHITECTURAL DRAFTING SERVICES - new/alterations, residential/commercial, also construction manager-consultant. Rich, 929-8514.

AUTO SERVICE - all phases of automotive repair and service. Brett, 929-4753.

BABY-SITTER - will baby-sit ages 2 and up, my house, Ronkonkoma area. 471-6416.

BABYSITTING - in my Wading River home by experienced mom, my 2-yr. old as playmate. Lorraine, 929-3910.

BRICKWORK - masonry, patios, walks, swimming pools, retaining walls, landscaping ties, Belgium block, 25 yrs. exp., Lab disc. Tony, 698-9274.

CERAMIC TILE - installation and repairs, all types of tile, kitchens, baths, foyers and countertops, quality work. Patrick, 289-7807.

CESSPOOL SERVICE - emptying and installations. Jim, 321-6720.

CHILD-CARE SERVICE - clean and loving environment, experienced mother w/1-yr.old, in priv. home near Lab. Jim, Ext. 4150.

CHIMNEY CAPS - fireplaces, wood, coal and oil flues, stainless steel, lifetime guarantee. Mike, 821-5526.

COMPUTER TRAINING - word processing, spreadsheets, graphics, database, desktop publishing, all levels. Gina, 929-3649.

COUNSELING - experienced, licensed CSW will help w/individual, marital or family problems, total confidentiality, insurance reimb. Linda, 929-5860.

DJ/MC - party & dance music from 40s-90s, all occasions, music & entertainment personalized for your affair, BNL refs. Lou, 698-8210.

HOME IMPROVEMENTS - extensions, dormers, decks, kitchens, baths, siding, lic. & insured, refs., free est. Chris, 286-2780/286-1348.

HOUSECLEANING - reasonable, very efficient, refs. Marty, 399-3496 any time.

HOUSECLEANING - honest, reliable, hardworking, flexible hours, free estimates. Sande, 924-3385.

JEWELER - special orders, repairs, honest, affordable, no job too large or small. Kelly, 821-5239.

KITCHENS - three styles for under $3,000, includes cabinets, top, installation. Carl, 698-9274.

LAND CLEARING - trees/stumps/brush removed, topsoil graded and raked with 450 loader, $70/hr. Tom Muller, 878-1060.

LAWN SPRINKLERS - automatic, free estimates, professional layouts, repairs, alterations and additions, prompt, courteous service. Lou, 928-7042.

LOCKSMITH - sales & service, 10% Lab discount, keys cut during lunch. Pete, 399-2813 after 5 p.m.

MAILBOXES - post or house styles, custom-made, heavy-gauge steel or wood, free catalog, many styles, Lab discount. Mike, 821-5526.

PAINTING - interior/exterior, Sheetrock, taping, spackle, wallpaper, staining, powerwashing, ref., insured. James, 399-4912.

PAINTING - licensed & insured. 467-5661.

PAINTING - spackling, plaster repair, Sheetrock repair, staining, varnish, wallpaper, stripping, appliance spray, int./ext. window glazing. 929-5524.

PIANO LESSONS - for children and adults, beginner or advanced level. Jun, 473-8406 eves., wkends.

PICKUP TRUCK & DRIVER - for hire, small to medium jobs, reasonable, experienced. 821-4407.

PLUMBING & HEATING - alterations & repair by retired BNL employee. Jim Morris, 472-1205.

POWER WASH - decks, siding, car motors, boats, etc. Brett, 929-4753.

RAILINGS & WELDING - custom wrought-iron railings, window & door guards, misc. weldng & repairs, resid. and comm., immed. service. Tony, 281-2513.

SHEETROCKING - and spackling, free estimate. Kevin Tisch, 567-6621.

SIGNS - of all types, paper, magnetic, store front, custom logos, paint or vinyl. Mike, 821-4083.

STRIPING, AIRBRUSHING, LETTERING - trucks, autos, motorcycles, boats, bugshields, helmets, shirts, signs, windows, storefronts. Gary, 549-9113.

TAXES - prepared by tax consultant, your home or mine, reasonable, serving Lab people for almost 20 yrs. John, 732-2472.

TREE SERVICE - 281-2746.

VIDEOGRAPHER - capture those precious moments on video, will tape weddings, parties, all occasions. Larry, 281-7240.

In Appreciation

A special thank you for everyone's kind sympathy, thoughtfulness and support upon the loss of my Dad.
— Eric Seebeck and family

Classified Ad deadline is 4:30 p.m. Friday for publication Friday of the next week.