



HOTLINE

PRINCETON PLASMA PHYSICS LABORATORY

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September 8, 1986

MESSAGE FROM THE DIRECTOR

This summer's TFTR experiments have brightened the promise of magnetic fusion power. TFTR has now reached the temperature level that will be needed for a practical fusion reactor. Several significant improvements of the tokamak "magnetic bottle" were discovered in the process.

The announcement of the TFTR results on August 7 received favorable world-wide news coverage. Both Princeton University and the Department of Energy have expressed particular pride in the recent PPL achievements.

Successful accomplishment of the TFTR mission now seems assured. By the end of 1987, we expect further advances in TFTR performance, including a demonstration of "equivalent break-even" in deuterium plasmas. The actual break-even demonstration using deuterium-tritium is scheduled for 1989.

A national study group, led by PPL, has prepared a proposal for the next major step beyond TFTR: The Compact Ignition Tokamak (CIT) has the goal of achieving burning-plasma conditions just like those in the plasma core of a net-power-producing reactor. The new project is estimated to cost about 300

million dollars, assuming that the TFTR facilities are reused for CIT. The proposed schedule calls for project authorization in 1988, with completion of construction in 1993. The CIT proposal is supported by the DOE and has received favorable mention by Congressional committees.

The University has offered to give the DOE a 40-year lease on C- and D-Sites to facilitate the siting of the CIT at PPL. The DOE is considering

authorization of new office and shop space on C- and D-Sites, so that the Laboratory can consolidate its activities, while the University will be able to develop A- and B-Sites for other uses. The new DOE-University contract, which goes into effect on October 1, 1986, will formalize these real-estate arrangements. The University has stated its intention to continue as the manager of PPL during the 40-year period of the C- and

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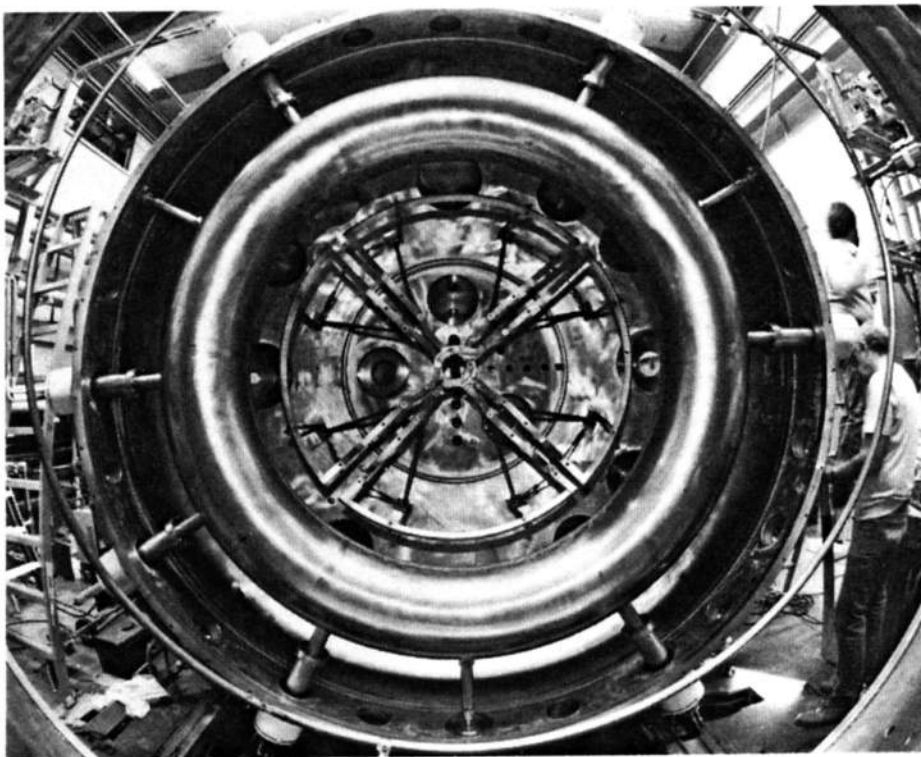
Reporters for both print and broadcast media filled the Gottlieb Auditorium August 7 during a press conference held to announce achievement of 200 million °C temperatures in TFTR. The event received extensive worldwide news coverage, and was featured in newscasts by NBC, WOR, and the New Jersey Network.

D-Site lease, with Laboratory staff maintaining their status as regular University employees. There are plans to strengthen direct ties between PPL and the Main Campus, especially in regard to joint research and academic initiatives.

Looking back to fiscal years 83-86, the PPL budget declined by about 30% following completion of TFTR construction. Our budget for FY87 will be about the same as the budget for FY86. Future budgets, both for PPL and for the US magnetic fusion program as a whole, are expected to rise again -- thanks to the TFTR results, the probable authorization of the CIT project, and the prospects for major international collaboration in magnetic fusion research. The Laboratory's staff, particularly in the engineering disciplines, will be needed to play a central role in the CIT project. As during the years of TFTR construction, the Laboratory policy will be to stabilize the level of permanent staffing by relying on subcontractors and participation by the other fusion laboratories to share peak work loads.

In summary, the work of the Laboratory has been going extremely well and is earning widespread recognition and support. During periods of rising opportunity, the immediate impact on the staff is often to increase near-term problems and demands -- such as the extra effort that will be required to consolidate the Laboratory on C- and D-Sites. The main implication of recent events is that PPL's long-term future looks very promising.

S-1 UPGRADE



The passive figure-8 coil stabilization system is visible through the newly installed S-1 flux core

An improved flux core and liner helped the S-1 Upgrade successfully pass its preliminary high-power tests August 6. The machine, which had been shut down for alterations for almost a year, is expected to reach new spheromak plasma parameters this fall.

After a successful run period in early 1985, S-1 developed problems with its flux core power feedthrough, adversely affecting the amount of coil current that could be fed through the core. Leaks also developed in the machine's flux core liner, requiring replacement of the entire liner. The liner is a 0.02-inch thick shell of Inconel, with fiberglass applied to its interior surfaces. The liner surrounds the flux core, and serves to maintain vacuum purity by encapsulating the flux core windings.

The new liner was made by Explosive Fabricators, Inc. of Colorado. Explosion forming is an expensive process, and cost and schedule constraints precluded using the process on the first S-1 flux core liner. However, explosion forming results in a more precise and regular liner surface than could be obtained by spin forming, the method used to fabricate the original liner.

The first step in the explosion forming process involves preparing a mold of the liner from a block of tool steel. A sheet of Inconel was clamped over the top of the mold, and the entire assembly was lowered into a water-filled tank. Explosive charges were detonated in the water, and the resultant shock waves forced the Inconel into the mold. This process, which was repeated several times,

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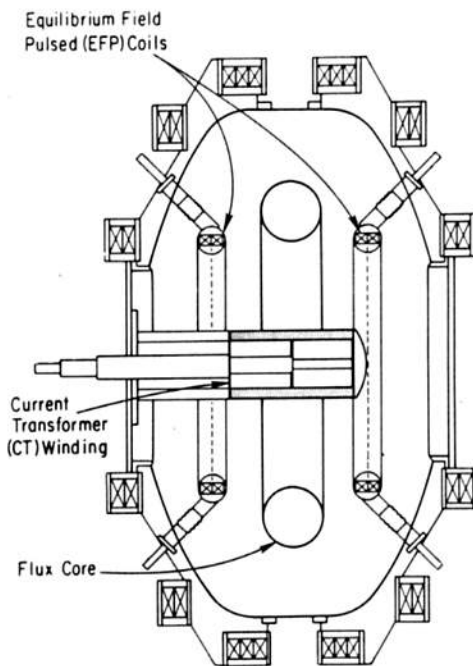
allowed the liner to be shaped without the ridges or high and low spots spin forming can leave. The new liner is expected to have a longer life expectancy and greater reliability.

When the liner was removed last year, the flux core windings were also examined and redesigned. The copper conductors in the original flux core windings consisted of insulation-covered stranded cable. The new windings were made using conductors with solid copper cross-sections. The change provides the potential of operating the flux core at higher current levels. PPL's Coil Shop completed the second flux core last March.

The S-1 program was hindered when problems surfaced during the testing of the new flux core. Although the insulation sleeve that had previously covered the copper conductor was deleted in the new design, impregnation of the core with epoxy resin was expected to provide sufficient insulation. Testing, however, revealed an insulation breakdown, proving that the insulation scheme was inadequate for the high voltages the core must withstand.

In March, the Coil Shop began winding a third S-1 flux core. The copper conductor was now wrapped with Mylar tape prior to being impregnated with epoxy resin. The work was completed in May, and the flux core was successfully tested to its design rating of 41,000 volts. It was installed in the S-1 machine, checked in place with its supporting buswork, and successfully passed full power tests held in early August.

On August 6, both the TF and the PF coils were operated at 20 kV, the full design rating for each system. With the new core, S-1 should be able to produce plasma currents of over 500 kA. The maximum current range with the old core was 350 kA.



Schematic of how a poloidal-field transformer installed in S-1 will look

Engineering Department Head Jack Joyce offered his thanks to the engineers and technicians in the Coil and Vacuum Shops for their outstanding performance with the S-1 project. He singled out specifically Jeff Alton, who followed the project personally on the machine floor. Masaaki Yamada, co-head of the S-1 program, agreed, adding that "Jeff devoted 120% of his time to the core, and it paid off."

The near-term goal for the S-1 Upgrade is to return to reliable operation with all diagnostics. A multipoint Thomson scattering unit, fabricated by Dr. Fred Levinton,

is being added to the device's diagnostic array. The experimental program will then pursue high-current operations in an attempt to have improved machine parameters in September and October. Dr. Yamada expects that the S-1 Upgrade will achieve higher temperatures (hopefully over 150 eV) as well as increased confinement time (reaching n_f of over 1×10^{10}) in the near future.

In the coming year, the S-1 Upgrade experimental program will begin investigating the details of spheromak confinement utilizing the Taylor relaxation mode. A significant S-1 finding was that spheromak plasmas always adjust their configurations by means of flux conversion toward the Taylor minimum energy state. The discovery of the flux-conversion mechanism has created the opportunity to push the parameters of the S-1 machine towards the 1-MA, 300-eV level by means of a relatively small modification: introduction of a poloidal-field transformer coil. When the present experimental run period concludes next spring, the transformer coil will be installed on S-1. S-1 should also be able to improve its parameters into the reactor regime by adiabatic plasma compression.

The PPL HOTLINE is issued by the Princeton University Plasma Physics Laboratory, a research facility supported by the United States Department of Energy. Correspondence should be directed to PPL Information Services, Module 2, C-Site, James Forrestal Campus, ext. 2754.

Obituary

Thomas R. Hurley, 43, died August 5 at the IT2 Building on A-Site. Many of Tom's co-workers and friends wanted to remember him. HOTLINE lets them speak for themselves:

"Tom had been the lead technician for Plant Maintenance and Operations at A-Site since 1980. During this period, he also conducted training classes for approximately 10 PM&O technicians at a time. He assisted Ray Pressburger in developing a safety program for PM&O, and conducted the safety meetings and safety inspections for that group for years. It was basically this program that was adopted as a model for the lab-wide Area Safety Coordinator (ASC) program. Tom served as the ASC for PM&O since the inception of that program. Tom was loved and respected by all who knew him, and he will certainly be missed in PM&O." (Connie Stout)

"His perserverance, interspersed with appropriate moments of humor, assured the success of our safety program." (Bob Smart)

"Tom has worked closely with me for many years. I will truly miss him as a friend and a professional associate. He has been my right hand man when we established the safety program for Maintenance, then the Administrative Department, and then the whole lab. His work in keeping Administrative safety a leading group at the lab will be missed very much by everyone." (Ray Pressburger)

"The sudden death of Tom Hurley has left me, as I know

it has many of us, in a state of shock and disbelief. Having known Tom as a friend and co-worker for a good many years and knowing his warm, outgoing personality; his ability and willingness to help others; the enthusiasm he had for his work; and his general apparent love of life makes it harder to understand and accept this tragic occurrence. Tom touched many people during his career at PPL, and he will be sorely missed. Tom, if there really is a heaven, I am sure you are there and I can only say "go with God." (Henry Miller)



Tom Hurley

"I remember talking to Tom after our classes were over at IT2 Building. He was very idealistic; he believed that the world could be a better place if only we'd all work at it. His ever-present pipe announced to everyone "Tom's here!" He always had a smile and a joke for everyone; Irish jokes were his favorites. He was fiercely proud of his Irish heritage, and we discovered that green foil shamrocks had sprouted in various spots

around the lab after he had passed by. He was a friend. I'll miss him." (Pat Zeedyk)

"Tom was one of the nicest people I have ever met. He would help anyone in any way. I will truly miss him. My nickname for him was "Mr. Safety." Admin. Safety will never be the same." (Sandy Phillips)

"Tom was one of the finest gentlemen I have ever met. He always had a sympathetic ear and a kind word towards everyone. He always smiled and joked with everyone. He will be missed by all his friends." (George Kalescky)

"He was very safety conscious, and kept up on safety for the shop as far as films and lectures. He assured that the proper masks were used for safety-related jobs on site. He kept up on the days lost time accident sign. He ran the school in IT2 for job education. He couldn't win the Pick-6 lottery on a bet." (Mitch Dorun)

"I liked Tom because he was a real person. He had a quick sense of humor, and he was nice. I also miss very much the smell of his pipe tobacco." (Terry Greenberg)

"Tom will be missed as a contributor to the PPL Energy Conservation Program. I found Tom to be a conscientious employee who addressed job tasks in a consistently professional manner, was flexible to new ideas, and was cooperative. His efforts were the difference that made the difference at A-Site." (Bob Gulay)

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"Tom Hurley was one of Maintenance's most popular employees. He was well-liked by his co-workers, with a keen sense of humor and always a friendly jibe at his co-workers. He was definitely good for morale at PPL. His friendly disposition, helpful attitude, will be missed by all who knew him as the "big guy" he was." (Anonymous)

Tom is survived by his wife, Jean Brown Hurley; a daughter, Barbara Nini of Hamilton Square; his parents, Lois and Wilbur Hurley of Cream Ridge; a sister, Carol Tilton of Hopewell; a nephew; and two nieces.

Memorial contributions may be made to the Muscular Dystrophy Association.

Safety Awards

PPL's greatly reduced 1984 accident rate earned the laboratory the DOE Award of Excellence and the National Safety Council's Award of Honor. By maintaining its winning accident rate in 1985, PPL has now received the National Safety Council's Award of Merit, the New Jersey Industry Recognition Safety Award, and a second DOE Award of Excellence.

To win the National Safety Council award, the lab competed against other comparable national laboratories, including several other DOE facilities. The Council examines each contestant's accident experience over the last three years. Laboratories with significant reductions in lost time injuries and lost work days become Council award winners.

The DOE's Phase I Award of Excellence recognizes PPL's



Celebrating PPL's achievement of working for one million man-hours without a lost-time accident are (left to right) Deputy Departmental Safety Officer Paul McCann, Occupational Medicine and Safety Office Manager Les Thompson, PPL Director Dr. Harold Furth, Project and Operational Safety Office Manager Joe Stencel, and Deputy Departmental Safety Officer Halsey Allen.

continued satisfactory progress in improving its safety record. PPL and the Ames Laboratory in Ames, Iowa are the only DOE Chicago Operations Office facilities to receive Phase I awards.

In 1985, PPL continued to reduce both its disabling accidents and the severity of each accident. The laboratory is presently well on the way to another safe year, having recently attained one million man-hours worked without a lost-time accident.

The Occupational Medicine and Safety (OM&S) Office credits the laboratory's outstanding safety performance to the employees. Although the Area Safety Coordinator (ASC) program keeps safety alive in the

workplace, and both safety groups (OM&S and Project and Operational Safety) complement each other, each PPL employee is responsible for the laboratory's safety record by working safely.

According to OM&S Safety Branch Manager Les Thompson, "When I joined the lab two years ago, the overall safety program needed direction. Since then, OM&S has instituted frequent meetings, safety audits, thorough accident investigations, and we've added more training courses. Now people understand what's required of them, and things are getting done."

Les also noted the positive attitude toward safety throughout the lab. "There's an awareness of safety by the

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employees, and a commitment by management to provide the resources and training to help people get the job done safely. I think people have finally recognized that our safety program isn't a one-time thing: our concern for employees' safety is here to stay, and we must conduct research without accidents."

Les commended outgoing Deputy Director J.R. Thompson's efforts to revitalize the PPL safety program. "J.R.'s commitment to safety, which also has the backing of Dr. Furth, is a major reason we've accomplished so much. They've both encouraged management commitment, and that's been the foundation for the success of the program."

Bill Dorn, Industrial Safety Engineer, pointed out that achieving one million man-hours of safe operation demonstrates that "accidents don't have to happen; they can be avoided." He added that it is important not to permit our eagerness to reach technical goals to encourage taking shortcuts on safety. It could take years to recover from a serious accident, but by continuing to work safely, we will save time and money in the long run."

Both men agreed that significantly more interest in safety exists throughout the lab now. "The ASC program increased safety awareness," Bill continued, "and safety awareness is half the battle. The other half is getting something done about the safety problems you find before an injury occurs."

To report safety concerns, employees should contact their supervisor or their Area Safety Coordinator.

Safety Training

The Occupational Medicine and Safety Office has scheduled the following training courses for September:

Hazardous Materials/Right to Know: Sept. 9-11

Respiratory Protection/Confined Space Entry: Sept. 16-17

Back Injury Prevention: Sept. 18

Basic Radiation Training: Sept. 22-26

Powder Actuated Tools: Date to be announced

Employees must obtain permission from their immediate supervisor to attend any course. Supervisors must call Mary Ann McBride at ext. 3468 to enroll their employees. Attendees will be notified of the time and place their class meets one week before each session starts.

TRANSITIONS

The HOTLINE offers its congratulations to the following employees, who recently became proud parents:

Rich Myslinski of Engineering Services and his wife, Dottie, whose daughter, Rochel Lynn, was born August 13;

Joe Pownall of Engineering Services and his wife, Gwenn, whose son, Joseph, was born August 13;

Jim Conover of Materiel Control and his wife, Pattie, whose son, Ryan, was born August 13;

Jeff Gettlefinger of TFTR Operations and his wife, Lori Trani-Gettlefinger of Public Safety, whose son, Andrew, was born August 19.



People who watch a lot of TV are more likely to have headaches, backaches, and joint pain than those who watch little or no TV, according to a survey of 1,254 people by Louis Harris and Associates.

Dr. John Bonica of the University of Washington, a pioneer in the pain research field, said that the findings are related to a tendency among frequent TV viewers to be lethargic. Watching repeated commercials that focus on head and body pain might also play a role, he said.

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"People who sit around watching television most of the time just aren't getting enough exercise," Bonica said. "Tension headaches are very common for them."

The study, financed by Bristol-Myers Co., found that people who exercise regularly, don't smoke, drink little or no alcohol, and watch little or no television experience less pain than people with the opposite habits. It also found that women experience more pain than men, and that headaches are a malady of the middle class, affecting people mostly in the \$15- to \$50-thousand annual income range.



To safeguard your personal property at home or at work, the Department of Public Safety suggests having your valuables engraved.

Public Safety has the equipment to engrave any of your personal items, such as calculators, clock radios, computers, etc. By engraving these items with your driver's license number, you will help deter theft. To arrange for engraving, call the Public Safety Department at ext. 2895.

Most police departments also have engraving programs for items in your home. Simply contact your local police department for the necessary information.

For additional tips on methods of preventing crime, call the Department of Public Safety at ext. 2895.

GIVE LIFE



Bloodmobile Wants PPL Plasma

The Bloodmobile will again visit the laboratory September 11 from 10 a.m. to 3 p.m. at the Sayre Hall auditorium. Those wishing to donate blood should contact Meg Gilbert at ext. 2036 to set up an appointment. Donors will be scheduled every 15 minutes, and refreshments will be served.

Although employees are covered for blood needs under a group plan, the University must meet its yearly quota of blood donations to continue to offer this benefit.

Toner Disposal

Waste dry toner from copy machines should not be disposed of in trash receptacles unless it has first been placed in a sealed container, according to the Occupational Medi-

cine and Safety (OM&S) Office.

The toner is composed of fine plastic beads and carbon black, neither of which are particularly toxic or require disposal as hazardous waste. When waste cans containing loose toner are emptied by Building Services personnel, the dry powder is released to the air. The dust thus created is irritating to the eyes and difficult to remove from the skin.

Any questions regarding this procedure should be referred to the OM&S Office.

Computerized CPR

Resusci-Annie is no dummy any more.

The familiar mannequin, who has helped teach cardiopulmonary resuscitation (CPR) to so many people, has finally joined the computer revolution. Now outfitted with a series of sensors, and aided by an Apple computer and a Sony videodisk player, Annie is "teaching" CPR classes to PPL employees.

CPR is a lifesaving technique that couples mouth-to-mouth resuscitation with chest compressions. CPR can help revive someone who has had a heart attack by maintaining oxygen and blood flow.

The interactive learning system, developed and patented by the American Heart Association, allows students to acquire CPR skills at their own pace, with the computer -- and Annie -- acting as course instructors. The system generally cuts training time, provides more standardized and detailed instruction,

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and can be used on a 24-hour basis.

Students meet for an initial one-hour training session, during which an Emergency Services Unit member demonstrates how the system works. Class members then spend time during the week working with the system. A one-hour follow up session is provided during the second week to answer questions or resolve problems. Students usually complete the course in two weeks.

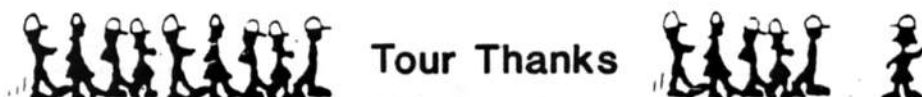
The CPR learning system is a self-contained, stand-alone unit. It interfaces the videodisk player and the micro-

computer with two video monitors, a computer controlled audio player, a light pen, and the sensor-equipped mannequin. The system's CPR instruction begins with classroom lectures, viewed on the videodisk monitor. Students are periodically tested on course material through multiple choice or fill-in-the-blank quizzes. Questions are presented on the computer monitor; the student responds by using a light pen to select answers. The results of each test are automatically recorded by the computer.

The second portion of the course involves work on Resusci-Annie. Sensors moni-

tor movement of the mannequin, including depth and placement of chest compressions, and the effectiveness of mouth-to-mouth ventilation. A combination of audiovisual coaching, visual computer displays, audio tones, and a computer graphic summary provides students with immediate feedback on their performance. The course concludes with a complete CPR test, which must be completed to the computer's exacting specifications.

To sign up for CPR training, contact Mary Ann McBride at Occupational Medicine and Safety, ext. 3468.



Tour Thanks

Taking its cue from the season, the laboratory's spring tour program grew with a vengeance. From April through June, 95 guides conducted 60 tours, showing 1,465 visitors just what makes PPL tick. April led the period with 788 visitors, led by 39 guides on 27 tours. To those hardy souls who keep our "tourists" enthralled, we extend our sincere thanks:

April

Jeff Alton
Peter Beiersdorfer
William Blanchard
Charles Bushnell
John Doane
Fred Dylla
Robert Ellis
Robert Fleming
George Gammel
Ralph Izzo
John Johnson
James Kamperschroer
Fred Kloiber
Naren Kokatnur
Paul LaMarche
Benoit Leblanc
George Levitsky
George Martin
Harold Murphy

John Murray
Don Monticello
Ernest Nieschmidt
David O'Neill
Robert Pinsker
Ned Sauthoff
Allen Stevens
Stan Schweitzer
Harry Towner
Michael Ulrickson
Irving Zatz

May

Halsey Allen
Michael Bell
Norton Bretz
David Ciotti
Pat Colestock
Anthony DeMeo
Fred Dylla

Ray Fonck
George Gammel
Charles Gentile
Tom Harley
Harry Howard
David Ignat
Ralph Izzo
John Johnson
James Kamperschroer
Christopher Keane
Naren Kokatnur
William Langer
George Levitsky
George Martin
Sid Medley
Ernest Nieschmidt
S. Ramakrishnan
Greg Rewoldt
Steven Sesnic
Stan Schweitzer
Marilee Thompson

Michael Viola
Irving Zatz

June

Dale Ashcroft
David Ciotti
James French
George Gammel
Charles Gentile
Jerry Gilbert
Benoit Leblanc
Paul LaMarche
Ed Lawson
George Levitsky
George Martin
Ernest Nieschmidt
Robert Pinsker
Robert Philbin
Allen Ramsey
Robert Woolley
Irving Zatz