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NEWSLETTER

Lawrence Berkeley Laboratory
Applied Science Division

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INTERVIEW WITH PAUL CRAIG

Paul Craig has been associated with the Energy & Environment/Applied Science Division for many years and most recently has been working with the Energy Analysis Program. He is currently Professor in Applied Science at University of California, Davis. He received his Ph.D. in Physics from CalTech in 1957; was a Staff Member at Los Alamos 1958-62; and Group Leader in Cryogenics Group at Brookhaven 1962-71. He was a Guggenheim Fellow 1965-66 and worked for the National Science Foundation 1971-75.

ASD: You have a varied and interesting background. Can you tell us a little about your professional history?

Paul: I started out in physics. I had been interested in mechanical things ever since I was a kid, and an experimental physicist is, in my view of the world, like a classy version of an automobile mechanic. I like to tinker with things, and physics allows me to tinker but lets me think about what it all means too. That is a wonderful combination. The first part of my career was focused on experimental physics and the understanding of the physical world. I did this at Los Alamos where I was in a low-temperature physics group. Later, I ran a low-temperature physics group at Brookhaven. During the time that I was doing my

physics, to the best of my knowledge, nobody ever used anything that I ever learned for anything practical. It was basic physics of the sort which is absolutely fascinating, but practical applications, if there are any, are way down the line.

ASD: When did your career interests begin to change?

Paul: My interests gradually began to shift as I discovered that there were many things in the world which seemed to be very important and I wanted to work on some of them. My career up to this stage had been in pure physics. It dealt with the physical world, where you could quantify and where you could work in the laboratory. My focus shifted to systems involving human beings. Here, everything becomes much more difficult; the whole subject matter is instrinsically mushy; you can't do experiments very easily; unlike physics, there are no fundamental principles that stand up for long periods of time.

I see my post-physics career as having two sub-elements. The first element was dominated by bureaucracy. It started when I went to Washington, D.C. to work with the National Science Foundation. I began with the RANN program (Research Applied to National Needs). When the energy embargo of 1973 occurred, the government needed people to work on energy. It was very easy for me to switch over.

Most of my time in Washington I worked on energy policy matters in support of the Science Advisor to the President. We did a lot of analysis for the OMB (Office of Management & Budget). The energy agencies would come in with their budget proposals and we would critique them. Our role was to have access to technical knowledge so we could give substantive criticisms to the OMB staff, which would have the effect of pushing budgets up or pushing budgets down. Washington was a fascinating place to be, and perhaps I even did some good there. In Washington, as in most big bureaucracies, it is hard to develop a sense of effectiveness. In Washington one has a feeling of being where the action is -- a feeling I've since come to believe is often not justified.

ASD: When did you become associated with the University of California?

Paul: I accepted an administrative position at the University of California coordinating energy activities on a systemwide basis. That turned out to be a very frustrating experience, largely because of the difficulty of coordinating academics. It was both more difficult and less satisfying than my time in Washington, but it did turn out to provide a pathway into academics. For the past four years, I have been a Professor in the Department of Applied Science (the department with a branch at Livermore) at UC Davis. Although Applied Science is in the College of Engineering, my particular interests don't have very much to do with engineering. This now brings me to the second element of my

post-physics career. This has to do with energy research and with the arms race.

ASD: You are working with the Energy Analysis Program here at LBL. Would you tell us something about the project you are involved with and your role in it?

Paul: I am interested in understanding the way in which buildings behave when you put people in them. The DOE-2 model developed here provides an extremely accurate engineering model of how buildings operate if they don't have any people in them. We were interested in finding out how good a job you can do at predicting what the energy use of a house will be when real people live in it. Our group includes people with both sociological and technical skills. We are studying two cities with similar weather but very different demographic characteristics: Davis and Lodi. Our survey includes many questions covering education, attitudes, and demography. We also asked behavioral questions such as "Do you open your windows at night?". Our survey ran the full gamut from general questions about goals in life to mechanical questions about how the house is used. We also obtained technical data on the houses by direct audit and through city records. We used all this information to establish the inputs to the DOE-2 model and to an appliance model. We discovered that there are a lot of problems in going from the good physical data at a weather station to what actually goes on in the microclimate of a house, and those uncertainties lead to a lot of discrepancies. We discovered that people don't always tell us how they are actually manipulating the house, generally because they don't know themselves. The "bottom line" of our study is that we found we could explain only about 60% of the variance in summer energy use in the occupied houses -- in contrast to the 98% or so accuracy of the DOE-2 model when the input parameters are well-known.

ASD: You are also doing research on socio-economic systems and the arms race. Would you tell us about your work on these projects?

Paul: Several years ago, I became disturbed by the acceleration of the arms race. Kenneth Watt, an ecologist at Davis, and I had been studying long cycles in economics; in particular, the Kondratieff Wave. This is a two-generation (half-century) cycle in human affairs which one can think about roughly in the following way: My parents were young adults during the depression of the 1930's. They and their contemporaries had a rough time and chose not to have many kids, so I was in a very small age cohort. Consequently, there wasn't so much competition for me when I grew up. People in my cohort tended to have lots of kids. As these kids are growing up, they are discovering that they have a lot of contemporaries and that it is hard to get jobs. There is a two-generation phenomenon here. With any luck (and this means primarly if we can avoid nuclear war), my grandchildren will have a good time of it. The Kondratieff Cycle shows up in many aspects of human affairs. We noticed

that there is a correlation between wars and these long waves, and that this correlation goes back a long time -- a couple of hundred years.

ASD: What correlation have you found between economic cycles and war?

Paul: We found that there have been economic highs and lows for hundreds of years; we have quite good data back to the beginning of the 1800's. After each one of the great depressions, we found there occurred a period when many people were killed in wars. Once we had found this systematic behavior, we went on to ask what it will mean if the regularities persist in the future. What do we have to look forward to? We will be at an economic low somewhere within the next two, three, or four years, after which the economy should improve up until the beginning of the next century. That is the good news. When the economy peaks out we enter a time of high risk of war. We found that for the last two centuries the number of people killed in wars has been going up at about 4% per year. That is a lot faster than the population. If the next war follows the historic trend, it might be expected to occur in the first decade of the next century and it might kill somewhere between 100 million and one billion people. This is an absolutely staggering number. Unfortunately, at great expense and with great effort, the Soviet Union and the United States have been installing the military wherewithal to make that possible.

ASD: Has it been this work that has motivated you to introduce your course at UC Davis on the technology of the arms race?

Paul: The arms race is driven by a dynamic that involves the entire society. As an educator, I believe that one of the best chances for finding new directions is through initiatives from knowledgeable citizens. Together with John Jungerman, the Chairman of the Physics Department at Davis, we developed a course focused on training students, primarily students without any science background, in technical aspects of the arms race. Our goal is to use the arms race to teach physics and use the physics of the arms race to teach students that they should read their newspapers carefully and critically. There are a lot of things a student, or any citizen, can understand much better if he/she has some understanding of the science of the arms race. We are now in the process of developing our course notes into a textbook.

ASD: Are you optimistic that we will be able to resolve this question of the arms race satisfactorily?

Paul: We are presently in an exponential growth in weapons in the world. That obviously can't continue forever. The nation and the world must find a way to get off of that continued growth curve. There are only a limited number of ways in which this can all end. One is for these weapons to be used, in which case there isn't anything for us to think about. A second way would

be for everyone to give up nuclear weapons. I don't think that is going to happen. What we need to do is identify some gradual ways to level out and then to bring the number of nuclear weapons down to a more manageable level. My personal belief is that governments are unlikely to do that themselves. There is just so much bureaucratic inertia on both the Soviet side and the U.S. side that the chances of that happening by government alone are pretty small. My feeling is that if ever there was a time when fundamental principles of democracy need to be applied, it is right now. Our only chance of reversing the preoccupation with more arms is through citizen action. There is no chance for such action in the Soviet Union; there is such a chance in the U.S. I see glimmers of that happening.

The optimistic message from our work, if there is one, is that we still have a few years to stabilize things. I don't believe in the kind of determinism that is implied by the economic cycles we have studied. I think the analysis is more suggestive than compelling. I do believe that the nuclear era is totally different from anything that has happened in the past, and that we now have an opportunity -- perhaps our final opportunity -- to prevent disaster. History provides us with frightening warnings. History books are full of accounts of great civilizations that vanished.

VISITORS

Alan Streb, recently appointed Deputy Assistant Secretary for Conservation, Conservation and Renewable Energy, DOE, visited LBL on January 4-5. The program for his visit included presentations and laboratory tours by the principal investigators of the research programs which are under his direction, and an overview of the Applied Science Division by Elton Cairns.

NEW CO-LEADER OF THE APPLIED SCIENCE SEMINAR

Rolf Mehlhorn has been the coordinator of the Applied Science Seminar for the past two years, and it is largely because of his efforts that we have had a series of interesting and well attended talks. Recently Rolf requested help with the seminars, and we are pleased to announce that Jim McMahon of the Energy Analysis Program has agreed to serve as co-coordinator.

Among the best candidates for seminar speakers are prestigeous scientists who are visiting the Lab for other reasons. Such people will usually consider it a compliment to be asked to give a general talk to a technically oriented audience. When you know of an upcoming visit, let Rolf or Jim know. They can handle the detailed arrangements. Also, seminar coordinators always welcome suggestions for speakers or topics.

INVITED TALKS AND FOREIGN TRAVEL

November

- Tony Nero was in Los Angeles where he presented testimony dealing with present status and research needs of Indoor Air Quality before the California State Assembly Consumer Protection & Toxic Materials Committee.

December

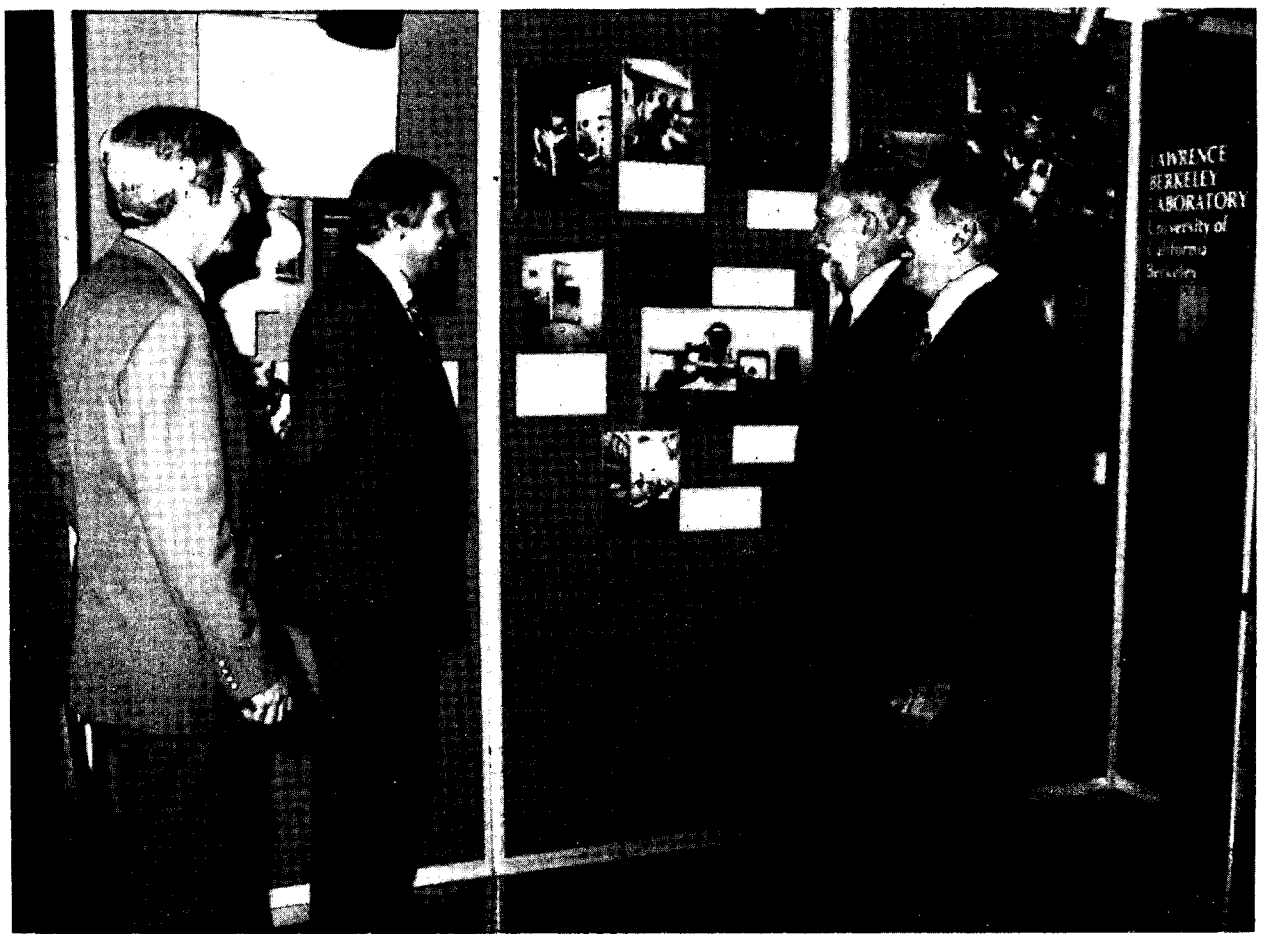
- Elton Cairns was invited to participate in an EPRI/LBL Workshop on the Electrochemistry of Zinc/Halogen Batteries held in Palo Alto. He presented a paper entitled "Research & Development Approaches for Zinc/Halogen Systems".

- Elton Cairns travelled to Stockholm, Sweden where he was invited to present a lecture at the Energy Storage Conference sponsored by the Royal Swedish Academy of Engineering Sciences. His lecture was entitled "Advanced Electrochemical Energy Storage Systems".

January

- Tica Novakov participated in a NASA Workshop on Heterogeneous Processes in the Troposphere in Sarasota, Florida, where he was invited to present a talk entitled "Role of Primary Gaseous and Particulate Oxidants in Heterogeneous Atmospheric Processes".

- Jayant Sathaye attended the Fifth International Conference of IAEE (International Association of Energy Economists) held in New Delhi, India.



LBL LIGHTING RESEARCH PROGRAM

The LBL Lighting Research Program was asked by DOE Under Secretary Pat Collins to provide a display for the lobby of the Forrestal Building in Washington, D.C. In the photograph above, Alan Streb, Deputy Assistant Secretary for Conservation, Pat Collins, Under Secretary, John Millhone, Director of the Office of Building Energy Research & Development, and Ted Kapus, Director of the Building Equipment Division of the Office of Building Energy Research & Development, are shown in front of the display. The exhibit, which ran from November 21 through December 2, 1983, featured illustrations of LBL lighting research plus hardware displays of energy efficient replacements for incandescent lamps and high frequency solid-state ballasts for fluorescent lights. A booklet outlining the lighting group's research accomplishments and future goals was prepared for the viewers. Copies of the booklet are available from Erica Atkin (ext. 5605).

The Lighting Program combines the facilities and faculties of LBL with those of the University of California College of Environmental Design, School of Optometry, and School of Medicine. It is a unique program in the United States, with its results directed toward enhancing the capabilities and long-term viability of the lighting industry and toward providing the design profession and general public with needed information.

DIVISION NEWS

- Isaac Turiel of the Energy Analysis Program has been notified that his book entitled "Human Health and Indoor Air Pollution" has been reviewed and accepted for publication by the Stanford University Press. The book discusses indoor air pollutants in residential and office buildings, their health effects, and methods of pollutant control.

- John Girman is serving as a technical consultant and member of the Minimum Ventilation Requirements Advisory Committee convened by the California Division of Occupational Safety and Health.

- Dave Grimsrud, Tony Nero, and John Girman served as co-chairmen of panels convened during the peer review of the EPA Office of Research and Development 1984 Plan for research on indoor air quality, in Cambridge, MA, December 8-9, 1983. The respective panels were Field Monitoring, Health Effects, and Methods.

RECENT REFEREED JOURNAL ARTICLES

"Photothermal Displacement Spectroscopy: An Optical Probe for Solids and Surfaces," M.A. Olmstead, N.M. Amer, and S. Kohn, Appl. Phys., A 32, 141-154 (1983).

"Methods of Estimating Air Infiltration Through Windows," J.H. Klems, Energy and Buildings, 5, 243-252 (1983).

"Energy Savings Potential for Attached Sunspaces in Different Climates," R.L. Ritschard ad Y.J. Huang, Progress in Passive Solar Energy Systems, 739-742 (1983).

"Effects of Metal Chelates on Wet Flue Gas Scrubbing Chemistry," Shih-Ger Chang, David Littlejohn, and Scott Lynn, Environ. Sci. Technol., Vol. 17, No. 11, 649-653 (1983).

"Current Status of the Impact Theory for the Terminal Cretaceous Extinction," Walter Alvarez, Luis W. Alvarez, Frank Asaro, and Helen Michel, Geological Society of America, Special Paper 190, 305-315 (1982).

"Modeling Semirational Competitive Behavior," Michael Rothkopf, Management Science, Vol. 29, No.11, 1341-1345 (1983).

"Organometallic Geochemistry," Richard Fish, American Chemical Society Symposium Series, No. 230, Geochemistry and Chemistry of Oil Shales, 423-432 (1983).

"A Novel Method for the Study of Optical Properties of Surfaces," Nabil M. Amer and Marjorie A. Olmstead, Surface Science, 132, 68-72 (1983).

10TH ANNIVERSARY CELEBRATION

These photographs are scenes from the 10th Anniversary Celebration of the Energy & Environment/Applied Science Division which was held at LBL on November 8, 1983. Along with the champagne reception, the occasion was celebrated with speeches by Ed McMillan, Jack Hollander, Will Siri, Art Rosenfeld, David Shirley and Elton Cairns, outlining the Division's past history, present accomplishments, and commitment to the development of new research areas in the future.

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Lawrence Berkeley Laboratory, University of California
Berkeley, California 94720
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