# SLAC BEAM LINE

*If it is certain, it is not physics; if it is physics, it is not certain.*
--Albert Einstein

*Volume 5, Number 5* *November 1974*


*In This Issue*



## BREAST CANCER MOVIE ON NOVEMBER 20

Cancer of the breast has received much recent publicity, not only via Ms. Ford and Ms. Rockefeller but also in the media accounts of the disagreement among physicians as to the best method of treatment. But whatever the treatment, it seems clear that the earlier the detection, and the smaller the tumor, the better are the chances for a complete cure.

As yet there is no one best method of detecting tumors while they are still small. However, the combination of regular self-examination plus annual mammography and/or thermography, when indicated by a physician, is our most effective method. These exams are included in the annual physical given by the SLAC Medical Department for all women employees over 40.

An American Cancer Society film on the technique of self-examination of the breast will be presented at SLAC on November 20. It should be viewed by as many women as possible. Guests of SLAC employees are welcome, and husbands are invited to bring their wives. Dr. Beal, SLAC's Medical Director, will be on hand to answer questions after the film.

*Date:* Wednesday, November 20, 1974
*Time:* 12:15 P.M.
*Place:* SLAC Auditorium

--Charles Beal, M.D.

### QUIZ

*Question:* Do the wind tunnels at Moffett Field, the temperature in San Jose, and the wind direction at Red Bluff have anything to do with SLAC?

*Answer:* Bet your sweet life they do, Charley. See page 3.

*Photo by Joe Faust*

*Although this young lady won the 12-and-under Bicycle Race on Family Day, she's on Page 1 because her smile is an even bigger winner. Her name is Amy Gibbons. Come back any time, Amy. For more pictures of Family Day, as captured by the cameras of Joe Faust and Bill Walsh, see Pages 5-8.*

### FAMOUS PREDICTIONS

"DeForest [the inventor of the radio tube] has said in many newspapers and over his signature that it would be possible to transmit the human voice across the Atlantic before many years. Based on these absurd and deliberately misleading statements, the misguided public . . . has been persuaded to purchase stock in his company."

--U.S. District Attorney (1913)

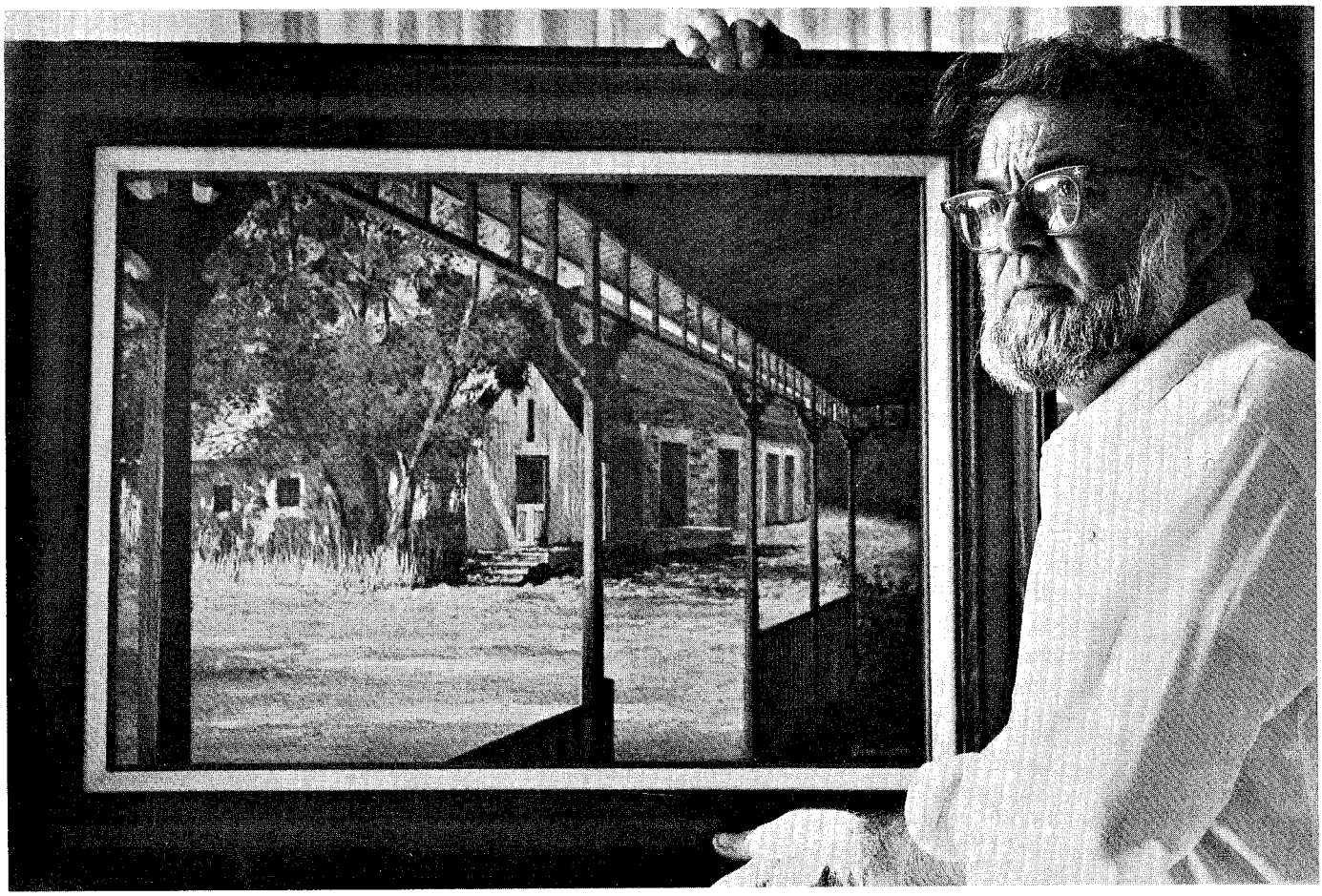


Photo by Joe Faust

# Glenn Hughes: Artist & Designer*

Talented people are not a rarity at SLAC, but how many of these people can also claim to be not first, not second, but *third* generation native Californians? Well the answer to that question is "at least one"--Glenn Hughes, who has been handling mechanical design problems for the Experimental Facilities Dept. at SLAC (on long-term loan from Plant Engineering) for many productive years. In SLAC's early years, Glenn ran the laboratory's Model Shop, and his adroit work helped to clarify many difficult design problems during that time. After the Model Shop activities began to taper off, Glenn moved over to EFD, where for the past several years he has been designing components for the experimental beam lines.

During his non-SLAC hours Glenn has developed into a superb artist, working with oils and acrylics, and producing a steady outpouring of striking and nostalgic paintings of early California. Glenn's paintings appear at SLAC from time to time--in such settings as a Family Day exhibit, or occasionally on display over his drafting board. He teaches an arts and crafts course in the Adult Education school, and he recently won a ribbon for his painting in an art exhibit.

Along with all Glenn's competence and talent, there is also a consistently good-natured and good-humored willingness to give that extra bit of help to experimenters at SLAC who may need a special effort to get their apparatus together and get "on the beam." We hope that Glenn will continue to brighten our days here at SLAC for many more years to come.

--Aaron Baumgarten & Bill Kirk

*We got tired of waiting for people either to leave SLAC or to retire before saying something nice about them. Yes, indeed, *Glenn Hughes is still here!*

# ELECTRICAL "LOAD-SHEDDING" AT SLAC

*Some Abbreviations*

kV = kilovolt = 1000 volts
kW = kilowatt = 1000 watts
MW = Megawatt = 1,000,000 watts

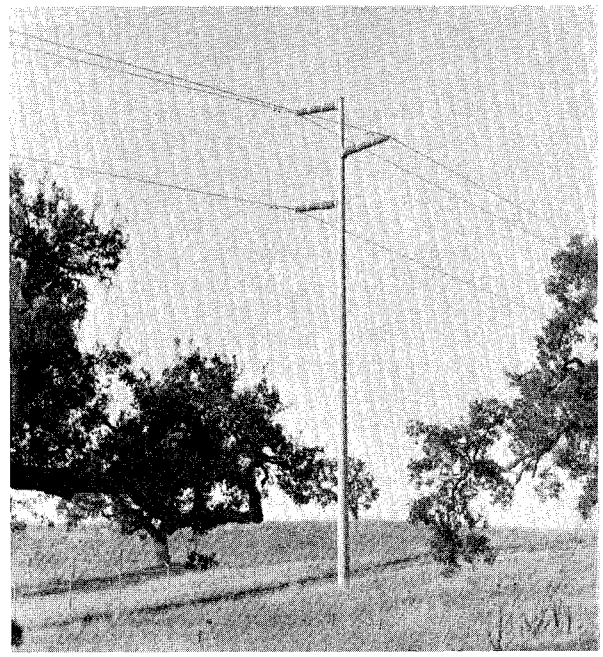
For the past two years SLAC has occasionally engaged in an unusual program called "electrical load shedding." That is, under certain circumstances, we will voluntarily choose to shut down some of the large power-consuming devices at SLAC (such as magnets or even the accelerator itself) or else reduce the power consumption of these devices in order to "power down" the laboratory to a total power consumption of less than 25 MW. In this article we plan to explain why load-shedding has become necessary at SLAC, and also to discuss the various factors that determine just when a power-down is likely to occur. To begin, let's review briefly how SLAC gets the large amounts of electrical power that it consumes.

*Two Sources*

SLAC receives its electric power from two sources: the Bureau of Reclamation (BuRec), and the Pacific Gas and Electric Company (PG&E). The BuRec power is partly generated at several hydroelectric stations in the Sierra, and partly at Bonneville Dam on the Columbia River. This power is carried, or "wheeled, " over PG&E's transmission lines. SLAC is connected to the PG&E system by an AEC-owned transmission line, 7.5 miles long, which brings power down from Skyline Boulevard at 230 kV to the SLAC site. In addition, there is an auxiliary 60 kV line from the PG&E sub-station at Cooley Landing (near the Dumbarton Bridge) which supplies power to SLAC on a standby basis whenever the main line is out of service because of routine maintenance or because of failure.

*Comparative Costs*

SLAC buys most of its electrical power from BuRec for the simple reason that BuRec power costs about one-third as much as PG&E power. (BuRec's rate is about 0.3¢ per kilowatt-hour as compared with PG&E's rate of 1.0¢ per kilowatt-hour.) The rate charged by PG&E is not only about three times higher but it is also subject to various add-ons that depend upon fuel costs and price-inflation trends. Given this comparative-cost situation, why doesn't SLAC just go "sole source" and use only BuRec power? The answer to that question requires a little explanation.



*A 7.5-mile, 230-kV transmission line connects the SLAC site to the PG&E main line on Skyline Boulevard. A smaller, 60-kV line provides auxiliary power to SLAC when the 230-kV line is out of service.*

*The BuRec Power System*

BuRec operates power-generating systems in several different areas throughout the United States. The particular BuRec system that SLAC is concerned with is called the "Central Valley Project." BuRec's CVP has a total electrical generating capacity of about 925 MW, and over the years there has been a continually increasing demand placed upon this system by new, qualified customers, and by old customers who wish to expand their consumption. At the present time, BuRec's CVP serves 52 different customers, including the following:

6 municipalities
2 utility districts
1 rural cooperative
23 Federal agencies
5 State agencies
15 irrigation districts

Among the Federal-agency customers, the largest single users are, in order, Ames Research Center (at Moffett Field), SLAC, and Mare Island Naval Shipyard. All the Federal-agency customers combined account for about 25% of the total BuRec CVP power usage.

*(continued)*

*SLAC's Share: "Firm" and "Withdrawable"*

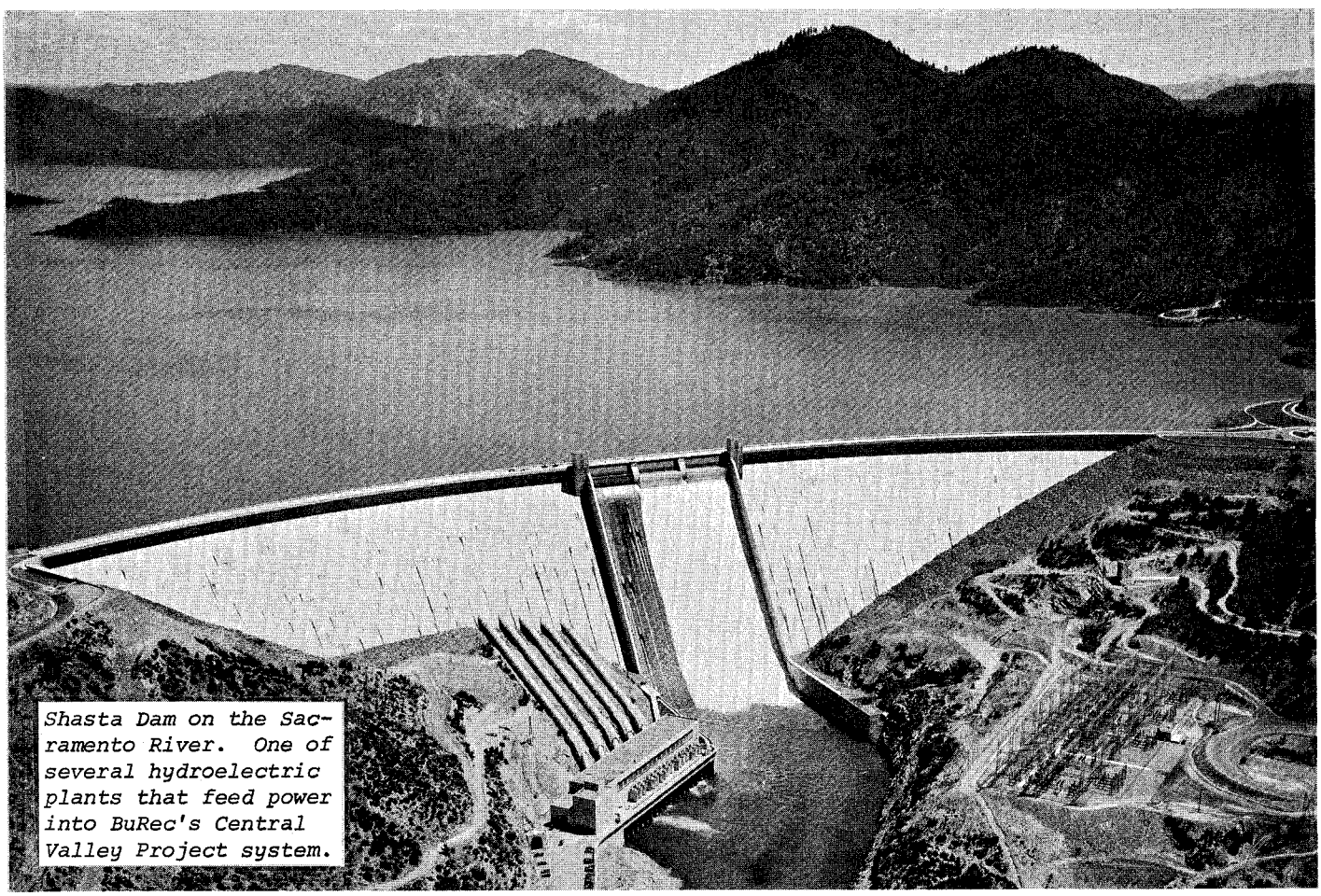
The power generated by BuRec's Central Valley Project is allocated among its 52 customers in either or both of two ways: (1) as "firm" power which is guaranteed to be available as long as the system is operating normally; and (2) as "withdrawable" power which *may* be available if the system is not operating near its maximum capacity. As an example, SLAC's present allocation is 37.6 MW, of which 25 MW is firm and 12.6 MW is withdrawable. The firm allocation of 25 MW has remained constant ever since the SLAC accelerator first began operating in 1966-67 and is not likely to be changed in the foreseeable future. In contrast, SLAC's original withdrawable allocation of 20 MW has been gradually reduced to the present level of 12.6 MW, and BuRec anticipates that the needs of other customers will force SLAC's withdrawable allocation down to zero sometime in 1976. So the load-shedding program that we shall describe in the next paragraphs is not designed to *save* SLAC's withdrawable power allocation (since its eventual loss seems inevitable); its purpose, rather, is *to make sure we don't lose it any sooner than we have to.*

*BuRec's Ground Rule*

With the continually increasing demands upon its system, BuRec decided more than a year ago to set up a rather stringent operating ground rule for those of its customers who have withdrawable-power allocations. As applied to SLAC, this ground rule goes as follows:

> If SLAC's peak power demand from the BuRec system exceeds 25 MW *at the same time* as the total demand on the system exceeds 925 MW, then *on each such occasion* BuRec may decide to reduce SLAC's allocation of withdrawable power, *on a permanent basis,* by an amount that BuRec may determine.

We can illustrate the potentially severe consequences of this ground rule by the following example. At 1:30 A.M. on the morning of June 6, 1974, SLAC was consuming power at the rate of about 54 MW, or 29 MW higher than our firm allocation of 25 MW. If the total BuRec system had been operating above 925 MW at that time, and if BuRec had decided to penalize SLAC by reducing our allocation of withdrawable power to zero, then the extra 29 MW would have become power supplied by PG&E at the higher rates. Extending this situation to the full month of June, our power bill would have been about $210,000 instead of $159,000, a difference of $51,000. Needless to say, spending an extra $51,000 per month on electrical power is something to be avoided for as long as we can possibly avoid it.



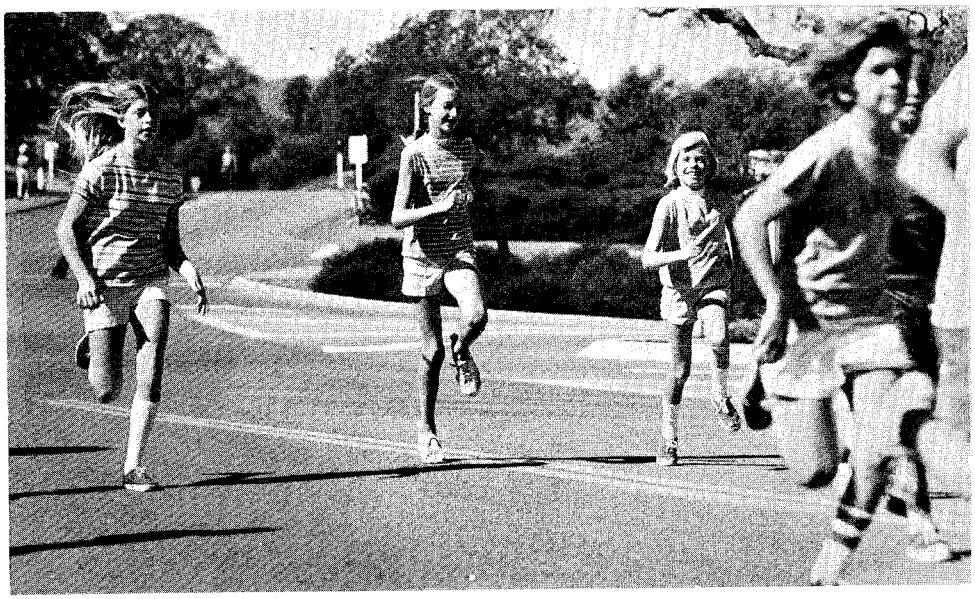
*Shasta Dam on the Sacramento River. One of several hydroelectric plants that feed power into BuRec's Central Valley Project system.*

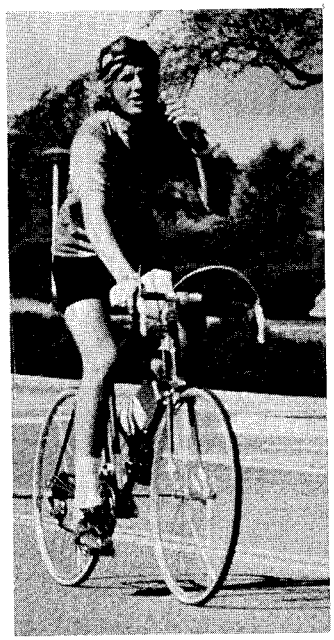
*(continued on page 9)*

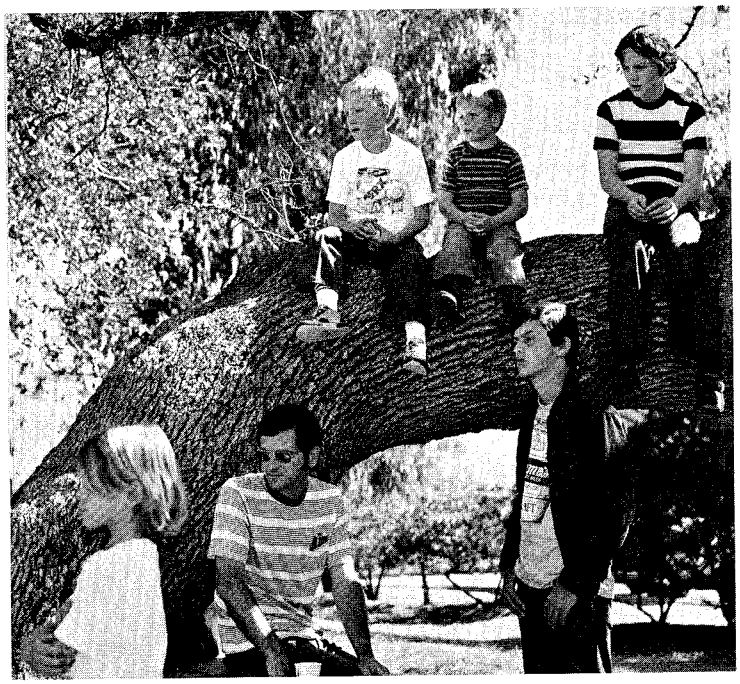
# SLAC FAMILY DAY
## October 12, 1974

**An Album Of Photographs By**

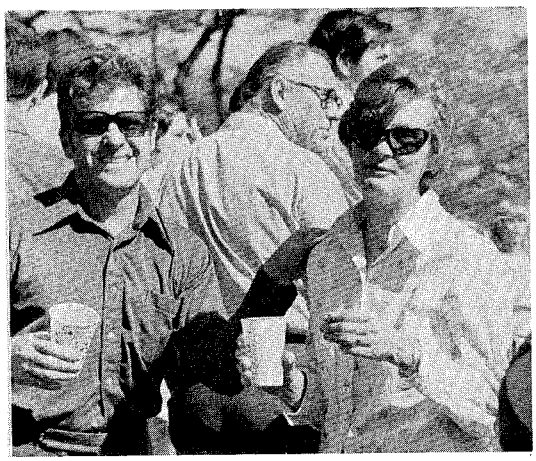
**Joe Faust (p.5,8) & Bill Walsh (p.6,7)**

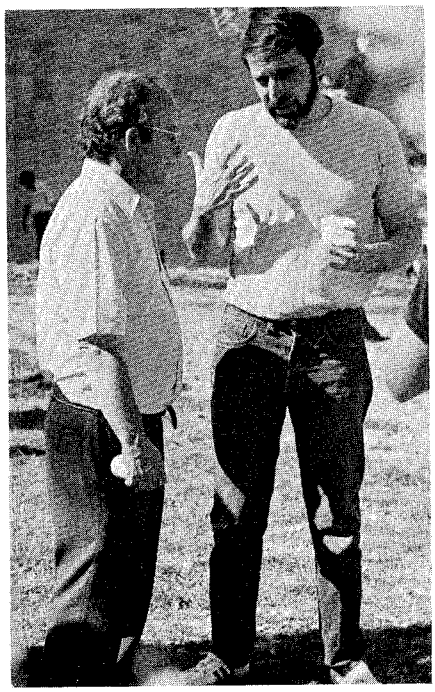


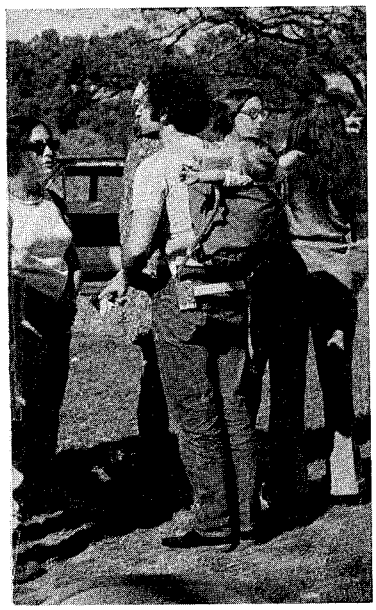


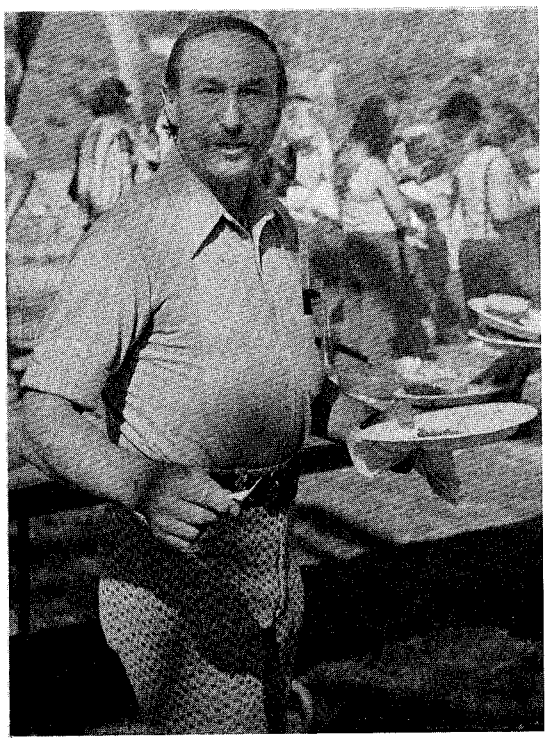


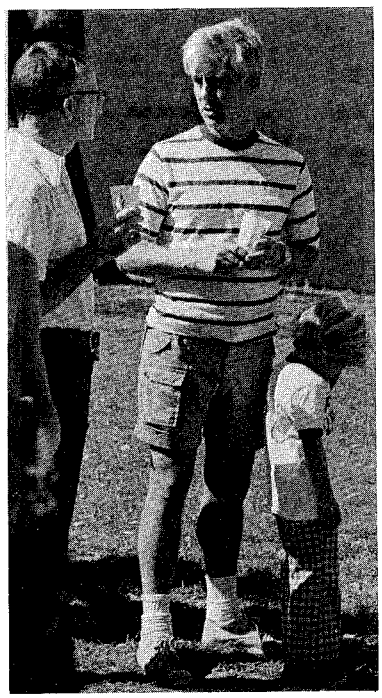
*FAMILY DAY 1974*
*Photos by*
*Bill Walsh*

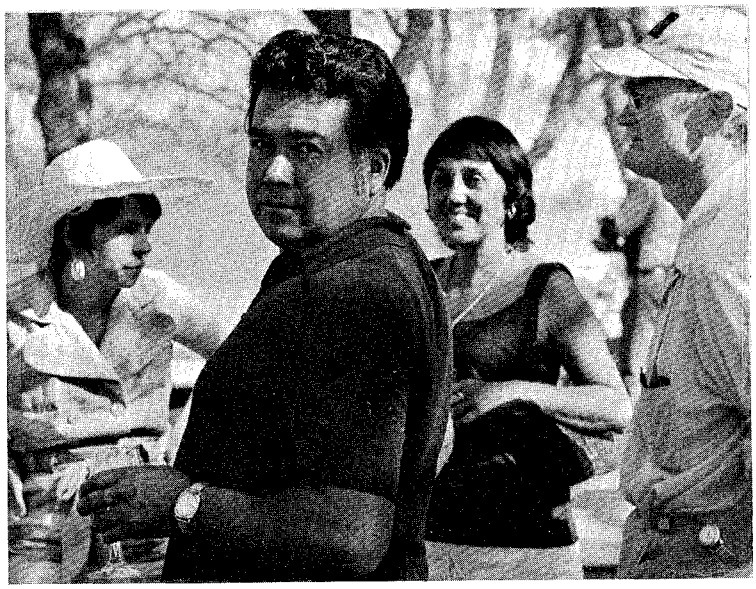


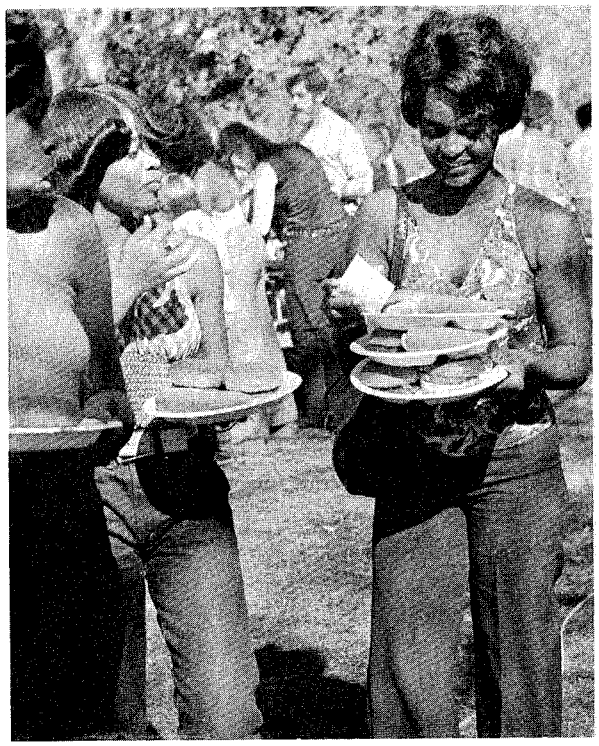


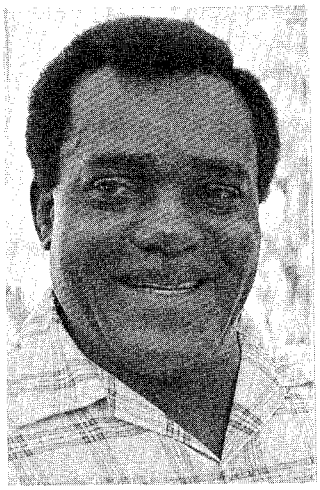




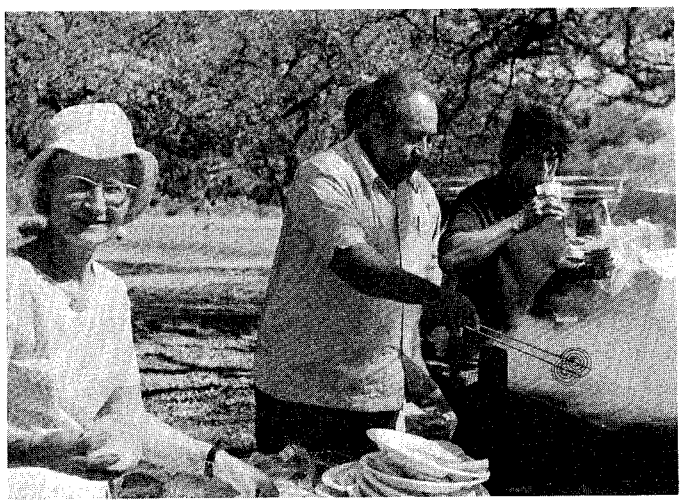


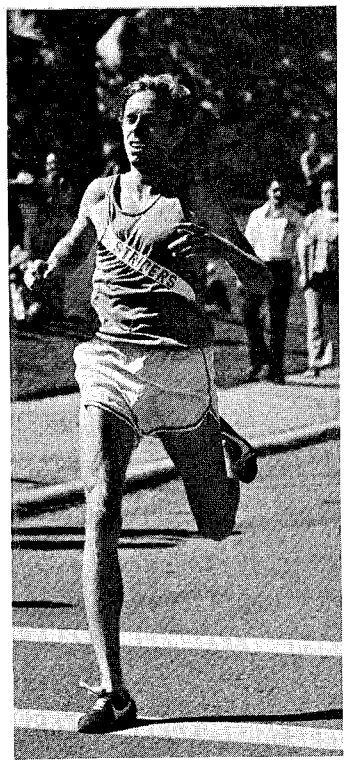






*FAMILY DAY 1974*
*Photos by Bill Walsh*





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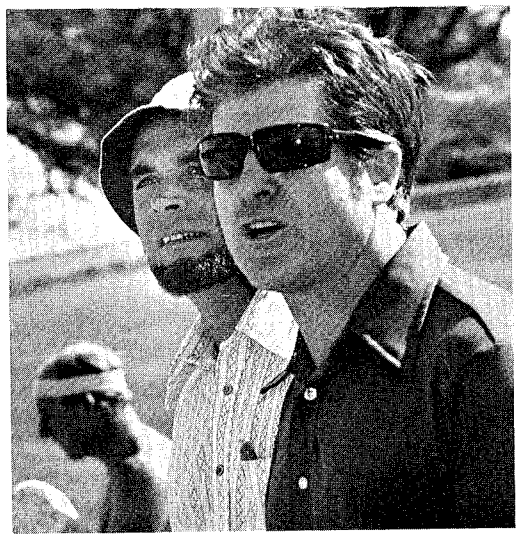
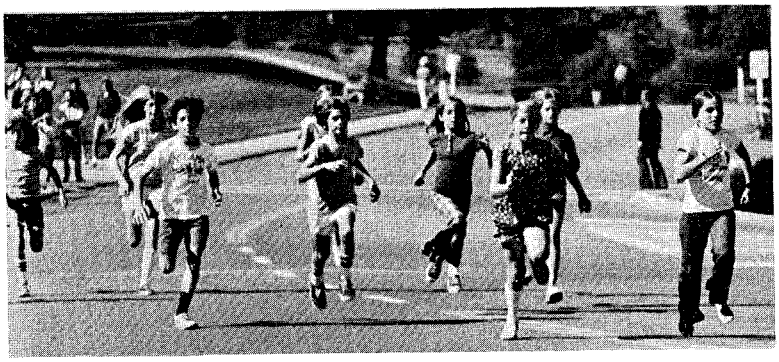
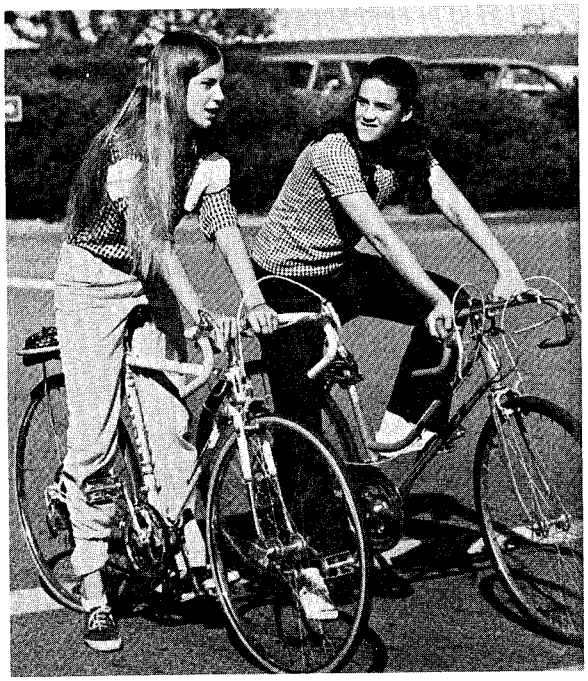
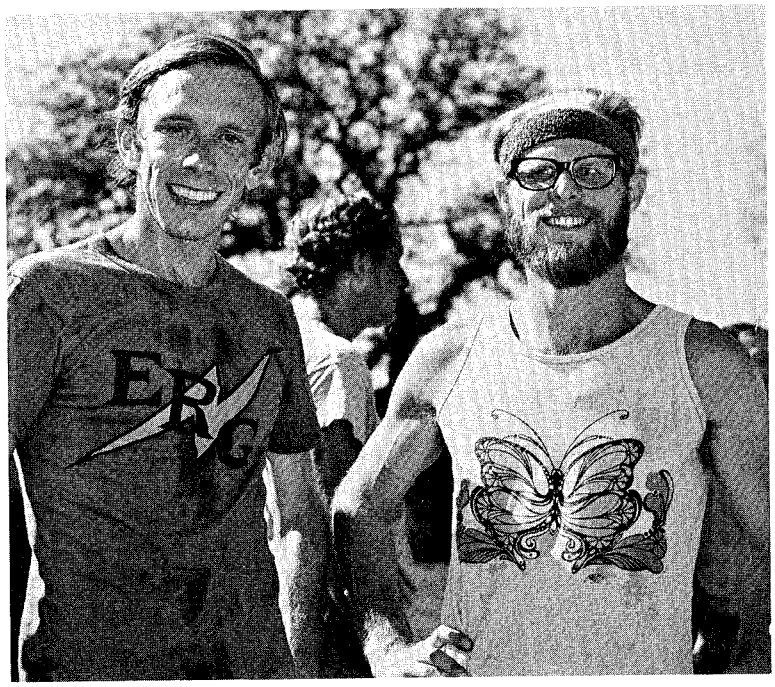


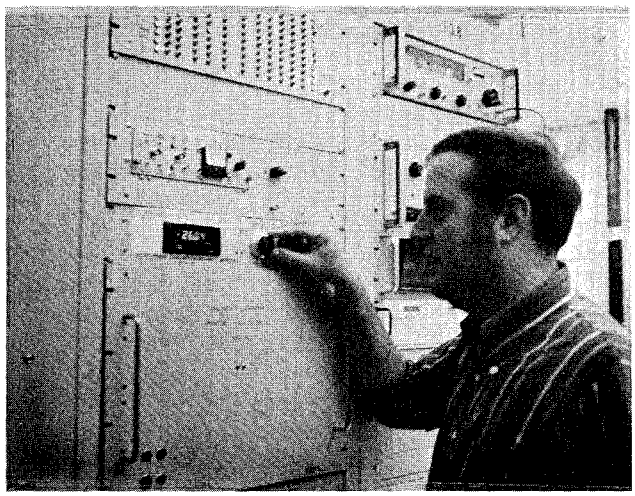






*Load Shedding: Experience To Date*

To summarize, then, the purpose of the load-shedding program is to make sure that SLAC's demand on the BuRec system is less than 25 MW whenever it seems likely that the total BuRec load will approach its rated capacity of 925 MW. During 1973 and through the first nine months of 1974, SLAC has actually gone through a "power-down" in order to shed electrical load on 14 separate occasions. Two examples can illustrate these power-downs. On July 26, 1973, we powered down from about 38 MW to 21.4 MW at a time when the total demand on the BuRec system approached (but didn't actually reach) the 925 MW limit; as a result, neither SLAC nor any other withdrawable-power BuRec customers were penalized. A year later, on July 25, 1974, SLAC also powered down, in the late afternoon, from about 32 MW to 24 MW at a time when the BuRec system *did* exceed 925 MW; thus SLAC avoided being penalized, but other withdrawable-power customers may not have avoided penalties.



*In the Main Control Center at SLAC, Hal Smith is shown at the Master Power Meter. This meter provides a measurement of the total rate at which electrical energy is being consumed throughout all of SLAC at any given time.*

*(Photo by Emmett Carmena.)*

*Load Shedding: Knowing When*

It is more complicated than it might seem to decide when SLAC should start to power down in order to avoid beaking the BuRec ground rule. This is because the BuRec system, which is rather widely dispersed through a large part of California, does not have a single meter or total-load indicator to measure the demand that is being made on the full system. As a result, SLAC and the other vulnerable customers of the system have to rely on several indirect methods to estimate how heavily the system will be loaded on any given day. At SLAC, the following kinds of information are collected each day as input:

1. *Estimates*. PG&E is asked for yesterday's peak load and for an estimate of today's load. Similar information is obtained from BuRec.

2. *Weather information*. The Weather Bureau is asked for the previous day's high temperatures and for the predicted temperatures for today in four cities: Red Bluff, San Jose, Sacramento and Fresno. Aviation weather news is obtained by radio or telephone. BuRec is also asked for a weather prediction (they make occasional 5-day forecasts).

3. *Ames wind tunnels*. PG&E is able to tell whether Ames Research Center is running wind-tunnel tests, but not able to predict how such loads may fluctuate.

In addition to these daily inputs, there are certain rules-of-thumb that have been developed in estimating the probable BuRec loads:

4. *Wind direction*. A north wind at Red Bluff usually means higher temperatures, and vice-versa.

5. *Friday*. Electrical loads are usually lighter on Fridays than on other working days.

6. *Christmas season*. The period between December 15 and January 1 is a time of heavy loading on both the BuRec and PG&E systems.

7. *PG&E/BuRec ratio*. The peak power demand on the PG&E system varies somewhat erratically between 11 and 16 times as much as the peak power demand on the BuRec system. Thus if the PG&E total system meter reaches a value of 10,175 MW it may indicate that the BuRec system is approaching 925 MW.

*The General Criterion*

After putting together most of the factors described above, SLAC has evolved the following general criterion for load-shedding:

*If*

The temperature at Red Bluff is over 100°F

*and if*

The temperature at San Jose is over 80°F

*and if*

PG&E's power demand is over 11,000 MW

*then*

BuRec's demand will probably exceed 925 MW

and SLAC had better start getting ready to power down to an operating level of less than 25 MW. In fact, if two of the conditions noted above are greatly exceeded, even if the third is not, that is also a signal to be ready for a possible power down.

*Load Shedding: What to Shed?*

When conditions have reached the point where it appears that the 925 MW BuRec load limit may be exceeded, SLAC has a number of options avail-

*(continued)*

able for powering down. The Table on this page gives a rundown of the power-consumption ratings of the accelerator, some of the experimental facilities, and elements of SLAC's physical plant, under various conditions. The usual procedure for powering down consists of selecting those items that will have the least effect on the lab's overall research productivity at the particular time that the load-shedding must be done. As an example, we might power down by reducing the accelerator's repetition rate from 180 to 120 pulses per second, shutting off the beam switchyard magnets and auxiliary systems that feed End Station A, shutting off the 20 GeV spectrometer, and perhaps running the streamer chamber magnet at half power. Load shedding of this sort might have the effect of reducing the number of active experiments from, say, six to four while the power-down condition lasted. Specific decisions about what apparatus to shed will always depend strongly on how the remaining 24 or so MW of electrical power can be used to produce the optimum research output at the particular time that powering down becomes necessary.

Table

Approximate Power Consumption Of Some Facilities At SLAC

| | | Megawatts |
|---|---|---|
| *Non-Operational Power** | | |
| Campus buildings | | 2.5 |
| Klystron Gallery | | 3.0 |
| MCC & Beam Switchyard | | 1.5 |
| End Stations A,B & C | | 1.0 |
| Computation Center | | 0.7 |
| Cryogenics Building | | 0.3 |
| *Total SLAC (typical)* | | *7.5* |
| *Accelerator Running* | | |
| Accelerator | | 9 to 31 |
| 1. Conventional power | 5.0 | |
| 2. Variable power: 60 pps | 4.2 | |
| 120 pps | 7.8 | |
| 180 pps | 13.0 | |
| 360 pps | 26.0 | |
| Beam Switchyard | | typ. 3 |
| 1. A bend (25 GeV) | 1.4 | |
| 2. B bend (25 GeV) | 0.6 | |
| 3. Beam Line 15 (to SPEAR) | 0.5 | |
| 4. Pumps & Cooling tower | 1.5 | |
| End Station A | | ≈ 6 |
| 1. 20 GeV spectrometer | 4.3 | |
| 2. 8 GeV spectrometer | 2.6 | |
| 3. 1.6 GeV spectrometer | 1.8 | |
| SPEAR | | 10 max. |
| 1. RF power | 2.0 | |
| 2. Solenoid detector | 2.5 | |
| 3. Ring magnets: 1.5 GeV | 0.6 | |
| 3.0 GeV | 2.4 | |
| 4.2 GeV | 4.7 | |
| Large Magnets | | various |
| 1. 72 D 36 | 2.5 | |
| 2. 40 D 48 | 1.0 | |
| 3. 100 D 40 | 1.7 | |
| 4. 70 D 43 (LASS dipole) | 4.3 | |
| 5. 40-inch HBC | 2.5 | |
| 6. 2-m Streamer Chamber | 5.0 | |
| 7. 54-inch | 1.3 | |
| Transport Magnets | | various |
| 1. Beam Line 8 | 0.4 | |
| 2. Beam Line 20/21 | 2.7 | |
| 3. Beam Line 23 | 1.8 | |
| *Total SLAC (typical)* | | *50* |

*Whether or not the accelerator is running

*Load Shedding Is Not Energy Conservation*

It is perhaps unnecessary to point out that the load-shedding program we've talked about in this article should not be confused with SLAC's energy conservation programs. SLAC has been able to reduce its annual consumption of energy by an estimated 7% through such means as turning off lights in the Klystron Gallery and office areas; turning down thermostats and shutting off heating, ventilating and air-conditioning units on the weekends; turning off major research magnets when not in use; lowering the temperature of the low-conductivity water system in the research area; and turning off standby units in the injector and klystron systems. These are significant energy-use reductions, but their purpose is quite different from that of the load-shedding program we have been discussing. (See Gordon Ratliff's article in the September 1974 *Beam Line* for a discussion of energy conservation at SLAC).

*Summary*

To reiterate, SLAC's load-shedding program is based on the desire to prolong the period during which the BuRec's allocation of withdrawable power to SLAC continues in effect. The economic incentive for the program can be judged from the fact that SLAC's electrical power costs for Fiscal Year 1975 would be about $250,000 higher if it were not for our allocation of BuRec withdrawable power. Knowing just when to power down depends quite strongly on the interpretation of certain kinds of data few of us ever imagined we would be dealing with--the wind in Red Bluff, irrigation pumping in the Central Valley, wind-tunnel testing at Moffett Field. A decision to power down at the wrong time would be inconvenient and inefficient; a decision *not* to power down when this is desirable could cost us a lot of money every month for several years. All in all, load-shedding is a rather peculiar (but also rather interesting) sidelight to the business of accelerators and high-energy physics research.

--Dick Neal & Alex Tseng

There are indivisible bodies, infinite both in number and in the variety of their shapes (although all of the same nature), of which everything else is composed--the compounds differing from each other according to the shapes, positions and groupings of their constituents . . . The atoms have all sorts of shapes and appearances and different sizes. . . . Some are rough, some hook-shaped, some concave, some convex, and some have other innumerable variations. . . . The number of shapes among the atoms is infinite because there is no more reason for an atom to be of one shape than another. And this is the cause they assign for the infinity of the atoms. . . . Some of them rebound in random directions, while others interlock because of the symmetry of their shapes, positions, and arrangements, and remain together. This is how compound bodies were begun.

--Democritus (c. 400 B.C.)

# Minus 210° Centigrade

Late on a hazy afternoon toward the end of August, 1978, Sylvestor Montague, aging playboy and persistent investor, decided that he had had it.

"That's it," he said to his broker, Charley Threadneedle, as the ticker closed down for the day. "I'm finally getting out of this rat race."

The Dow had rallied during the last half-hour of trading to finish up 1/4, at 117-1/2, but Montague was in no mood to listen to any of Threadneedle's youthful enthusiasm about the "fantastic values" and the market "finally bottoming out."

"Look," said Montague, you just do what I told you. Take the last five thousand and put it all in IBM, first thing in the morning. Offer 8-1/4 to start, but go all the way to 9 if you have to."

"But, Syl--"

"No! No more of your baloney, Charlie. Just do it, and I'll be back to check with you after awhile."

"When?"

Montague's 55-year-old face crinkled up in a sly smile. "Oh, I don't know," he said. "How about May first, 2005 A.D.?"

Bright and early the next morning Montague presented himself at the Azusa branch of the Cryogenic Fresh Start and Better Deal Society (CFSBDS) and went over the terms of his contract with his counsellor from Mission Control for the last time. Yes, his Voyage was all set. Yes, there would be suitable clothing and a warm meal and $250 in Traveler's checks and a free telephone call waiting for him when he arrived at Journey's End. Satisfied with the arrangements, and feeling at peace with himself for the first time in many years, Montague calmly swigged down his knock-out drops in a fat tumbler of scotch. And shortly thereafter, with all the hushed solemnity befitting such an occasion, he was popped directly into his own personal Perpetual Vial of liquid nitrogen. And in this state, as the years rolled by--the Comet of Halley, the turn of the Millenium--he was distinguished from his follow Cryonauts, row upon cylindrical row, only by the markings on the brass plaque that was affixed, at navel level, to the side of his Vial:

*Montague, Sylvestor*
*5-1-2005*
*Good Times Ahead!*

Then came Arisal Day! He was thawed. He awoke. He grinned his pleasure. He dressed, accepted his Traveler's Checks, declined with thanks his First Supper, and rushed to the Televiewphone to call his broker.

"Charley Threadneedle, please."

"This is he speaking."

"Charley! Charley, you old galoot! Why you look ancient! You must have aged-- Hey, Charley, it's me! Syl Montague!"

"I know. I was notified last week that--"

"Never mind that, Charley. Just tell me what happened."

"What?"

"What happened to the *stock*, man? You remember--about 600 shares of IBM, my last five thousand dollars?"

"Yes, I figured it up for you when I heard you were coming in today."

"Well? How much. *How much is it worth?* for crying out loud."

"Well, your 622 shares have a present book value of about $13 million--"

"Thirteen *million? YAHOO!* I told you, Charley. Didn't I tell you, Charley boy? Yes sir, Charley, you should have come along with me, you old prune. *Thirteen MILLION--*"

"I'm sorry, sir, your three minutes is up," said a pleasant-faced young woman speaking out of the Televiewphone screen.

"OK, OK, just a second. Charley? Are you still--"

"I'm sorry, sir, your three minutes is up," said the musical voice. "For an additional three minutes, please deposit two hundred thousand dollars."

--Bill Kirk

> There is something fascinating about science. One gets such wholesale returns of conjecture out of such trifling investment in fact.
>
> --*Mark Twain*

## TRANSACTIONAL ANALYSIS FOR SUPERVISORS

A number of seminars on transactional analysis for supervisors has been arranged by the Staff Development Services of the Personnel Department. These seminars are designed to help participants understand human behavior and to apply this understanding to on-the-job situations. For example, performance appraisel, problem-solving, and decision-making are skills that can be increased through some experience in transactional analysis.

Each session will start with a 30-minute film, followed by discussion and role-playing. Sessions will be held on Tuesday mornings, beginning on December 3, and will run from 10:30 A.M. until noon. Attendance will be limited to the first 20 supervisors who apply. To sign up for these seminars, please phone either Carol Colon or Helen Perigo at extension 2353.

--Gerry Renner

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Dorothy Ellison, Bin 20, x2723: want ads, clubs, sports people; general news.

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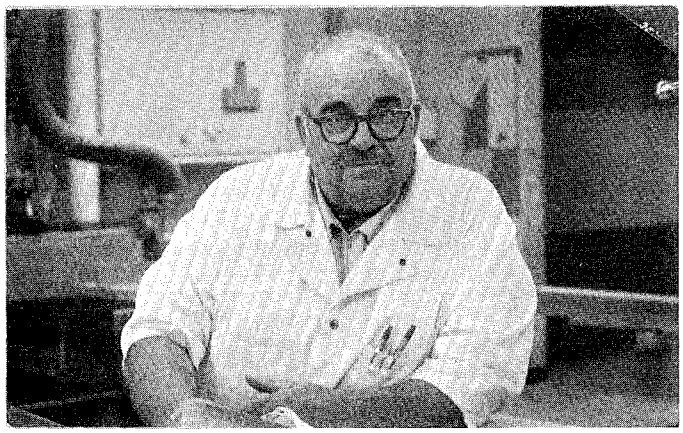

*Photo by Glenn Hughes*

## BOB MASKELL TO RETIRE

One of SLAC's most skillful craftsmen, Bob Maskell of the Carpentry Shop, will be retiring this month. Bob has had an interesting and varied career. Born in the little town of Munising, Michigan, his earliest work experience came in helping his dad run a movie theater and a skating rink. His family moved to the state of Washington when Bob was about 13, and soon afterward he began his work as a carpenter's apprentice in a cabinet shop. After his dad died, Bob became the chief means of support for his mother and sister. The family continued its interest in staging vaudeville and film shows in a number of small town halls and churches, and in this work they traveled nearly the whole west coast from Canada to Mexico.

Bob and his wife, Shirley, were married in 1939, and during the Second World War Bob was employed as a pipe-fitter at the Basalt Shipbuilding Company in Napa, California. During this period he again made use of his knowledge of the motion-picture business by arranging for film showings for children's groups and for hospital patients. In 1945 Bob returned to the motion picture business for two years before finally deciding to devote his full-time efforts to his craft of carpentry.

He worked for Lockheed and for United Technology Corporation in this area before joining SLAC in 1963. At SLAC, Bob's special skills and exceptional ability to solve difficult problems have proved extremely valuable on many different occasions. We'll miss not only Bob's skill and experience in handling the tough jobs that he did so well, but also we'll miss him as a good friend.

--Don Ewings

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