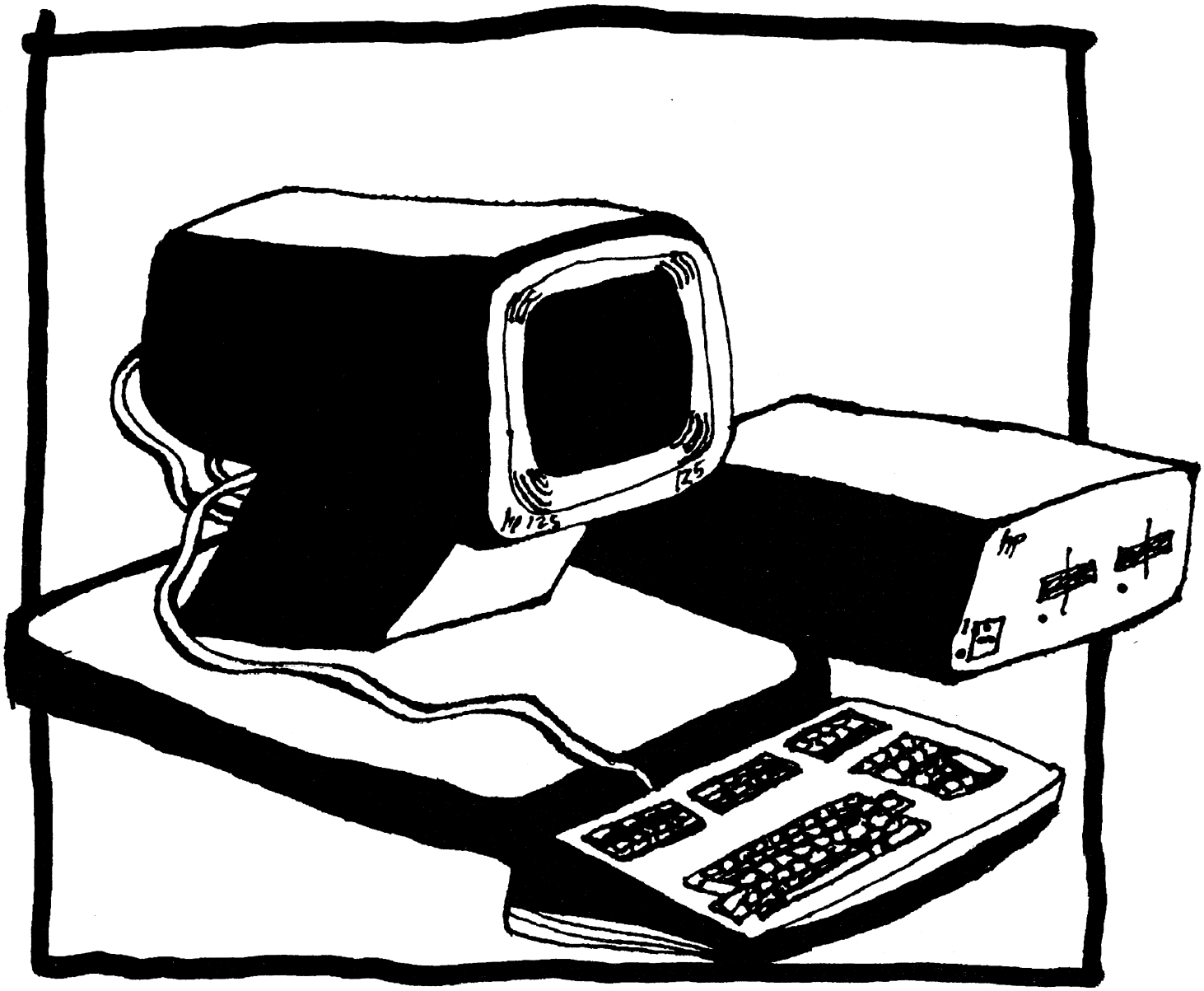
The Analytical Engine

JOURNAL OF THE COMPUTER HISTORY ASSOCIATION OF CALIFORNIA



HP 125 *Lana Taber*

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Editorial: BOOTSTRAP!!

In the last four months the ANALYTICAL ENGINE has done more — and more has been done for it — than ever seemed possible. Read POMONA and the articles, read SPOTTER FLASH and the Overview of Bureaucratic Processes, and you'll see. The Computer History Association of California is doing the job it was created to do, and in the process, attracting national and even international attention.

So much has happened in just over a year that, when we look back, even our own beginnings seem scarcely visible. All the more important to have clear and unsparing sight of our future. It's time to invite the cooperation of colleges and universities, of companies, computer industry workers, teachers and students, of everyone who sees or *will* see that California's history of computing is worth saving. The CHAC has become greater than we dared hope. It is still too small, measured against the job that must be done.

Some of you who read this are subscribers. Many more are not. If you are not, please consider: Subscribing, joining, donating are the best things you can do, to preserve the work that you yourself have done, and protect the history that you love.

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VAPORZINE?

This issue of the ENGINE is 'way late. Read it and you'll understand why. Nonetheless, it shouldn't have been.

The schedule we try to keep for each issue is first-fifteenth-first; so that, as an example, the July issue will close for copy on July first, the e-mail edition will be uploaded to online subscribers and the request daemon on July fifteenth, and the paper edition will be mailed on August first, typically reaching subscribers about a week later.

There are two ways to make sure this schedule is adhered to. First, we need volunteers — preferably volunteers experienced with Word for Windows or Word for the Macintosh — to help with editing, proofing and composition. Distance from us is no problem since RTF files can be transmitted rapidly by e-mail. So, if you're a Word user who likes to proof and format, please consider giving us a hand.

The second, of course, is that we need more articles! Not only because we like them....why else would we put out a magazine....but because the more *you* write, the less *we* have to write. By contributing to the ENGINE, you assure the variety, comprehensiveness and interest of what we publish. And the articles we prefer are short and punchy; it's not a major undertaking to write one if your references are at hand. Start one today and know the thrill of seeing *your* writing in California's premier journal of computer history.

"JUST LIKE THE GOLDEN GATE BRIDGE":

Rey Johnson and Jack Harker talk about IBM San Jose and RAMAC

[The story of the modern computer is inseparable from the story of the hard disk, one of the most successful data recording technologies of the postwar era. The earliest commercial hard disk, IBM's 305 RAMAC, is very much a part of California's computer history — because it was developed in IBM's laboratory at 99 Notre Dame Avenue in San Jose.

Reynold B. "Rey" Johnson had worked as an IBM engineer since 1934, developing a mark sensing machine produced as the IBM 805 Test Scoring Machine in 1937. He continued to work on engineering of input devices and, on January 15, 1952, was named manager of the San Jose laboratory.

John M. "Jack" Harker joined IBM and the San Jose facility in May 1952, and became a principal engineer on many random-access file devices, focusing his research on air-bearing lubrication and the avoidance of the dreaded head crash. The work done by these gentlemen answered difficult theoretical and practical questions and, ultimately, revolutionized the retrieval of magnetic data. It also confirmed the San Jose Lab's position as one of IBM's most adventurous — and most financially successful — facilities.

On Saturday, March 5, 1994, Rey Johnson, Jack Harker, Kip Crosby and Max Elbaum gathered in Rey's study-library-laboratory for an extended conversation about RAMAC, the Low Cost File System, and the early challenges of engineering random-access storage.]

KC: In the context of the San Jose labs, let me ask first — trying to go back to the perspective of the late '40s, early '50s — IBM was, not only in its physical location but in its mind-set, very much an East Coast company. It had a formidable European presence through IBM World Trade, and the data processing needs of Asia were considered to be minimal. Why did IBM suddenly decide to put a laboratory in California?

RJ: Well, in 1951 Tom Watson, Jr., Vince Learson and others in the IBM top command decided they'd conduct market research to establish whether computers were business machines or not. And so they sent a team out — Dr. Cuthbert Hurd, I believe, headed the team — and they visited all the large companies, [especially] aircraft companies, government agencies and the military, to establish the size of the market for computers. Proposing a rental of $15,000 a month, and assuming it had the qualities of the ENIAC and the UNIVAC and whatever was necessary, they came out to the total market for 17 machines. At that point Mr. Tom Watson made the decision to manufacture 18. But in the process they discovered that, of the business market, it was really the aircraft industry that was interested in innovative data processing. Converting airflow data into usable information was one of the key problems that required unprecedented processing power. And since many of the aircraft companies were located in California and the Pacific Northwest, IBM was determined to have a laboratory close at hand. I had the freedom to locate the lab anywhere on the West Coast, but before I came West, IBM management had pretty much decided — or recommended — that it should be in the San Francisco area. Now, IBM had a plant in San Jose that was manufacturing punch cards for the Pacific region, and it had been a very successful business enterprise since it was established in 1944. They had a cafeteria, an accounting system, and a lot of amenities which I — as a raw engineer, essentially — was very pleased to have as resources while we got started. That's why San Jose was chosen. I had actually hoped, when I first came out, that we would locate the laboratory in the Stanford industrial site or somewhere nearer Stanford.

KC: At that time the Stanford industrial site had a couple of other firms that would be important

to the computer evolution — notably Hewlett Packard and Varian.

RJ: Yes, but remember, I was not a computer engineer. I had had responsibility for input in IBM. I developed a test scoring machine (the IBM 805) announced in 1937; and I had responsibility for keypunch input development in the '40s. And I was aware of the punch card input problems. I had a record of 53 patents by that time and I developed several products, including time clock products which were revolutionary. They therefore gave me complete freedom to innovate the programs. The programs were to be of my choosing, as long as they weren't copies of any of the programs that were in work in the other laboratories, and to that they added some contract customer work — adapting IBM machines to customer requirements.

KC: So that among other things, you were acting as support engineers for the installed base of 701s?

RJ: 701s hadn't been announced. They were in work — the first one was finished in the spring of '52. But the 701 was not a business machine. It wasn't planned that way, and nobody in IBM really had the insight to see what computation would do for business — data processing or computing as we know it today. At my request Lou Stevens joined me as assistant manager — he had been the input/output manager on the 701 project — and we worked in the context of card processing and keypunching, which I had a lot to do with. There was usually a time card every week for everybody, and you had to be sure to enter the right information, so you needed a punched master card to put into the keypunch, for entering the account number and the rate, *et cetera*. So a tub file was provided, from which cards were pulled. And when orders came in from customers, you needed a tub file of inventory items. If it was groceries you wanted one for cornflakes, and every item that was ordered by a grocer wholesale, you needed to have the inventory information — the cost and the pricing and so on. Thus the tub file was a central feature of many keypunch departments. IBM at that point was manufacturing enough punch cards to go around the world every two weeks, and probably 95 percent of what we would call machine memory today was in punch cards and files. We never thought of it as memory, but nevertheless, that was the memory problem we attacked.

KC: But the tub file, to my understanding, was a very laborious way of keeping track of things like inventory. There were many applications, such as invoicing, for which the tub file wasn't especially well adapted.

JH: Well, for the systems that were in use it was surprisingly efficient, because you had these cards with all the information on the item pre-punched. To assemble an order you'd pull up a customer card, and you'd pull up a card for each item, and you'd have a pack that could then be processed through your keypunch equipment. In terms of today's technology, that's awkward. But compared to anything else that was available, it was very efficient.

KC: For a purely mechanical system, it was probably as good as you could get.

RJ: The foresight of any of us was pretty bad in terms of the potential of computers to do the job — at that point. Of course there had been years of ongoing work in the Poughkeepsie laboratory, where Ralph Palmer in particular had developed a tape processing machine. They had experimented with sorting tapes, going from tape to tape, starting and stopping tapes — that work had proceeded. But that was still a batch system and it didn't meet the input problem posed by the tub file. That's the reason I chose the tub file problem as one of the problems for San Jose.

JH: Let me interject and get back to your first question, in historical terms. The West Coast universities, particularly Cal Tech, Stanford and Berkeley, had developed reputations in

electronics, and IBM wanted to hire graduates; but they found they had a very hard time doing that and attracting them to either Poughkeepsie or Endicott. If you had seen Poughkeepsie or Endicott in those days, you would have understood. In fact, the only person that Rey brought with him was Hal Martin, who was a Cal Tech graduate they'd succeeded in hiring back East, and Rey chose him to come back. But most of the people who were hired for the lab were either out of the West Coast universities, or out of the aerospace industry.

RJ: On the other hand, it's possible to overplay that. At one time in IBM I was the only senior engineer — they called them inventors — with a college degree. And my degree was in educational administration. All the key inventors that built IBM's data processing were people who had come from drafting or customer engineering or the factory — bright, clever, talented people. They had developed all our printers, punches, sorters and so on. In 1939 — this is a bit of background but it'll give you the feel of IBM at the time — Thomas Watson Sr. had heard of someone who was going directly from typing to punching, and he wanted me to develop an accounting machine that would work from typed characters, [for which] I could hire anybody I wanted to. They engaged the patent department to advertise for scientists or engineers for this work anonymously — IBM itself would never advertise for help for its engineering. It was in essence a blind ad, and a number of people answered it. I hired an MIT graduate to assist me on that job, and he and I developed mark sensing. We actually developed an accounting machine that worked from rather large typed numbers; it never went into production, but mark sensing became a very important data input system. Julian Bigslow was succeeded by another outstanding engineer, Gordon Slaughter, who went into the service too. When he came out of the service in 1945, he came to see me. He said "Rey," — and he was a personal friend besides my assistant at that time — "I have really been sold on electronics and I think that electronics is the career I would like to pursue, and I'm not sure that IBM has a career for anybody in the field of electronics." At that point I'd developed test scoring and mark sensing, both of which used amplifiers, and I knew that all the electronic work in IBM, up to that point, had been done by a single engineer; so I had to concur. We went down to see Wally McDowell — who was lab manager — and talk about it. As much as we hated to see Gordon leave, we all three agreed that there wasn't a career opportunity in IBM for an electronic engineer in 1945.

KC: By the early '50s, in trying to develop the 701, IBM found they didn't have that talent. And they converted a number of mechanical engineers — they literally gave them courses in electronics...

RJ: Frank Towns, I know, built the Harvard ASCC and the subsequent one [SSEC] that went into Corporate Headquarters — he was sent for a short course at Cornell. I also recall an Engineering managers' meeting with Walter Titus, vice-president and general manager at Endicott. He said, "I want to know if any of you know what a binary numeric system is." And not one of the people of that group knew what a binary system was — this in the early '40s. It helps you understand why I had to run ads to get a graduate student, and why there wasn't a career in electronics with us as late as '45. Of course, Ralph Palmer's multiplier was an application of electronics, to computing in the early 1940's.

KC: Now the electronic multiplier was the 604?

RJ: The 603 was first, and 604 was Ralph's successor to the 603. The 604 was a very successful multiplier.

KC: Right. And many of the people who later became customers for the 701, 702 and their follow-ons had been using 603, 604 technology, especially the aircraft companies?

RJ: Yes. Some California engineers wired the multiplier right to accounting machines....

JH: There is an interesting story, about Northrop [Aircraft] during the Second World War, where a number of customer engineers — Bill Woodbury, among others — actually rewired accounting machines into a program-controlled machine. It was a group of about three or four very bright people. I've never seen that published.

KC: This was a bunch of people who were somewhat familiar with the work being done at the Moore School. ....You don't think so?

RJ: There was an electronic data systems group that grew out of Moore School. But EAM had very little input from Moore School early on.

KC: But I'm saying that the people at Northrop might have been.

JH: They might have. At the time their job was purely maintaining the equipment and they were very bright people. The supervisor at Northrop — Oliphant, I think his name was, took Bill Woodbury under his wing.

RJ: Woodbury and Toben developed what was known as the Wooden Wheel. Woodbury was a very important input into the RAMAC too. He came out and joined our staff about 1954. Actually, what changed things was the UNIVAC and von Neumann's concept. Watson, Sr. staked the pride of the company on building the Harvard relay calculator.

KC: The ASCC, the Mark I.

RJ: Yes. The Mark I was all electromechanical. And I think every engineer in IBM had all the physics they ever needed for any of those machines. Nothing went beyond electrical circuits and maybe vacuum tubes.

KC: And then the SSEC, the one installed at World Headquarters, was somewhat of a follow-on to the Harvard machine, and was the last of the big electromechanical calculators?

RJ: Yes, it was the last of that architecture. The big computers IBM built in Kingston for the air force demand — SAGE — they were very big. They developed useful technology but no products.

KC: Actually, the Air Force provided some of the impetus behind RAMAC, did it not, through the Material Information Flow Device contract?

RJ: When we were able to size the project, I routinely asked marketing people to visit the laboratory operation and discuss our programs. And my main input was a man whose name I can't recall right now, but he said that for tub files, "five thousand unit-records is all you need, and anything beyond that will make it too big." At that point we got this request to bid for the Air Force Material Flow device, and John Haanstra and [Arthur] Critchlow, I think, and maybe Lou Stevens, went out to Dayton. We had quite an in-house discussion as to whether to use our new concept of disk files or drums. Drums were the standard at that point, and IBM being very conservative, it was ordinarily impossible to get them to try an innovation — in a customer's machine particularly. But at the last minute I convinced Wally McDowell that we should bid the disk files, and they required fifty thousand inventory items with a hundred characters each — that's five million characters, and that became the specification for the disk file.

KC: What we would now call a five-megabyte hard disk?

RJ: Yes.

KC: Now, when you say that the drum was standard, was this at about the time of the introduction of the 650?

RJ: The 650 drum had been in work, yes. But [RAMAC] was contemporary with the 650 introduction. I had very serious arguments with Vince Learson, who was responsible for market planning, and who wanted us to build a component for the 650, rather than the RAMAC as a product. He didn't seem to want the RAMAC.

KC: I understand that he was also a very easy man to argue with.

RJ: He was very strong, but fortunately he had too many other things to do to oppose our program at that point. And I was enough of a political animal to recognize that the San Jose laboratory needed a product, not a component — because if it was a component, they would pull that back to Endicott, rather than do it out here. That proved to be politically wise, but the RAMAC actually was too underpowered to carry the load. I mean, its printer was slow, and its input was punch cards, and it had a hundred characters of core memory and a drum for a buffer. So it was overpowered on inventory direct access, but underpowered in other respects. But they sold a thousand of them.

KC: We're getting a little bit ahead of ourselves, because there's something that has to be established here. First of all, as you mentioned, Vince Learson was never completely enthusiastic about the machine. Second of all, IBM had finished the 650 and was beginning to sell 650s to customers.

RJ: Not when we started. The 650 was developed contemporaneously. And let me say one other thing that happened: Vince Learson sent F. J. Wesley out to work with us, and Wesley really got religion. He wrote a memorandum to all the corporate people and he said, "IBM has to change their thinking and planning and their systems. We can no longer do things on a batch basis, whether it's tape or cards. The random access is the way to go and we have to plan our new systems this way." He used all the power of conviction that he could possibly use. And that was a very, very important input into the decision to manufacture the RAMAC in San Jose.

JH: We're skipping over a little bit here. Go back to your tub file. The first concept of what we were going to do was the file-to-card machine. The first disk file that was built and operated essentially replaced the tub file, which was the original concept. And that was as smart as we were, at that time, as to what it should be. You're now getting into sort of the second phase of it, when Rey had assembled a team of very capable systems planners — Wesley, and John Haanstra certainly was brilliant, Murray Lesser. I think at that time Greg Toben was here, wasn't he?

RJ: Woodbury was there too.

JH: And with this input the concept of a transaction processing machine evolved, which was the real key of the RAMAC. It was really the first transaction processing machine. As you said, unfortunately, it wasn't quite up to the job.

KC: It wasn't quite up to the job, but so long as you had data processing machines that were discrete units, you always had the problem of some components of the system being slower than others, and trying to bring them all up to speed.

JH: But this was really a radical break from corporate philosophy, because the 701s, 705s were all batch machines. They mechanized the punch card business, but still operated as card systems — in other words, when you ran a payroll, you would match your input cards against the master file. The RAMAC and the systems design that went into it was really an important departure for IBM.

RJ: And there was a lot of competitive action at that point. There was a unit developed in Los Angeles that provided random access with tape loops. There was a development at Rand, I believe, where they had tape strips. And somebody came back and said that somebody had experimented with putting all the accounts of the Detroit Edison on the flywheels of their power station. I was determined to evaluate every conceivable technology, and so we had one guy working on wires, one guy was working on plates, one guy was working on tape strips and drums, and of course one guy on disks. We evaluated all technologies before we chose disks. It's been my procedure always to give every competitive approach a chance to be chosen, before making the choice of a technology, because so many inventors or engineers choose technology with an enthusiasm that runs away with them, and

then they're blind to all others.... So I knew, when we chose disks, that they were the best system.

KC: In the aid of that, of evaluating competing technologies, you had introduced a management style at San Jose which depended on every engineer in the place being conversant with all projects. That was another way, to my understanding, in which the San Jose lab was very different from IBM.

JH: He created a wonderful environment for young engineers. Every engineer wanted to run his own project, and you really thought that maybe you had a chance. Everybody tried to come up with ideas, and Rey created that environment, it was wonderful.

RJ: I had a statement that I often repeated: "Don't forget, your most important assignment is to give assistance to whoever asks for it if you can, and the second in importance is the job you have to accomplish." One of the employees put that on a brass plaque and put it in the laboratory. It became a very important factor, because everybody was involved in the RAMAC; a small segment called it a bologna slicer and didn't think it was a particularly good project. But it was open and good-humored; there wasn't any back-biting between departments, as there had been in Endicott over the years, where engineers literally fought for their projects.

KC: Again and again we come up with ways in which San Jose was different from the classic IBM New York laboratories. It's my understanding that at one point you guys had Birkenstock — in his role as the head of product planning — cutting a memo saying roughly, "I don't know what those guys are doing out there, but I'm not sure I like it."

RJ: I never knew him to say that, but he gave me a hard time on occasion.

JH: It wasn't a transplanted IBM operation. With the exception of Rey, Hal Martin, and Jim Hood who came out as assistant lab manager, and Jack Poole who came over from the card plant to run the administration, there were no IBM'ers. It was a very free-spirited group that they managed to hire — and a remarkably talented one.

RJ: They were good. On the opening day we put an ad in all the West Coast dailies; we had four hundred applications, and from that four hundred I chose probably 25. So I had an excellent choice. The tub file was classified essentially as an input. Much of my work in IBM was keypunching and mark sensing and test scoring, work that was keyed to get the information efficiently into the system. I also had developed a couple of high-speed printers. I built a high-speed wire printer....

KC: For the model 26?

RJ: The wire printer for the 26 was my design, but after that I built a line printer — eighteen hundred lines a minute, where the code was a rod [rather than the Type 26 code plate — Ed.] and it was positioned harmonically. I had a model in my shop which ran quiet enough so that you could carry on a conversation next to it — at eighteen hundred lines a minute — because it was driven by harmonic cams. IBM decided to make a product out of it. Now I had learned in my time recording and keypunch days, when I had both product development and product initiation responsibility, that I didn't have the temperament to discipline my innovation; and every Monday morning, my guys used to complain that I'd come in with an engineering change. So I was very glad to pass that high-speed wire printer on to Frank Furman, who was one of the most trusted printer engineers in the business. And Frank developed that into a product that was announced, and he changed the drive from my harmonic positioning to an impact system. This mechanical multi-head wire printer was the noisiest machine that IBM had ever created. Its failure as a product was my greatest disappointment at IBM.

KC: So back to the disk file. Had there been other research, other theoretical publication about the idea of recording data on a spinning disk?

RJ: [Jacob] Rabinow came up with doing that, but his format of starting and stopping the disk made it unacceptable. He had a stack of disks, each of which had a sector cut out of it, and the whole stack arranged like a donut. And then inside he had a head that had to go around, and when it got to a disk then this disk would be driven one rotation. In that sense it was unsatisfactory. And of course there were Wurlitzers around....

JH: It was a takeoff of a Wurlitzer player.

RJ: We had a very simple technology — the technology of drums and tapes. And so the choice of disks just had to be studied enough to know that surface to surface, you had the best, most efficient arrangement of data. In the tub file application of that time, the concept was there'd be one tub file used by 20 keypunch operators. You could put 20 accesses around this disk array and access each independently, both as to track and time.

JH: The initial design of the RAMAC stipulated that we had an 18-degree envelope this access mechanism had to fit in, because Rey said you've got to be able to get 20 of them around. We managed to get three working at once on the 650.

KC: Three heads?

JH: Three access mechanisms. You could order a 650 RAMAC with up to three accesses, is my recollection, although I don't think many people did. If you look at it and wonder about the configuration of the access, that was a key parameter that we all had to live with.

KC: That you had to get 20 sets of carriers, basically, to the disk at one time?

RJ: This [*hands over a small section of a disk platter*] is a surface of a disk segment upon which the recordings have been developed magnetically — painted white, and then you put a magnetic powder on it and develop the bits, and then you spray a cover. We chose a hundred bits to the inch and 50 tracks to the inch, which was conventional tape and drum data density. We didn't push the density at all in the RAMAC.

JH: I think it was 20 tracks to the inch, wasn't it?

RJ: Twenty tracks to the inch. I have this free sample of Hewlett-Packard's disk. [*He hands over a plastic model of a Kittyhawk disk, the size of a pocket matchbox.*] That's their twenty-megabyte disk, isn't it? That would be four times the size of the RAMAC.

KC: I almost hate to tell you this, gentlemen, but I think you can get these in forty megabytes capacity....

JH: The trick was getting a head. That way you could record magnetically, because we couldn't make disks in those days as flat as the ones used now. Drums by contrast were all very precision devices with a few ten-thousandths of run-out. The heads were adjusted in place away from the drum; you'd run a head into contact and space it back away, watching the output signal on an oscilloscope. But the invention that made the disk file possible was the airhead to support the magnetic read/write element.

KC: Right, because there was, to my understanding, the first problem of — was a disk like a drum, or was a disk like a tape? In other words, could you have the heads in contact with the surface or not?

JH: If you looked at Rabinow's design — because you only spin it once, you could propose putting the head in contact. But not if it's going to run continuously.

RJ: One of the most important events, for me personally, was when we put these 150 disks on a shaft. They were machined out of just ordinary flat aluminum, as flat as we could get them. When turning they were all quite wobbly. We ran those disks at a thousand RPMs, and you could put your finger on a disk and follow it. You could keep your finger on it — it didn't get hot, it didn't wear

— and I knew at that point that we were "in like Flynn". We had to try to get them as flat as possible, but we were in. Fortunately we'd had some people with us who had done air bearing work, so we decided just to put air pressure in the head to keep it away from the surface, and five three-thousandths of an inch wasn't too far for this kind of density of recorded spots.

KC: Now this was not the approach that came later. This was an approach that actually supplied compressed air to the disk heads?

RJ: I think all of the thousand RAMAC computers that went out had compressed-air head spacing.

KC: There were compressed air disk systems for other devices besides RAMAC, were there not? I know somebody built one for STRETCH.

RJ: STRETCH came along five years later. STRETCH had to have a full gamut of heads. And the first models were pressure, but with all that air, the air pumps broke the camel's back.

JH: IBM bid and committed the STRETCH machine, which required a parallel array of heads because the data rate — it was a high data rate machine — all the heads were read in parallel.

ME: It was a supercomputer by the standards of the day.

JH: Yes. And this was the main input, this was how they would wash data back and forth for computation. It was to be based on the Advanced Disk File, that became the 1301; and we ran into trouble making the gliding heads, the self-acting bearings, work. The only way to meet the commitment of the STRETCH delivery was with air-fed heads. And it required a bank of compressors. A good friend, Ralph Golub, wound up with the development of it, and it was a monster, but it did the job.

KC: By May of 1953, you had developed the pressurized recording head, you were doing experiments with 16-inch disks, and one problem was that the distance between a head and a moving disk surface was difficult to measure.

RJ: For us it was difficult to measure. We didn't really know how to do that at that point.

KC: So what did you come up with?

RJ: I think pretty much the recording signal. We had, indirectly, the recording signal, and so if the signal was good enough all the way around, that was good enough for us. And that's the way I remember it, Jack.

JH: You could calibrate the spacing statically.... recognize that the RAMAC as produced had head spacing of about a thousandth of an inch. And it being an air-fed head, you didn't have to have the disk moving, so you could set it up on a plate, and put a dial indicator on it, and measure the spacing within the accuracy of what we needed.

KC: That worked for a pressurized head. When you went over to a slider....

JH: Now you're into another generation. You're into the 1301.

RJ: When did the first product come out? And you brought it out, I guess, with the gliding heads.

JH: 1301. That was shipped sometime around 1960.

KC: I have June, 1961.

JH: Fine. And that's a whole other development story. Yes, we did have difficulty measuring a lot of things. It's the first time we got into optics as measurement.

KC: Before we get to the 1301, let's discuss two other RAMAC issues. What about getting the oxide on the disk?

RJ: We tried painting, spraying, brushing, until one of our fellows said, "Pour it on and spin it on." And we set up paper cups which poured a uniform amount for every disk, and

it spun until some of it flew off the edge. That gave us a very uniform coating. And we had some trouble with smoothness, and so one of the guys got nylon hosiery and poured the paint through the nylon hose, so we got rid of the coarse grains. The spin-coating method was used for years; it was automated in the factory, but it was still the same process — spinning it and pouring the paint on.

KC: So this was basically a kind of paint; it was a liquid with an iron-oxide suspension?

RJ: Yes. It was essentially the same iron oxide that was used to paint the Golden Gate Bridge — a ferric, red oxide, which is there for rustproofing, and for us it was for magnetic qualities. Jake Hagopian, a very excellent engineer, had the job of coating. He worked with the paint people in developing the best mixture that the paint people thought would work. It worked. And for the density we had, nobody ever needed to touch the surface.

JH: Wasn't Marcel Vogel the one that finally came up with the right formulation?

RJ: Marcel Vogel was a chemist. He proved to be indispensable over many years of developing coatings.

KC: Now this resulted in disks that did not need to be polished afterwards, correct?

RJ: I don't think they were ever polished, the first disks.

JH: I can't tell you when we first started buffing disks. I don't know whether the first production disks were buffed or not.

RJ: But Marcel and the paint companies and Jake Hagopian knew that the mixture had to stick, and it had to be hard, besides having the magnetic quality.... Here's a story. [*Shows a disk marked off into successively smaller segments.*] A given amount of information required this much space [*roughly half the disk*] on the RAMAC, the first improvement put the same information in there [*an eighth of the disk*] and that was produced as the 1405. And then each model that came in, this much information was put in that [segment] until we got it in there [*points to an area about the size of a period*] with the later machines. The improvement came as a result of improving the grain size, improving the signal processing, improving the head gap and the head width, with each one of these iterations.

JH: It's been a job of miniaturization, much as with the semiconductors. It's a very scalable technology. Probably the greatest gain in density was when we first made the 1301, where we got down into the two-hundred-microinch range of spacing and the head geometry compatible with that, and then Winchester got us — starting out — to 25-microinch spacing, those were two major jumps. In signal processing we went from an NRZI to an MFM encoding, but that was a comparatively modest increase. In recent years you've seen signal processing really starting to be used in a classic communication-equivalent sense....

[*To be concluded in October*]

THE "MORE" COMMAND IN UNIX

by Dan Halbert
halbert@world.std.com

I was a first-year graduate student at UC Berkeley in 1978. I had been an undergraduate at MIT, and had used the ITS timesharing systems there, which ran on PDP-10's. ITS put a "—MORE—" at the bottom of the screen when one typed out files; you pressed the space bar to continue.

At Berkeley, we'd just gotten our first VAX UNIX system, though there were already PDP-11 UNIX systems. There was a very simple program through which one could pipe stdout to do screen-at-a-time output. It rang the terminal bell after printing 24 lines, and waited for a carriage return. It was called "cr3". My guess is that in some version of UNIX, someone had hacked a page-at-a-time output mode into the tty output drivers. Using stty, one could already say "cr0", "cr1", and "cr2", which added different amounts of delay when printing a carriage return, for the benefit of slow printing terminals. "cr3" was probably unused, and the page-at-a-time mode was piggybacked on it. But our version of UNIX didn't have this "cr3" stty mode; instead we had the "cr3" program that provided equivalent functionality.

Many of the terminals at Berkeley were Lear-Siegler ADM-3 and ADM-3A "dumb" terminals. Both models (or maybe just the ADM-3's) rang the terminal bell when the cursor advanced to near the right margin, as a typewriter bell would. Unfortunately, they rang the bell on output as well as keyboard input, which made for incessant beeping. It was particularly maddening in a room full of terminals. So most of the bell speakers had been disconnected.

Since "cr3" rang the terminal bell to indicate that a full page had been output, you couldn't tell when it was waiting for input on those muted terminals. The problem was exacerbated by the slow response time of the overloaded UNIX systems.

So I wrote a simple "cr3"-like program, but had it print "—More—" instead of ringing the bell. I had it accept space instead of carriage return to continue, because that was what I was used to from ITS. I also made it take multiple filenames, and had it print lines of colons ("::::::::::::") before and after it printed each filename.

I named the program "more". This was a daring move at the time, since it was such a long name for a UNIX command, and was also a real English word.

Subsequently, my friends and fellow graduate students Eric Shienbrood and Geoff Peck greatly expanded the program, adding all kinds of command line options and different possible responses to the "—More—" prompt. It was of course distributed in the BSD versions of UNIX.

Some time later, Don Norman wrote an article for *Datamation* entitled "The Trouble with UNIX", in which he complained, among other things, about the cryptic nature of most UNIX command names, citing "more" as an example. I never did tell him that I thought "more" was a great improvement over "cr3".

I was later amused to see "more" appear in MS-DOS. [Also in ZCPR3. — Editors]

POMONA

CHAC had a lot of fun — and did a lot of work — at our first-ever trade show, the Los Angeles Computer Fair at the Pomona Fairplex on March 18th, 19th and 20th. We attended at the kind invitation of our friends and computing comrades, David and Tamara Greelish, co-founders of the Historical Computer Society of El Paso, Texas.

The three of us were loaded for bear with hardware, documentation, flyers, spiffy new vinyl booth banners, and plenty of copies of the ANALYTICAL ENGINE and the HCS newsletter, *Historically Brewed.* David and Tamara had brought a vanload of hardware including a Commodore SX-64 — really one of the most attractive basket-handle luggables ever — and a PET, a Radio Shack TRS-80 Model 4, an IMSAI 8080, a Timex-Sinclair 1000, and an Apple Lisa, II+, and Mac 512, as well as a nameless, homebrewed S-100 box. A brown-case Osborne One and a NEC APC sat forlornly on the booth floor because we had no more table space, and the IBM PC never even made it out of the van.... Rather than bring any of CHAC's hardware, since I flew, we relied on Joe Schopplein's brand-new and inspiring color photos of our collection.

Reaction varied but was generally gratifying. The aisle crowd kept up a good pace, impelled by the hunt for bargains, but every so often someone would step out of the current, look around the booth slack-jawed, and say something like "What's *that*?" The hands-down favorites were the Lisa, the PET and the IMSAI — we met about fifty people who claimed to have built or bought IMSAIs when those were new. (In classic trade-show fashion, the IMSAI's boot disk promptly lost a sector after having been dependable for a million years, but David could at least light the front panel.) We surprised a few people who said forlornly "Don't you have a TRS-80?" since they were expecting to see a Model I, but the Model 4 we *did* have looks completely different. Friday overall was a light day and very enjoyable, since it allowed us to steam the real-time wrinkles out of our procedures and still have plenty of conversation.

On Friday, too, I had the great pleasure of a long, undisturbed lunch with Erwin Tomash, a founder of the Babbage Institute. As might be expected, this became a long, hard-headed conversation about nonprofit networking, fund-raising, research practices and curatorship. Mr. Tomash summed up dryly by wishing us every bit of the luck that we'll need, but noting that we'd "set a significant challenge" for ourselves. His wisdom and experience are an invaluable gift to our Association and I look forward to staying in touch with him.

Friday's show traffic tapered off early, but we all knew that Saturday would be a different story. We made sure that everything was in place, then headed for our hotel rooms at pedestrian hours knowing we'd need all the sleep we could get.... Sure enough, the doors of the Fairplex opened at ten and the aisles were packed by five after. All in all, we talked to between eighty and a hundred people who actually browsed our booth, flipped switches and told entertaining war stories — especially, for some reason, about the Jet Propulsion Lab at Cal Tech. And this one gentleman who had retired from an aircraft company *did* think he could point us toward an IBM 704 — ! Lots more people just wanted to know what we were about, and four hundred CHAC FAQ's and subscription flyers flew off the table on Saturday and Sunday. A fair number of copies of the ENGINE and *Historically Brewed* disappeared too, most of them paid for although a few simply vanished into the river of people.

In general we were too busy to leave the booth, but I made an exception when Steve Roberts happened by. As many of you may know, Steve is the designer/builder of some of the most advanced human-powered vehicles in the world, and has made a name for himself riding his creations around the country while he stays in touch with the world through cutting-edge wireless communication. He had his latest, BEHEMOTH, with him at the show

— in true hacker style the name is a far-fetched acronym standing for "Big Electronic Human-Energized Machine, Only Too Heavy," which at 580 pounds (including camping gear) it may be.... I can't really describe BEHEMOTH here beyond saying that it's an eight-foot-long recumbent bicycle, equipped with tightly compressed DOS and Macintosh computers under its front fairing, packet radio at several frequencies, integrated cellular communication, and astonishing amounts of custom electronics including a solar-powered satellite antenna relegated to a trailer. The bike itself, with three derailleurs, 105 speeds, and hydraulic power leveling, can "easily" be ridden (by Steve, I mean!) at ten to twelve miles an hour for many hours. A nice touch is a water-cooled helmet that, Steve says, "dissipates 75 watts on a warm day." Hey, that's the piece *I* want! One paragraph cannot possibly convey the flavor of California's only (?) local-area network with wire wheels, and we look forward to receiving an article for the ENGINE from Steve when his schedule permits it. His absorbing new project, the Sea Moss Microship (talk about ramming a pun through,) will use solar arrays to power the electronics of a comparably decked-out trimaran — because his goal is still to "maintain stable publishing and personal relationships while traveling full-time," and "water doesn't have hills."

By day's end we were parched from talking and burdened with what my old pal and trade-show vet Carol used to call "tasteful knee-length headaches" — mostly because the CD vendor in the next aisle was drawing attention with postmodern rock at top volume. Saturday was frankly punishing, we gave up on some after-hours socializing we'd been looking forward to, and it's just as well that Sunday reached the same heights but tapered off by three o'clock.... All in all the Computer Fair was an invigorating experience, although a first assessment shows uneven results; we haven't had a lot of correspondence or contact from the people we met. On the other hand, no one said organization-building was quick, and with our appearance at Pomona, we have begun to bring the CHAC to *all* of California. And the community of hardware and software developers in the Los Angeles area — especially those with ties to the aerospace industry and to early micro builders — obviously deserves further study.

We're looking forward to more fun at a trade show in Northern California later this year. (Offers of a donated booth gratefully received at any CHAC address.)

COLOSSUS RECONSTRUCTED

Construction of an exact replica of COLOSSUS, one of the earliest programmable electronic digital computers, headlines the planning and preparation of a Historical Computer Exhibition at Bletchley Park. Computer-related work for the Exhibition is being undertaken by the Computer Conservation Society (CCS), a volunteer specialist group of the British Computer Society. The Bletchley Park Trust is making progress in acquiring the Park as an historical campus, with long-term plans to create active public museums of Computing, of Cryptography, and of Radio and Radar; the Park's official opening is currently scheduled for Monday, July 18th, 1994. If further plans proceed as expected, it is hoped that the CCS will enjoy substantial facilities for restoration workshops, as well as archive, library and research facilities and accession storage.

In the meantime, CCS Secretary Tony Sale and other CCS members have mounted an exhibition of wartime code-breaking memorabilia, including fragments of an original Colossus, some of the plans for the Colossus rebuild project, a Typex machine — the British equivalent of the Enigma — and a "bombe" decoder. German hardware on display includes a four-rotor naval Enigma, a Lorenz SZ42 and a Siemens T52, all rarely seen before. There is

a working radio intercept station with a pair of National HRO receivers.

This Exhibition, in the Assembly Hall of A Block, is now open to visitors on alternate weekends, from 10:30 am to 4:00 pm on Saturday and Sunday. The next open weekend is June 4th and 5th, 1994. Admission is UKPounds 2.00 (UKPounds 1.25 concessions and children), and includes a 90-minute guided tour of some of the wartime buildings, including the original 'Hut 6'.

Bletchley Park, a country house and grounds some 50 miles north of London, was the site of highly secret work deciphering intercepted German military radio traffic during the Second World War. Thousands of workers included Alan Turing, Max Newman, and several other early computer pioneers. Throughout the war, Bletchley Park produced highly important strategic and tactical intelligence used by the Allies — Churchill's "golden eggs" — and it has been claimed that the war in Europe was probably shortened by two years as a result; but total secrecy was observed by all those involved. Information on the nature and scale of this work began to emerge only when COLOSSUS was declassified in October 1975.

Directions: Bletchley Park is 150 yards from Bletchley railway station on the line from Euston station, and is signposted. By car, it is off the B4034 Bletchley to Brackley road, and about seven miles from the M1. For further information call the Bletchley Park Trust office at +44 0908 640404, during office hours and on open weekends.

[Thanks to Chris Burton, John Honniball, Tony Sale and Richard Wendland for information on this fascinating and inspiring effort. Those of our readers who want to get up to speed on COLOSSUS and the ULTRA project would enjoy reading:

ULTRA GOES TO WAR
Ronald Lewin
McGraw-Hill, 1978. — Ed.]

TURING, YOU SHOULD BE WITH US

Forty years ago this spring, Alan Mathison Turing died. Few can deny any longer that he did it by his own hand.

By the time he died, we must assume, much that was best in him had been corrupted by reverses of circumstance. It was his part to spare England and the Allies months, perhaps years, of agony; yet when he died he was called a traitor. He was unswervingly loyal to Monarch and Country; yet shadowy bureaucrats maneuvered to strip him of his freedom, and took Monarch and Country as their authority. And for no more than expression of homosexual preference, he was branded a criminal — in a way that no one could undo because the charges were whispered. The fearful tactics of the Star Chamber beat down one of the finest mathematicians who had ever graced England.

We will never forget Turing, for we live in his world. From his ultimate reduction, to the space and the mark and the stepwise tape, came the vast breadth of the computable, and from that the power of computing as we know it.

We owe it to his memory to remember, no less, that we live in a world where the good and the great are hindered — or worse — by intolerance and fear. And it is a more crowded world than Turing ever knew, with sharper competition and more perilous contradiction.

We owe it to his memory to lighten the shadows of fear, and to lessen the burden of intolerance, wherever and whenever we find the opportunity. We have a command of information and opinion that can span the globe in seconds; certainly one of the noblest uses for it is to combat prejudice and ignorance.

Turing, you should be with us, in silvered eminence, marveling still at the progress of computation.

IN MEMORIAM: AARON FINERMAN

Aaron Finerman, editor of *Computing Reviews*, died in Boca Raton, FL, on April 6, 1994. His death followed a short illness.

Mr. Finerman was a Fellow of the Association for Computing Machinery and had done much innovative work for both the ACM and the AFIPS. As Chair of the AFIPS Editorial Committee during the 1970's, he devoted considerable time and energy to the inauguration of the Federation's publishing efforts, including the *Abacus* and the *Annals of the History of Computing*; he personally selected Bernie Galler as the first Editor-in-Chief of the *Annals*.

His tireless attention to, and regard for, the history of computing will be sorely missed, as will his friendship. We extend our condolence to his family and colleagues.

LIVERMORE UPDATE

The great computers, components and memorabilia at the Computer Museum of Lawrence Livermore Labs, featured in January's ENGINE, have been removed from the Almond Avenue School and placed in storage while a new location is sought. The Museum's once and future Curator, Ms. Barbara Costella, has been re-hired by the Laboratory and is coordinating an effort to refurbish the collection and house it permanently. We hope that active participation by Laboratory management, and a lot of willing work by enthusiasts, brings the attention of a broader community to this very fine institution. Good luck to all concerned!

MICRO MUSEUM TOUR AT UC DAVIS PICNIC DAY

Picnic Day at UC Davis is a time for alumni, families of current students, prospective students and their families, and well-wishers to see student-run exhibitions and sporting events on campus (such as dachshund racing, dog Frisbee, sheep trials, rugby, water polo, track meet, rodeo, equestrian dressage, etc.).

On this year's Picnic Day, Saturday, April 16, the CS club worked with the IEEE student chapter to put on tours of the University's computer facility. A morning of informal discussion between students and alumni was followed by scheduled tours of the computer graphics classrooms, Internet workstation classroom, and the microcomputer museum. Students had spent weeks getting a wide variety of systems up and running, ranging from Ataris (kids loved 'em), to Osborne 1, DG 1 laptop, Kaypro, Radio Shack Models 1 and 2, and many others. Also displayed, but not operational for lack of time, were a MITS Altair, an IMSAI, and a Maltron ergonomic keyboard.

The Picnic Day tours were well received by a smattering of alumni, several prospective students, and hordes of interested folk. The museum was a highlight of the tour. Altogether, a definitely repeatable event that generated several offers to donate more gear for the museum.

UCDCSC hopes to have a permanent exhibit available one of these days, but is still negotiating for space. At present, the items up are about ten computers that can remain on display in a portion of a research laboratory.

— from Dick Walters, advisor, UC Davis Computer Science Club, walters@cs.ucdavis.edu

ADIOS AMIGA?

Commodore International Ltd. of West Chester, PA, USA, announced on April 29 that it plans to transfer its assets to trustees and has placed its major subsidiary, Commodore Electronics Ltd., into voluntary liquidation. The decision was described by Commodore as "the initial phase of an orderly voluntary liquidation of both companies." In recent years the company reported heavy

operating losses exacerbated by poor sales of new products, particularly the Amiga CD32 video game.

Commodore started 40 years ago as a typewriter repair company in Toronto (ON), then began producing adding machines and calculators. In April 1977 it introduced its first personal computer — the Personal Electronic Transactor, or PET — at the First Annual West Coast Computer Faire in San Francisco's Civic Auditorium. An immediate success, the PET allowed Commodore to compete with Radio Shack and Apple in sale of computers to home users and small businesses. Later models included the 8016/8032 business computer, the famous VIC-20 and C-64, and the SX-64 color luggable, all introduced in the early 1980s.

The company's shutdown will be lamented particularly by users of the Amiga, a personal computer optimized for graphics and sound, which Commodore produced in a profusion of models since 1985. Amiga partisans claim, with considerable justice, that theirs is one of the best available small computers for manipulation of video images and MIDI soundtracks. At our press time there was some speculation that a third-party developer would purchase the rights to this machine and continue production.

SPOTTER ALERT

As this issue's SPOTTER FLASH demonstrates, CHAC has begun to get press — more, and wider, press than we'd imagined likely. The national syndication of the New York *Times* article makes it imperative that our valiant volunteer spotters be more vigilant than ever.

If you spot any mention of CHAC or the ENGINE in *any* periodical, please:

* If your copy of the piece is clippable, clip and mail to the El Cerrito address.

* If you can't spare the physical copy, send the text as net.mail to cpu@chac.win.net, or photocopy and fax to the El Cerrito address.

* If you're too busy for that, just send the publication name, date and page number and we'll do the hunting.

Thanks!

SPOTTER FLASH

Mike Malone's column on collectible computers was published in the New York *Times* Business section for Sunday, April 17th — featuring not only CHAC and KC, but our brother-in-history David Greelish (HCS) and Hewlett-Packard archivist Karen Lewis. Nicely illustrated with pictures of an Altair 8800 and an HP 65 calculator, it added up to more publicity than CHAC had seen in its entire life.

This article went into syndication and it appeared in, that we know of, the San Francisco *Chronicle,* the Orlando (FL) *Sentinel,* the Everett (WA) *Herald,* and there must have been others. The phone was ringing off the wall, at least by our standards, for the next month. This made us rather more of a national organization than we'd had any notion of being, but "if you build it...." and we have every intention of building *on* this as far as possible. Thanks again, Mike!

Forbes ASAP for April 11th features a half-page on the CHAC and its mission, in Kevin Hogan's Tid-Bytes column. We're pleased and proud on the occasion of our first national ink, even if we're a bit taken aback by Kevin's brutally concise description of our strategic goal: "trying to collect and catalog all significant hardware and software created, developed or used in" California. If we're trying to do all *that* we may need one or two more buildings....or a disused airport.... Of course, brevity has its points, and Kevin managed to work in references to the ANALYTICAL ENGINE, National Computing Science Day, Initiative 1999, and even our friends the Computer History Association of Delaware. It's easily the nicest executive summary of our purposes so far. As for the lead para:

> Have an old mainframe gathering dust in the basement? There's a cabal of fanatical computer hounds ready, willing and almost able to take it off your hands.

....well, sometimes the terrible truth must be told. And what a wealth of meaning there is in that "almost." Thanks, Kevin! (To anyone packing a mainframe for shipment to our El Cerrito address; please call or e-mail first.)

DESPERATE PLEA FOR STORAGE SPACE

Look — we were desperate for space when we *started* this. You can imagine what we are now. And there are three fundamental reasons:

1) Small computers. As you'll see from this issue's ACQUISITIONS column, we're assembling a truly fine and representative collection of California micros — from the BYT-8, SOL-20 and Apple One to a Mac 128 and an Atari ST. The best we can say about these is that they're out of harm's way. They aren't all in one place, they aren't particularly accessible, and they couldn't be exhibited without a lot of logistical hassle; and for this second-rate arrangement we pay a significant storage bill every month.

2) Medium-size computers. We now have two truly wonderful minis, and they're sitting in somebody's living room in San Francisco. Luckily for us, it's a big living room, and the person in residence is one of CHAC's staunchest backers. But this obviously can't be considered more than a stopgap!

3) Documentation — to such an extent that even we're surprised. Back in the days when computers were scarce and expensive, they arrived with many more manuals than they do today, and HP systems in particular travel with *walls* of docs. (The manuals for the 9100 programmable calculator are bigger than the device itself.) Add in the docs for commercial software; event-related books like the Computer Faire symposia; magazines like *User's Guide*, *Dr. Dobb's Journal*, and *Softalk*; newsletters like FOGHORN and *Cider Press* and BAMDUA.... We can see a looming need for, literally, thousands of linear feet of shelf space. For the moment we'd be very happy with a couple of hundred.

Since August we've engaged in several negotiations for long-term storage, and they've all come and gone. We keep hoping that some public-spirited person will tap us on the shoulder and offer us a secure, dry room in a warehouse. Hellooooo out there....

DESPERATE PLEA FOR MONEY (And Things)

Time for us to have a wish list! Until very recently our accession technique has amounted to not much, but we need some guidelines for inventory, or we won't even know what's in what box. In pursuit of that we could definitely use the following:

Mylar archival bags (comic-book bags)

Open-back document shelving boxes

File boxes or drawers for all diskette sizes — c'mon, you've got those old eight-inchers somewhere....

Secondhand steel shelving (but with all the bits, please)

Volunteer time for shelving and labeling

Volunteer hardware repair

Reference manuals for California hardware/software

....and of course *cash always welcome!!* Unlike some of this other stuff, it ships easily, too.

AND SPEAKING OF MONEY....

At the end of April we did a paper mass mailing, looking for new ENGINE subs. We wanted to reach as many people as we could, so we used the Internet to ask our friends for

mailing addresses. A gratifying number of you responded and, of those, quite a few said how *glad* you'd be to join our mailing list.

However, some of you have not subscribed yet. No doubt this is a simple oversight on your part. After all, if you got that letter, you know how eager we are to have you as a member. And if you know that, naturally you feel encouraged to become one. The inertia involved in writing and mailing a check is trivial by comparison to your enthusiasm.

Tell us that sleepless hours over a purring LaserJet™ were not spent in vain. If you got that letter, PLEASE SUBSCRIBE TODAY. And we'd be glad to have your sub even if you didn't.

OVERVIEW OF BUREAUCRATIC PROCESSES

This was the quarter when everything broke loose. Success upon success, long-awaited, hotly pursued success.

CALIFORNIA TAX-EXEMPT STATUS

This, and everything contingent on it, was delayed by a mixup over a check, but a physical visit to the Franchise Tax Board's San Francisco office did wonders to clarify the situation. On February 28, the CHAC was granted tax-exempt status as a charitable and educational organization, under section 23701(d) of California's Revenue and Taxation Code. This in hand was half the battle won, since with our California exempt status assured, we could go after the much more complex Federal equivalent.

CALIFORNIA CORPORATE CERTIFICATION

On March 24th, the CHAC was certified as a nonprofit public benefit corporation by California's Secretary of State, with appropriate notification to the state's Attorney General. We responded on April first by filing the required Statement by Domestic Nonprofit Corporation, and your Association is now not only the Right Thing, but the Real Thing.

FEDERAL TAX-EXEMPT STATUS

All that done, we were in position to file IRS Form 1023 and petition for Federal tax-exempt status. This was enough of a grind to make the ENGINE late, since the form itself is ten pages, and with the required attachments, continuations and samples, ours went into the envelope at a handsome seventy pages or about a quarter-inch thick. CHAC director Bruce Rice cautions that we may be called in (or at least called up) if the IRS wants more complete answers, but for better or worse, it's in the mail....

NONPROFIT MAILING PERMIT

With California exempt status and corporate certification, we can apply for a nonprofit second-class mailing permit, which would potentially cut the ENGINE's mailing costs by almost eighty per cent. Application forms and instructions are on their way to our El Cerrito office.

CREDIT CARD PURCHASE

Not with a ! but a whimper.... No, you still can't subscribe or renew with a credit card. But there may be a glimmer of light in the distance because we're about to try our luck at yet another (our fourth) bank. Stay tuned.

HELP FIGHT IRON DEFICIENCY ANEMIA!

Attention, those who know and love old iron! The ANALYTICAL ENGINE is not getting enough articles about early computer use in California! There are even those who have had the temerity to grumble about our supposed "bias" towards IBM and/or Intel, when there is no such bias for or against, we are completely non-partisan but we can only publish what is submitted. Therefore we, in turn, propose the following article topics in hopes that they will jog someone's interest or memory:

- Logistics Research and the ALWAC
- BDDDA, the G-15 or other Bendix adventures
- BINAC or MADDIDA at Northrop in Hawthorne
- Computer Research: CADAC, 105, or 107
- CA/DIC at UC Berkeley
- Consolidated Engineering 36-101
- JOHNNIAC at RAND
- MINAC at Cal Tech
- The RAYDAC experience at Point Mugu
- SWAC at UCLA
- UNIVAC, STRETCH, CDC or Cray at LLNL

and *any* early computer use at the aircraft factories!

We would be *exceptionally pleased* to receive articles, or proposals therefor, on any of these topics. Deadline for Volume 2, Number 1 is July first, and the issue will appear in mid-July; preferred article length is 750 to 2000 words and submissions should be sent in machine-readable form. (ASCII E-mail is fine.)

APPLE CONTEST

In the January ENGINE we asked "What was the text, in tiny letters, that ran around the edge of the picture frame in the original Apple logo?" The answer, which is "A mind forever voyaging through strange seas of thought — alone," comes to us from Gregory Nakshin of Staten Island, NY, who laments that he has "all the manuals for an Apple One, but no Apple One." Hey, the opposite predicament could be almost as frustrating. Gregory receives our congratulations and an extra issue on his ENGINE sub.

Book Review: FROM DITS TO BITS

by Herman Lukoff (1923-1979)

Robotics Press, 1979
ISBN: 89661-002-0

Reviewed by Brian Deith, University of Wisconsin

From Dits to Bits could as justly be titled "The Journey of an Electrical Engineer." The book is autobiographical to a charming extent; rather than presenting a cold, hard series of dates and places, Lukoff lets us see computer history in the making, as he did.

The journey begins in Lukoff's youth, as a radio hobbyist in Philadelphia in the early 1930's. He discusses what it was like to be involved in radio, detailing his triumphs and disappointments:

> 'Dad, Dad,' I yelled, 'I'm getting Italy on my radio!' My illusions were dispelled a half hour later when the announcer said, 'This is WDAS in Philadelphia, your foreign language broadcast station.'

Lukoff's education took him from the schools of Philadelphia to the University of Pennsylvania's Moore School of Engineering, birthplace of ENIAC. During his senior year he was invited to participate in Project PX, an ENIAC forerunner; his task was to construct test equipment necessary for the construction of the computer. His supervisor on the project was J. Presper Eckert, then a graduate student at the school, later to be renowned as a computer pioneer.

Lukoff's involvement allows him to bring to light facts not well known. He reproduces a

memo by Dr. John Mauchly, dated August of 1942, proposing the use of electronic circuits for high speed computation. Perhaps more surprising is Eckert's memo of January 29, 1944, describing how to store data on magnetic disks. Lukoff points out that Eckert's memo specifically suggests storing *programs* on disks, predating Dr. John von Neumann's similar — and more widely credited — suggestion. (The text is given in the appendix of the book.)

After a leave from the Moore School to serve a tour of duty in the Navy, Lukoff returns in time to join the EDVAC project. Again he provides views of "inner workings" that could not be duplicated by others. The EDVAC engineers developed mercury delay-line memory to implement Eckert's idea of storing instructions; Lukoff's task was to devise a control system to compensate for temperature changes in the mercury column, which would also change its length. Here he goes beyond the technical details of the memory to provide some of the more human aspects of developing and presenting computational equipment:

> The next day we were there at 10 a.m. to greet the thousands of attendees. No sooner was the equipment turned on than unusual things started to happen. The mercury memory would suddenly fill up with all kinds of extraneous pulses. When cleared, it would refill. I noticed that the pulses were changing rhythmically every two seconds. We wondered what could be causing that phenomenon. Onlookers pressed for explanation, which was embarrassing, to say the least. As I pondered the problem, the corner of my eye caught a rotating Army Signal Corps radar antenna halfway across the hall. Every time it rotated in our direction, the mercury memory pattern changed. That had to be it! I approached the radar operator, and asked him if the antenna was radiating power. Sure enough, it was. It did not make any difference to him whether the radio frequency power was on or off, so I convinced him to leave it off. That cured our problem...

One day, Lukoff received a call from home — an invitation for him to join a company, the Electronic Control Company, that Dr. Mauchly and Eckert were forming to build the Universal Automatic Computer later known as UNIVAC.

Lukoff joined the company and continued to work with memory, this time with CRT tubes. He explored the possibilities of storing and reading an electrostatic charge from the face of an ordinary CRT screen. This would provide faster access to memory than the delay line did, as the cathode-ray beam could be deflected more quickly than the acoustic signal could be read from the column of mercury. (Paradoxically enough, radio was again to be Lukoff's undoing. After some detective work, he discovered a local radio station atop a nearby building was causing distortion in his memory. Shielding solved the problem.)

Development of electrostatic memory was shortly suspended (to be resumed later) to free up resources for Eckert and Mauchly's next computer, BINAC. This device, built for Northrop Aircraft as a missile-guidance computer, is sometimes called the first commercial stored-program computer built in the United States; it utilized mercury memory, as the technology was more developed and considered more reliable.

Though Lukoff did not know it at the time, BINAC was in a neck-and-neck race for the honor of being the first commercial stored-program machine. Manchester University's Mark I (MADM) ran its first stored program on June 21, 1948, while BINAC was still undergoing construction; but BINAC was accepted in August 1949, while the commercial version of the Mark I was delivered to the customer on July 7, 1951. BINAC, with 512 31-bit words and unprecedented processing speed, was significantly faster, more powerful and more flexible than MADM with 128 40-bit words. (BINAC, however, was fragile, and the Mark I eventually made a better transition to commercial use.) The UNIVAC I, Eckert and Mauchly's first commercial success, was deliv-

ered to the U. S. Bureau of the Census on March 30, 1951; forty were ultimately sold, and their reliability owed much to Lukoff's innovations in computer manufacturing.

Obvious throughout this book, Lukoff's engineering abilities were practical and irrepressible, and not confined to working hours. He shares the detail of some "incidental" projects, like the Bubelator, which was of great significance to his household if not to history in general. He was minding his son while his wife was off shopping, and quickly discovered that every half hour, he had to stop what he was doing to rock his son's carriage. Within an hour, he had an electric baby carriage rocker built and running. His wife, returning, was incredulous, the baby was delighted, and (since the baby's nickname was Bub) this crucially useful machine was christened the Bub-elator!

Lukoff became the head of Sperry Univac's engineering department, supervised the creation of UNIVAC-LARC and many other UNIVAC models, established Sperry's semiconductor manufacturing capability, and was a pioneer in computer-aided design. He recounts his career with humor and perspective too often lacking in works of technical history. Enjoyable reading, insights and facts not well known, and personal human interest are well blended here to produce a truly valuable source in the field.

BALLOTS

Since mid-March, meaning at Pomona and afterwards, we've distributed over a thousand subscription blanks with the National Computing Science Day ballot on the back. Some of those have come back to us — not enough, but some — and the vote so far has been about six to one in favor.

We are not without regard for the opposing view, which is roughly "Keep the Feds out of computing," but the Feds have been in computing since pen touched paper for ENIAC, so that's an answer to a question we don't think we asked. With 86% favoring the proposal so far, we have a clear mandate to begin research. Meanwhile, keep those ballots coming!

ACQUISITIONS

APPLE MACINTOSH 128

Bruce and Mary Yow

The computer for the rest of us! How could a computer collector live without one? The original Mac was one of the few computers designed within deliberate limits — even the standard 128K RAM was a concession wrung out of Steve Jobs, who thought half that was plenty — yet it gradually opened up almost unlimited possibility. The Mac's combination of a windowing interface, easy operation, small footprint, affordability, and tongue-in-cheek humor made it a winner from Day One.

In the last ten years, Macs have grown steadily more elaborate, and it's refreshing to go back to the roots represented by this humble yet ingratiating box. This one is historically pristine because it never suffered the semi-universal memory upgrade; in fact it seems that this case hasn't been cracked.

However, we will need to crack it someday. It brings up a diagnostic code that means one of the RAM chips is bad, and we even know which chip, but opening the case of a Mac is a task best left to those who've done it before. Anyone who would care to donate parts and labor for the repair will earn our considerable gratitude.

And thank you, Bruce and Mary Yow, for your donation of — just maybe — California's quintessential computer.

MORROW MICRO DECISION

Neil Abbey and Arthur Colton

That early admirer of user-friendliness, George Morrow, was always pushing the envelope. In particular he liked to build computers that a new owner could unpack, put in place, hook up, boot up, and use to get some work done. This is a sequence we take for granted now; twelve years ago, when the Z-80A was a hot chip and internal floppy drives were uncommon, it was much more the exception than the rule. But Morrows worked, and this one does today.

The Micro Decision was also unusual in the scope of its standard configuration. Its monitor was optional, but everything else was bundled: floppy drives, ports, CP/M 2.2, a word processor, spreadsheet, database, three languages, and even a menuing system with a CP/M tutorial. Sitting at this machine, watching its futuristic Lear Siegler turtleback monitor, evokes the dream of a computer for Everyman and Everywoman. In 1982 that was still a distant dream; if by now it has nearly come true, Morrow is one of the pioneers we have to thank.

And thank you, Neil and Arthur, for your donation of this computer, monitor, docs, full software, backups, a Silver-Reed daisywheel printer and half a dozen ribbons! Hmm, maybe I'll use WordStar for a few of those letters....

LOBO MAX

Steve Scharf

Lobo International of Goleta, CA — down by Santa Barbara — was primarily known as a maker of extremely rugged disk drives. This machine came to us with a dual 8" floppy that is a tank! I mean, think carefully before you pick it up!

Around 1982-83, though, Lobo took a side trip into computer development and produced this handsome MAX-80 that, like the drives, went just a bit further than the standard spec of the day. Its Z-80B processor runs at 5 MHz when many manufacturers thought that 4 was quite quick enough; it addresses 128K RAM accessible through bank-switching, instead of the more usual 64K. The systems manual says proudly that the disk controller can talk to four "3 1/2 or 5 1/4-inch drives" *and* four 8" drives *and* a hard disk. The video is remappable and so are the keys....

Like the TRS-80 Mod I or Atari ST, this is a "computer-keyboard" that only needs to be attached to drives and a monitor. Its dove-grey case and sharp-edged styling make an aggressively attractive machine that seems packed with muscle. Ours arrived with CP/M Plus and a full suite of apps including Pascal, and, incidentally, some of the most voluminous and detailed docs ever seen for a micro. Thanks a lot, Steve; this one's a showpiece.

EXIDY SORCERER

Klaus Krause

The idiosyncratic and colorful Sorcerer takes us back to a delightful time — the days when micros were sold on the basis of their differences, not their similarities. And this one's pretty different!

Like the early Ataris, the Sorcerer tried to bridge the gap between a game machine and a general-purpose computer; but with 32K RAM and a Z-80, it had power enough to be stiff competition for an Apple II. An unusual (and nice) feature is a full graphics set available from the keyboard with a special shift key. Standard ROM-packs included a word processor, a BASIC, and an assembler/debugger, making the Sorcerer usable with nothing more than a monitor; third-party software was generally supplied on audio cassettes. "Serious" options included a six-slot S-100 expansion chassis and a 10Mb hard disk, but even without all that, the base computer could be a lot of fun for $895.

Corporate diffidence and minor design kinks combined, unfortunately, to deprive this machine of its rightful stature in history. All

the more reason for your Association to have one, especially this mint one, with a whole box of add-on goodies and user-group newsletters. Thank you, Klaus Krause.

HP 3000/42

Innovative Information Systems, Inc.

Civic-minded Kristen Helm of IIS called us (it's the price of fame) and told us that a 3000 was headed for the scrapyard. Well, we had to have a 3000, didn't we? *Everybody* had a 3000, didn't they? A lot of people *still*.... Anyway, we weren't about to let history be history. Roger and Michael slam-dunked it into the moving van and we figured we'd sort things out later.

When that time comes we'll need some help. There's a 7933 disk drive, with a disk pack that may or may not have survived, and a 7974 tape drive with plenty of tapes, but we don't know which tapes. We have full MPE V docs but *no* hardware manuals. And although some of the cables are included, some are definitely missing.... Luckily, an amazing number of CHAC members have HP 3000 experience. We're not sure what we'll do with this after we boot it up, but we'll think of something. Thanks to Kristen for alerting us and to IIS for parting with this fine workhorse.

PACIFIC DATA SYSTEMS 1020

Duane Atkinson

"In contrast to other equipment," proudly states the Engineer's Guide, "the products of PDS are designed primarily for use by the man with the problem...the business or technical man in any capacity." The clear implication is that there are no whitecoats between you and the hardware; you're welcome to sit down and hack.

Built by a "leading manufacturer of small, direct-access computers" in Santa Ana, CA, the 1020 resembles nothing so much as a robustly built desk with a couple of typewriters on it. The one on the right is a numeric keypad and instruction console with a paper tape reader/punch, and the one on the left actually *is* a typewriter; an IBM Selectric I whose 15 ball-bats per second could barely keep up with the comparative torrent of output from the computer. Memory is installed in modules of 1024 signed words, each four decimal digits; the standard complement was two modules, and two more could be added. The "magnetostrictive delay lines" (we'll have to look that one up) operate at a hair-raising two-and-a-hair megabits per second. Scientific programming was accomplished through the "PDS Engineering Interpreter," an English-like symbolic interpreter that proposed to take the black magic out of programming.

This revisionist stance is typical of the whole computer — and its docs. "[A] large computer installation," trumpets the sales literature, "requires specialized facilities, and most important, specialized personnel.... Many manufacturers will lure you with specialized 'languages,' FORTRAN-type, ALGOL-type, and other strange types. This is a siren song, and you'll do well to beware of it...." The quotes around "languages" are in the original. Ah! Do the old promises ever lose their charm? Are they yet stale through repetition? Here, says PDS, is a power-sipping 350-pound mini that you can trundle into your own office (on fat casters) and talk to like a faithful friend. No air conditioning required.

Claims for ease of use may be exaggerated, but there's no doubt that Duane Atkinson and his company pushed a fair amount of work through this computer. It was quickly discovered that sheet-fed output — for the Selectric lacks any tractor — made essentially no sense; so Atkinson constructed an unusual aluminum bracket that holds a roll of Teletype paper behind the platen. A true engineer's touch on this bracket is a lamp-and-photocell loop that automatically stops output when the roll runs out.

We've never seen another PDS computer and we suspect that they're scarce. According to the sales literature, the company was founded in 1962; this 1020 dates from 1964, and Mr. Atkinson recalls that PDS was purchased or otherwise absorbed by Control Data Corporation in 1966. If you remember more than that about this somewhat mysterious manufacturer, send us detail by e-mail or drop a line to the El Cerrito address.

HP 9100/9125

Duane Atkinson

HP's own product literature on the 9100 begins with a straight-from-the-shoulder description: "a programmable, electronic calculator which performs operations commonly encountered in scientific and engineering problems...." Ah, but then you get to the jaw-dropping list of what it'll do. Arithmetic ops, log functions, trig functions, hyperbolic functions, coordinate transforms....floating-point....40-millisecond square root.... Gee. This poor thing never realized it was a computer — though the HP data sheet slyly refers to its 2208 bits of core memory "[that] enables the calculator to store instructions and constants...." Programs can be read from and written to mag card, and an integral CRT handles the display. Obviously, nothing was spared to make it ready for day-in-day-out use. Results could be tidily transmitted to the 9125 flat-bed pen plotter with a 10"x15" (25x38cm) plot area.

This is one of the all-time great desk calculators and, at over US$7,000 for the calculator and plotter together, was meant for the serious customer of the late sixties. Naturally, though, it was part of a history with its own inexorable logic. Bruce Flamm, in the newest issue of the *International Calculator Collector*, quotes HP developer Tom Osborn:

> About fifteen minutes....after we finished the 9100, Bill Hewlett said we should have one in a tenth the volume, ten times as fast, and at a tenth the price. Later he added that he wanted it to be a shirt-pocket machine.

Hewlett's target, which seemed almost ludicrously distant in 1968, was comfortably met four years later by the HP-35 — thirty thousand transistors of MOS/LSI in a nine-ounce box for $395.

(When Doug Jones — author of our January article on the IBM 701 — heard that we had a 9100/9125, he mailed us a program he'd written that does Spirograph-style decorative plots. If we *ever* have enough room around here for a decent test bench, it's one of the first things we'll run.)

IBM 5100

Duane Atkinson

The IBM 5100, a luggable the size of a large briefcase, was IBM's first foray into the market for authentically small computers. As such it was very serious iron — and very, very expensive.

With a built-in cartridge tape drive, integral keyboard, numeric keypad, and APL or BASIC in firmware, the 5100 could be used as a line-powered standalone — although its 50 pounds precluded easy portability. On the other hand, when set up with the optional 5103 dot-matrix printer, external storage, and a CRT monitor, this could stand in capably for a small IBM mini. Not a schematic descendant of IBM's bigger iron, nor quite the technical ancestor of the 5150 PC, this 5100 still stands as the conceptual link between Big Blue's large and small computers. Our example worked hard for a living in California and will find a comfortable retirement in your Association's museum.

ASR-33 TELETYPE

Duane Atkinson

Yes! We finally have a Teletype. Early micro hackers will remember the days when an ASR-33 was *the* I/O terminal of choice, indispensable yet unattainable, miserably scarce on the open market even if you could part with the small fortune required. Now we have one reputed to be in working order, ready to connect to (for example) our IMSAI 8080....and the Golden Era of micros will resound again. Earplugs, anyone?

We thank Duane Atkinson for his comprehensive generosity and hope that we can give his meticulously maintained hardware another few decades of use. At a stroke, our collection was expanded to calculators in one direction and minis in the other. (DID I MENTION ANYTHING ABOUT NEEDING SPACE??!!)

HP 86

Alan Hawk

Thanks to Alan's public spirit, this computer came home to us from Maryland....in two forty-pound boxes! Introduced in late 1982, this proud member of "Series 80" (Models 85, 86 and 87 in their various flavors) is one machine that builds the bridge between HP's programmable desktop calculators and the Series 100 true micros.

This one includes a monochrome monitor, 128K RAM in two 64K plug-in "drawer" modules, a 9130A floppy drive, and carefully preserved manuals and software including HP Word/80, HP File/80, and VisiCalc PLUS complete, and docs (though no disks) for FORTRAN-77 and the UCSD p-System. This computer worked for its living, whether heavily or lightly, until 1993. In March of this year, with due care and forethought, it was donated to our Association; we've said this before and since, but people simply *don't* throw out Hewlett-Packard computers, and that's fine with us! Thank you, Alan Hawk.

BYT-8 (OLSON 8080)

Frank McConnell

The BYT-8, which might be called the "definitive S-100 box," was the house-brand computer of Paul Terrell's Byte Shop — the first retail computer store on the West Coast — which opened in Mountain View, CA, in December 1975. The one Frank brought us is quite capable, being stuffed full of I/O and boot hardware from Byte and Cromemco, and a Tanner memory board that seems to hold 64K.

A nice extra for this machine is an Olson front panel. The Olson 8080, which Haddock's *Collector's Guide* describes as "a variant of the Byte," was apparently identical to it internally; but whereas the BYT-8 has a blank faceplate, the Olson has a Real Front Panel™ with three rows of bat-handle toggles and two rows of LED's to permit Altair-style access to the works.

Straightforward and significant, this is one of the machines we'd love to hook up to our new ASR-33. And would anyone who has full docs for it please contact us?

HP 2674A PRINTER

Frank McConnell

Frank heeded our call for an HP thermal printer and snagged the next one that appeared to his practiced eye. As we mentioned in the January issue, this clever device fits under the top hatch of the HP 150 and spares the user from lugging around a separate printer during field use — or taking up desk space with one in the office. We have no idea what it originally used for paper but we're going to try fax paper.... Actually, if anyone had ever written faxmodem software for the 150, we'd make a fax machine out of it; like most things HP ever built, it obviously prefers work to leisure. Now we just need the hard disk.

Frank also brought us a box of miscellaneous publications including two Symposia of the

West Coast Computer Faires, a CDC 6400 manual from UC Berkeley, some early issues of *Dr. Dobb's Journal* and the BAMDUA (Morrow) and BAKUP (Kaypro) users' group newsletters, and a nearly flawless complete run of the early-eighties CP/M publication *User's Guide*. Gee....time for some Ziploc bags and another bookshelf. Thanks, Frank!

APPLE MAGAZINES

Harold A. Layer

Two boxes hit the step the other day, and proved to contain a donation from CHAC member and eminent collector Hal Layer — accumulations of several magazines related to early Apples, including *Apple Orchard*, *Nibble*, the San Francisco Apple users' group newsletter *Cider Press*, and a long, long run of the justly renowned *Softalk*. Apple-related publishing has been a roaring industry in California, and we thank Hal for his help with the first steps of a long hike toward comprehensive archiving.

APPLE PROJECT DOCS

David Craig

CHAC's newest member, David Craig, was kind enough to send a bundle of technical reference documentation concerning the Apple Lisa and the earliest days of the Mac — material that sheds light on a fascinating, and turbulent, period in the history of a great company. At press time we've barely looked at these documents (press time's like that) but we know that they'll drastically improve our understanding of both our Mac XL and our Mac 128. Thanks, David, and welcome aboard.

LETTERS

MORE COMPUTER MUSIC

Most interested to read Tom Ellis' article in issue 2 about making the tape drive sing. Reminds me that I wrote the music program for my first computer, the Ferranti Perseus, delivered in 1958 or -9. Ferranti computers in those days always had a decent 9" loudspeaker and amplifier which could be plugged into any useful waveform, so tone generation was no problem. To get percussion, however, I found that reading a zero length tape block from Tape Drive #0 made the pinch roller make a satisfactory click, without stealing time from tone generation. La Paloma, Flight of the Bumblebee and Arrival of the Queen of Sheba were *pieces de resistance*, with rhythmic backing to the foreground melody! Colleagues sat up all night punching the notation on paper tapes.

— from Chris P. Burton, Computer Conservation Society (UK,) via Internet

MORE ON THE PLATO SYSTEM

Joe Cychosz sent me the short article by Doug Jones entitled PLATO and SMALLTALK which appeared in your newsletter in January. It was very interesting! Although I was a system programmer at PLATO during the 70's, I wasn't aware of the exchange between PLATO and Xerox PARC (or if I was, I forgot about it.) I'd like to correct a couple of minor factual errors in Doug Jones' article:

- He states that multi-user games were the single most-used PLATO application. Actually, notesfiles were the most-used, consuming about 34% of all hours of PLATO use. Games were second, at about 20%.

- PLATO notesfiles were never moderated, at least not in the sense of USENET moderated newsgroups. All postings appeared immediately without any review. A notesfile director had the power to delete a note after it was posted,

however. A 1991 rewrite of Notes on the NovaNET system added the capability for moderated notesfiles for the first time.

With permission from you and Doug Jones, I'd like to repost his article on NovaNET, where I think a lot of people would be interested. (NovaNET is the new name for the PLATO system at the University of Illinois.)

— from David Woolley, via Internet

TIME-SHARING FOLKLORE (ET CETERA) WANTED

Greetings! I'm currently doing research on early time-sharing/interfaces/programming, and I was wondering if your organization might be able to provide me some leads towards information on these topics. Any info would be greatly appreciated. (I'm open to all sorts of bizarre topical material in these fields.) Thanks.

— from Blaine Jack, bjack@wvnvm.wvnet.edu, via Internet

LOOKING FOR DAVID AHL

Can anyone suggest how I can contact David H. Ahl? He was the editor of `Creative Computing', a US computing magazine, from the mid 70's until the mid 80's.

The last address I have for `Creative Computing' dates from 1985, and I doubt whether it's still valid (a letter sent there has never been answered).

Thanks,

— from Andrew Davison, ad@munta.cs.mu.oz.au, via Internet

TECH NOTE ON THE HP 5243

About a year ago, I was offered an HP 5243 counter for 1 pound. On the grounds that *anything* HP is worth 1 pound, of course I bought it. This thing has the most amazing counter/latch/display boards you've ever seen - the only active components for a 4-bit 1242 BCD counter, 4 bit latch, and nixie-tube decoder driver are 8 transistors. Here's how they did it:

The 8 transistors make 4 flip-flops, which are combined with steering diodes to make the counter. Each flip-flop has 2 outputs, the collectors of the 2 transistors, which are either at +19V or -10V (approx.) These outputs are fed through 56k resistors to neon lamps, and from there to a common 390k resistor to the -130V power supply. There are diodes connected to the junction of the neon and the 56k resistor, and the other ends of these diodes are connected to the transfer control line. Normally, the transfer control line is at +19V. Therefore, as the diodes are forward biased, the voltage on that end of the neons can't drop below 18.5V. Now, if one neon is lit, and dropping say 55V, there will be insufficient voltage across the other one (a maximum of 55.5V) to strike it. So, it stays in that state, no matter what the flip-flop does.

Now, if the transfer control signal is pulled to -10V, then the diodes are always reverse-biased. So, the neon connected to the +19V output of the flip-flop now has sufficient voltage across it, and lights. In so doing, it pulls the junction with the 390K resistor up to 19-55 = -48V. Now, the other neon has only -10-48V=38V across it, so it goes out. The neons are now in the same state as the flip-flop. Pulling the transfer control line up to +19V again returns the system to the initial state, and latches the state of the neons.

These neons are mounted in a plastic block lined with reflecting metal (one reflector/neon) mounted on the counter PCB. On top of this block is placed a ceramic thick-film CdS cell array, which implements the decode tree needed to convert 1242 code into decimal. This tree is in series with the cathodes of the nixie tube display, and directly drives it. So, a pattern of 1's and 0's on the neon matrix is converted to a decimal display on the front of the instrument.

Truly a wonderful hack, from the neon latches to the thick-film decoder. They don't make them like that anymore....

— from Tony Duell, via Internet

RING AND LOOP NETWORKS: REPLY TO KULIKOWSKI

Following up on the comments by Stan Kulikowski on the history of ring and loop network technologies in ENGINE #3, I looked in the bibliography of J. R. Pierce's "Network for Block Switching of Data", Bell System Technical Journal, Vol. 51, No. 6, July-Aug 1972. This is the paper in which Pierce proposed the slotted loop network technology that was the basis of the one of the first LAN systems at Bell Labs.

Pierce submitted his paper in late 1970, and among his citations, perhaps the most relevant are a paper by Edgar H. Steward, "A Loop Transmission System," in the 1970 *IEEE International Conference on Communications,* and Farmer and Newhall's paper, "An Experimental Distributed Switching System to Handle High Speed Aperiodic Computer Traffic," in the 1969 *ACM Symposium on Problems on the Optimization of Data Communications Systems.*

It is hard to pin down the origin of an idea, but in the case of J. R. Pierce's slotted ring network, we do know that by 1972, the prototype network at Bell Labs included a number of Honeywell (or 3C) 516 minicomputers. By 1973, when I used the network, one minicomputer was configured as a file server, while the other three were configured as workstations, each with a CRT display, a mouse, and other modern toys. I do not doubt that there were other early local area networks, but few are likely to have been put to uses that are so typical of the way we now use LAN technology.

— from Doug Jones, via Internet

TAKE A CRAY JUST BECAUSE IT'S THERE?

My university is in the process of trying to decide whether to acquire a supercomputer. I understand it is some sort of Cray, a fairly capable one. There is an apparently wonderful deal by which a state agency will "give" us the computer. All we have to do is operate it, support it, and (perhaps—I'm not so sure about this) give them free use of it.

Part of the support will involve starting up an entire empire of support and programming services, space to house it, air conditioning, etc., etc.

I am not at all sure it's worth it. Some of the alternatives, for example a network of high-end UNIX workstations, maybe with a vector processor attached, sound better to me. I've seen a couple of posts mentioning the costs and other gotcha's involved in supporting these beasts, including someone who mentioned that they had just turned theirs off for good because of the expense of running it. I would be very interested in hearing more about the potential problems and expenses involved, and getting more detail about sites that have acquired these beasts and lived to regret it. Thanks in advance.

— from Ross A. Alford, via Internet

HARDWARE RECYCLING: ASK, THEN DUCK

I'm looking for any and all information about uses people have found for old and/or obsolete hardware; that is, apart from junking it or turning it into aquaria. Some specific things I have in mind are donating it to ex-Iron Curtain or developing countries, local schools, etc.

If you know or know of someone who does this, any information at all would be greatly appreciated. Thanks!

— from Gal Kaplan, gal@das.harvard.edu, via Internet

LOGO'S TURTLE: REPLY TO JONES

In *The Children's Machine*, Seymour Papert writes: "The turtle came from thinking about how on earth a child could capture in computational form something physical like drawing or walking. The answer was a yellow robot shaped rather like R2D2 and, like him, mounted on wheels.... In those days, the turtle was a large object, almost as big as the children who were using it, connected by wires and telephone links to a faraway computer that filled a room." The turtle was developed some time after Logo debuted, but he doesn't give a date for either nor any measure of the time lapse.

GUI HISTORY: REPLY TO KULIKOWSKI

The NeWS Book (Gosling, Rosenthal, and Arden, Springer-Verlag, 1989) has a chapter on the genealogy of GUIs. It starts with the Alto at Xerox PARC "in the early 1970's," running Smalltalk and the associated windowing system, which had all elements of the system running in one address space, communicating via procedure calls. DLisp is mentioned next, also at Xerox PARC, developed in 1977. The Altos didn't have enough computing power, and their PDP-10 didn't have graphics, so they developed a Lisp-based windowing system which ran on the PDP-10 but displayed on Altos connected via Ethernet. "After DLisp, Xerox PARC developed a number of window systems supporting multiple processes in a single address space. These were all implemented in the Mesa programming language." Tajo, one of these systems, introduced icons and was the first notification-based system. Star, apparently another Mesa-based system, was Xerox's attempt to go commercial.

"In 1981 at MIT, the advent of the Motorola 68000 led to an attempt to build a workstation and its software environment called NU." This was a UNIX-based system, and all the GUI code was integrated into the UNIX kernel.

The W Window System was developed in 1982 for the experimental V operating system running on Sun hardware.

SunWindows, introduced in 1983, is next on the list, billed as the first widely-used UNIX window system. (It must be mentioned here that this book was in fact published by Sun and may be biased.) Some of the GUI code is in the kernel and some is linked into each application. Another system, Andrew, was developed in the same year by Gosling and Rosenthal, designed for a system which did not exist through most of the development, the PC/RT. The GUI code is in a user-level server process. "Andrew was the first practical UNIX networked window server."

The Apple Macintosh GUI, introduced in 1984, is in many ways a throwback to the very early days; once again, all elements of the system are in one address space and communicating via procedure calls.

X, based on W, was developed in 1984-85. X10 was the first widely-available version, but turned out to be relatively unportable. The following version, X11, was much more successful. X was similar to previous systems in that the GUI code was a user-level server process, but different in that the window manager was yet another user-level server process.

In 1986, NeWS was developed, and there the history ends. Microsoft Windows is not mentioned, presumably because at the time of publication it was still a market nonentity, since 3.0 had not been introduced yet.

— from James W. Birdsall,
jwbirdsa@picarefy.com, via Internet

NEW OLD-IRON CLUB AT CORNELL

First thing next semester (August 20th or so) we'll begin getting the paperwork together to get the Cornell University Classic Computer Club registered as a genuine University Club, with a faculty advisor and all that other won-

derful stuff. We have been quite active in our formation process. It all started late last September when an avid DEC enthusiast/Cornell Senior was running out of room in his apartment, and posted on a local newsgroup that he had a MINC-11 free for the taking. I had been interested in the history of computers for quite some time, but I'd never actually *seen* anything older than the TRS-80's used at my elementary school, so I snapped it up in a fit of nostalgia.

Needless to say I was hooked. My friends and I spent long hours fiddling with it, getting the power supply to work, and generally admiring the RX-02 floppies. We named it 'Sparky' ....and decided that we *really* had to get it working, and *really* had to see what else we could find. Thus was the CUCCC born.

Our one goal is to preserve and protect classic computers, and make sure people never forget the humble (and not so humble) beginnings of that multimedia whiz-bang box they bought at ComputerLand and don't properly appreciate. ("Only 80 WinMarks? What kind of computer is that!??")

As of today, we've got much more equipment than we've got space to put it in. Several PDP-11's of various flavors, IMSAI's, DEC Rainbows, terminals, bits n' pieces, a Honeywell DPS6, etc., so we need to get organized and find an on-campus home for these. Once we're official, people will be able to donate things to us and get a lovely tax deduction, because donated computers will be property of the club, ergo of Cornell. Nice how that works. Eventually we want to get a proper display of classic computers going, a hands-on look at computer history (granted, a very small slice of computer history) somewhere on campus.

Starting in late August, we'll have a newsletter (name currently being discussed) and other general club info available via WWW, gopher, and ftp at motherbrain.ithaca.ny.us. (Unfortunately, we haven't got a good place to send snail-mail to yet.) We'll have an FAQ made up RSN, er, we hope....

— from Seth J. Morabito (sjm1@cornell.edu), Cornell University Classic Computer Club, Cornell University, Ithaca, NY

[Seth,

Welcome to the great Club of Clubs! You have some interesting times in front of you, as we know all too well, and we wish you the very best of luck. Please keep the ENGINE informed of your progress and, especially, send along your newsletter when it appears. KC]

QUERIES

AEGIS/APOLLO WORKSTATIONS: ANYTHING WELCOME....

In addition to collecting old DEC 12 & 18 bit machines I've started collecting old Apollo computers. So far I've got several DN300, DN400, DN500 series machines. I've developed my own CAD system for the Apollo and eventually hope to store the schematics for the DEC machines online. The idea is to use old workstation technology from the early 80's to assist in maintaining machines from the 60's.

I've set up an archive on nickel.ucs.indiana.edu for storing old PDP8 source code, binaries, and documentation. I'd like to start archiving old Apollo stuff before it starts to disappear.

General Questions:

1) Has anyone written a book about the history of Apollo and Poduska (the founder) yet? If not, is anyone familiar with the company's history interested in writing down a few pages of text for the archive?

2) What is the status of Aegis 9.7 source code? Is there any chance HP/Apollo will release it?

3) What about schematics for the old, long obsolete machines?

4) What journal articles/conference papers related to Apollo still exist in ftp'able format? So far the only one I've found is "An Extensible I/O System" that was presented at the 1986 Summer USENIX conference.

5) What is the status of the Apollo Users Group? Do they have an archive anywhere? Does anyone have proceedings of old user group conferences?

Wanted:

1) I'm interested in buying old Apollo workstations/disks. If it's junk to you I'm probably interested in it. DN3000/4000 machines are still too modern for me (unless the price is right).

2) If you've got some old Apollo sales literature buried in your filing cabinet I'd be interested in it.

3) Aegis 9.7 on 8" floppies and tape cartridges.

4) Old Apollo training materials. Did Apollo offer any training classes to customers?

Aegis Questions:

1) What is the format of object files produced by Aegis compilers?

2) What is the format of the executables in the sau directories?

3) Are there any manuals on Aegis 9.7 internals?

Thanks in advance.

— from Jeff Russ, via Internet

ALTOS 2086: RELUCTANT DISK

I have an Altos 2086 that I'd really like to get running again, but unfortunately it lost its hard drive some time ago. I have a 'new' drive I can use, but no way of low-level formatting it.

If anyone can supply a program to perform a low-level format I'd be most grateful. I have the SDX disk, but it seems to only be able to format floppies; I've tried low levelling the drive on a Xenix peecee with an MFM controller, but the Altos wants its drive formatted with 16 sectors. Thanks in advance...

— from Geoff McCaughan, via Internet

AT&T IN/ix: DOCS AND CONTEXT NEEDED

I have a port of UNIX System V Release 2, known as IN/ix, to the AT&T 6300 (a PC/XT-class machine) by Interactive. As I understand it, this system was never officially marketed; I obtained my copy when a warehouse-full of AT&T 3B1 machines and associated items was discovered and sold off to the 3B1 community. It seems to have been distributed by a company called Media Software and

Systems, Inc., of Aurora, Illinois. That company has either gone out of business or moved, and Interactive has not answered my queries. I am particularly looking for manuals, since I have only the introduction/install manual, and there are no online man pages. Between my manuals for its predecessor, PC/IX, and my System V manuals for my 3B1, I can operate it, but there are tantalizing hints of features, such as overlayed executables (to escape the 64K+64K I+D program-size restriction), which I have no idea how to access. Any help is welcome.

— from James W. Birdsall, jwbirdsa@picarefy.com, via Internet

ATARI x00: STAR RAIDERS

Does anyone else remember the greatest video game of all time, *Star Raiders*, on the Atari 400/800 computers? An identical version was later released for the 5200 system. I would like to find out exactly who designed the game.

— from Matt McCullar, via Internet

ATARI 800: FASTER THAN THE OTHER WAY AROUND....

I heard there is an Atari 800 emulator for IBM PC/AT machines floating around, does anyone know where I can get this? Any help is appreciated.

— from David Fox, via Internet

ATARI 2600: REPLY TO PATRICK FLEMING'S QUERY

There was talk of a project to make an Atari 2600 emulator a few years ago but nobody ever followed through. If you want to attempt to code the 2600 there is hope though.

You can buy the new 2nd version of the Atari 2600/7800 assembler cart. Basically it allows you to assemble 4k of code in 2600 mode and 8k of code in 7800 mode (it works on both systems). I'm not sure if you can actually save anything to disk or tape with any kind of cable...but I'm under the impression you can't.

It comes with a 250 page official Atari system document for the 2600 and 7800 along with sample code from some games to get you started. As you know, there are several good guides to coding the 2600 on the net. Pick up a good book on 6502 and you're all set...

If you want the address I can go dig it out for you...it's about $60. (Basically it's a hacked Hat Trick cartridge for the 7800, so you NEED a 7800 to run it, even if you just want to use the 2600 side.)

— from Ralph Barbagallo, via Internet

C PREPROCESSOR: EARLIEST MENTION

I'd like to know the first mention of the C preprocessor in literature. Was it in K&R, or even earlier? Also, since when does it exist?

Many thanks in advance!

— from Lars Duening, via Internet

CARDS: DIG DEEP FOR THESE DOCS!

I have two cards that I am trying to ID. One is a full-length card with a full-length daughterboard marked:

JATEK Design Corp.
A/DFLGIFB

It appears to be some A/D board. There are 2 small 1/8" phone plugs on the mounting bracket along with a 2x12 square male connector where I assume the analog connections are made. I have searched my CDROM telephone book, but only turn up a construction company is Illinois. Phone number or operating instructions would be appreciated.

The other card has no manufacturer listed, but contains a Z-8 processor, 8K of static ram and a 27C128 EPROM. There is a red dipswitch which sets the base address of the card. It appears to have 4 ports which supply some type of valid data; they are in pairs 220-221 and 226-227, for instance, when SW1-5 is in

the off position. The value returned from the first pair of ports is usually 79$, which seems fairly close to a 8-bit signed 0 (80$), although adjusting the pot on the mounting bracket did not seem to change this offset. There is an RCA jack on the mounting bracket just below the trim pot. The card has "p222" printed towards the front of the board on the component side. The EPROM does not appear to be in the PC's address space, so it must just drive the conversion and scaling. Help, in the form of operating instructions, would be appreciated.

— from Guy Cox, via Internet

COCO: GETTING COMPREHENSIVE

I'm working on a bibliography of references (books, articles, etc) for or about the TRS-80/Tandy Color Computer. If you know of any references, please send me the bibliographic information (author, title, date of publication, pertinent pages, etc), or at least enough information so that others can look up the reference. Thank you.

— from aaron.banerjee@his.com, via Internet

COMPAQ PORTABLE PLUS: OPAQUE DIPSWITCHES

I need some information about the Compaq Portable Plus. This machine was manufactured in 1982 by Compaq Computers. It has 2 banks of 8 DIP switches on the motherboard. I need to reconfigure the machine, but I don't have the switch names/functions. I would appreciate it if anyone who has a manual would send me a listing of the switches and their functions. I have asked a few people locally, but no one has any information on this machine....

— from Bryan M. Armstrong, via Internet

COMPUCOLOR CURIOSITY

I've been curious about the CompuColor. From what (little) I can remember, it was an all-in-one system (like the TRS-80) driven by a Z80 processor. It sold for about $1000 and included one floppy drive (back in about 1981). It had low-resolution (128x64?) 16-color graphics.

The company was based in Minneapolis, MN, and I think the system could run CP/M. Does anyone know anything about this interesting computer artifact?

— from Jon Dunn, via Internet

CONQUEST (GAME) ORIGINS

I've begun hacking away at the source of the venerable game 'Conquest'. Its source is, to put it lightly, a mess.... If anyone can help me to find out who, where and when it was originally made, I would be very grateful.

— from Lars Clausen, via Internet

CONVERGENT TECHNOLOGY MINIFRAME: HELP WANTED

I have recently inherited 3 CT MiniFrames (caught them before they hit the landfill) and have some general questions.

3B1/7300 Binary Compatibility: As I understand it, a MiniFrame is somewhat binary compatible with the AT&T 3B1/7300 (which is based on it). What are the limits of this compatibility? (Obviously I can't run anything which uses 7300-specific HW, but what other limits exist?) Can I run some of the 7300 packages available on the Internet? Specifically, gcc (any version) or BNU?

Disks: It appears, from looking at it, that the MF can support disks w/ >7 heads, but is limited to 1024 cylinders by the WD1010 controller. Can I up the cylinder limit by replacing the 1010 w/ a 2010? Would I need other patches?

Availability of Hardware: Only one of my systems has more than the base 512K RAM on the motherboard. Obviously, I'd love to find more somewhere. Is MF hardware easy to find? How expensive, say, for a memory

upgrade? What about an Ethernet board and TCP/IP? (A brochure I have says that they did exist at one time.) What about disk mounting brackets? I *really* need one for a primary disk and could use a couple for secondary disks. (No second disks in any of my systems.)

Discussion of MiniFrames: What is the correct USENET newsgroup?

Thanks in advance...

— from John Ruschmeyer, via Internet

CYRNET NETWORKING: LACK OF DOCS

Does anyone know anything about a networking package called Cyrnet?

It's currently in use at the City Of Richmond Radio Repair Department, and they wanted to expand from the current setup of 4 computers to [more]; unfortunately, the manuals have all been lost. They called the company that made it, and were told: "We haven't sold software for more than 5 years. We don't even have any of the people from that division still working here. Sorry, we can't help you."

If anyone knows anything, It'll probably be a help, A spare manual would be a godsend.

— from William W. Arnold, via Internet

DATA GENERAL ECLIPSE MV/1400 DC: NOT MUCH TELLING

I have obtained an old Data General Eclipse MV/1400 DC minicomputer running AOS/VS (installed on 38 Meg(?) HD) Problem is: I don't know the system password, I don't have the system tape, and I don't know AOS/VS.

In short: any info on this beast including the OS (or, if anyone knows, where I can obtain DG/UX) is *very* welcome!

— from Johannes Elg, via Internet

DIGITIZING PUCKS NEEDED

I need help with two old digitizing tablets:

Summagraphics MM961: I need *any* style of the cursor (puck) or stylus. This model was normally shipped without one, expecting the user to purchase it separately.

Talos 4020 "Wedge": I need a manual for this unit. I would also like to obtain a cursor/puck if one is available (I have the stylus).

— from Alan Frisbie, via Internet

FRONTIER TERMINALS: DOCS NEEDED

Recently I came into an Altos 486 computer running Xenix. The machine was equipped with two Frontier terminals. These seem to be standard RS232 interfaced terminals with pretty nice graphics capabilities. Unfortunately, no docs came with the terminals. I would like to use them in a project where a graphics display would be handy. If you have any info on the escape sequences which generate the graphics commands, please email me. Thanks!

— From dcongdon@delphi.com, via Internet

HP: MASQUERADING AS AT&T

I have this Hewlett-Packard portable terminal/computer that I'm trying to find out about. It says AT&T Information Systems on the front, but is an HP unit underneath. The main unit is a calculator type QWERTY keyboard with a very small LCD display. It also has a mag-strip reader. It is encased in another unit that has NiCad batteries and phone jacks.The back says:

2450A07925 64K RAM

It has one 2-pin plug (power?), a 3-pin jack (DIN type?), and two other 3-pin jacks that are some kind of in and out as they are reversed (M/F) from each other. Questions: What is it?, What voltages does the power plug take?, and what can it do? Help....

— from Tom Reese, via Internet

HONEYWELL DELTA 2000: OBSCURE DATA STORE

I'm looking for people who have experience with Honeywell's Delta 2000 computer system. In the Delta 2000's printer controller, the data for the formatting of the printer output is, as one might imagine, stored in a ROM. My question relates to the buffers in which the data to be output was stored — the data storage apparatus — and its relationship to the data processor in the printer controller. Did the data processor in the printer controller use the data storage apparatus as a variable data store during processing? Also, I wonder what sort of hardware was used? The information that I have found on this does not indicate whether it is RAM, core, or something worse.

If someone could point me at someone whom might know the answer to these questions or could suggest some publication, library, etc. that might be of help, I would be very much obliged.

— from Andrew Robertson
Department of the History of Science
Harvard University

HUSKY HUNTER: WHAT WAS IT?

....I amuse myself by messing around with old and strange hardware, and recently I've managed to come across a portable computer with the rather dubious name of Husky Hunter.

Not only does the name remind me of a washed-out B-actress, but it appears that this British marvel of engineering is also supposed to be connected to some military hardware or similar....

Does anyone know anything else about this greengrayish piece of obsolete hardware? It's quite cute in a brutal and slightly fascist kind of way.

— from Jan Besehanic, via Internet

LISP MACHINE MONITORS: THIS HAS TO BE SOMEWHERE

Does anyone know any technical specs of the large monochrome monitors that were used on LMI Lisp Machines? We have four of them (three in working order) that we would like to put into service in some other way. We can do some electronic modifications as needed if the basic information can be found.

Also, anyone who wants to deal with the State of Georgia surplus property system could purchase various parts of defunct Lisp machines from us. I'm the person to contact. The red tape may be non-trivial, but we'd like the equipment put to good use somewhere.

— from Michael A. Covington, University of Georgia, mcovingt@ai.uga.edu

MICROLOG CONTROLLER: WHERE'D IT GO?

I picked up a pair of surplus 8" disk drives with a Microlog controller card that fits in a standard 8 bit ISA bus slot. I'd like to find someone who knows what formats this hardware was able to read, and ideally find the software for this combo. I've got some old CP/M disks I'd like to read, as well as some more oddball formats such as NBI word processor disks.

Failing that, does anyone know of a current hardware/software solution to read disks from old systems?

— from Dave Lacey, via Internet

NORTHSTAR ADVANTAGE: GETTING A GRIP

I recently purchased an old run-down North-Star* Advantage computer. Unfortunately, the person I bought it from didn't have any type of technical references or documentation on many of the programs included. I don't even know how to use the ED.COM program (doesn't work the same as DOS's EDLIN).

Any ex-Advantage gurus out there? Have an old Advantage manual laying around? I'd be interested in any helpful information you could provide.

Some of the software packages I'm having trouble with are:

F80.COM, etc. (FORTRAN compiler)
ED.COM (commands, etc.)
ASM.COM (instructions, etc.)
using the BASIC compiler.

The OS for the machine appears to be:

NorthStar* Graphics CP/M (R) Release 2.2
1.1.0 AQH ADVANTAGE(tm) Version

Thanks for any help you can provide! Let me know if you need any further info in order to help..

— from Bob Galles, via Internet

SIEMENS PC-MX2: NOISY BUT NEAT

Well, I just bought....a Siemens PC-MX2 UNIX box with 3 CPU's: a main NS32016, on the serial card an 8085, and on (what I think is) the network adapter, an 80188. It is a neat little computer although it makes a hell of a noise (3 fans). If anyone knows anything about the PC-MX2, I am interested in information about this adapter; I have some TCP/IP software for the computer but I don't know anything about the hardware. The "net-card" has 2 DB-style connectors, one 25- and one 15-pin.

— from Michael Christensen, via Internet

SGI 1200: ANYTHING AT ALL?

Hi. The subject says it... I have seen an old SGI 1200 computer in a flea market near here and want to know something about it. Does it do graphics? How old is it? etc etc... Thanks for info! EMail is better of course!

— From bmcbrine@hakatac.almanac.bc.ca, via Internet

SPERRY/VARIAN V77 MINI WANTED

....Years ago I worked for a long time on Varian Data Machines V77 series mini computers. Later they sold out to Sperry. I remember that Sperry at some point sold the rights to a company called Second Source Computers Inc in Tustin CA.

The machines I'm specifically interested in are the V77-600 & V77-200, although any models will do. If you have any info or know where I can get some I would like to hear from you. Especially if you have one in use or want to get rid of a working one! or if you have any info on Second Source.

— from jonathan, via Internet

TECHNICAL DESIGN LABS: WHERE ARE THEY NOW?

Whatever became of Roger Amidon and the fantastic Technical Design Labs of Princeton NJ??

They produced some of the finest ahead-of-the-pack S-100 products going. A quality operation. Their software was far superior to the lame stuff that got us to where we are today. Their hardware was feature-rich and had the ability to grow beyond the state-of-the-art at the time - their CPU board had the ability to run at 4Mhz at a time when Zilog only produced processors rated at 2.5Mhz.

I still have (on PPT) their ZAPPLE monitor, Z80 Macro Assembler, Text Editor and output processor, and both the 8k and 12k BASICs. This was just prior to CP/M dominating the market. They mention in a flyer that they were about to release their FDOS, in December 1976. So where did they go and what became of their Pro-from-Dover Roger Amidon?

— from David K. Bryant, via Internet

UNIX BOOKS: FERVENTLY WANTED

In November last year (!), I ordered a copy of volumes I and II of "UNIX System Software Readings" from Prentice-Hall (two books

which I believe are reprints of the UNIX special issues of the AT&T Bell Systems Technical Journal (BSTJ)). Last week (!!), volume II arrived. Great!

TODAY, I had a call from the bookstore, to say that volume I would *never* arrive, because Prentice-Hall have stopped printing it! Why do all of the *good* books, the *classics*, go out of print.... [smoking snarl abridged]

If there is anyone in the U.S. (or anywhere else) that knows of somewhere that has a copy of Volume I still in stock, I would appreciate hearing about it so I can snap it up! (The same goes for "The Multics System" [Organick], which is also out of print; I don't know how long ago).

— from Adrian Booth, via Internet

WANG CALCULATOR: TECH REF NEEDED

Perchance does anyone have tech data on the Wang LOCI-2, a mid 60's desktop programmable calculator? I have the manuals, but no tech info (e. g. schematics).

— from Michael Dunn, via Internet

WICAT 156: BACKGROUND, DOCS, AND UNIX WANTED

I have been offered a Wicat machine, and I am looking for any information anyone might have on it or the company. It is billed as model 156, a 68000-based machine with a 12-megabyte hard drive, from the early 1980's. It originally ran a UNIX variant, but that did not work very well so the owner had it replaced with an operating system he describes as "VMS-like." In particular, if anyone has or knows where to get the UNIX variant for this machine, I would like to hear from them.

— from James W. Birdsall, jwbirdsa@picarefy.com, via Internet

ZENITH MINISPORT ZL-1: ELBOW-DEEP IN THE HARDWARE

A friend....bought an old Zenith Minisport laptop from a swap meet and was wondering about it. The laptop is model ZL-1, has a 2" floppy drive, came with a power AC adapter, and has 1Mb of RAM.

1) What can it do? What are the stats on the machine? Is DOS in ROM?

2) Is there a source for 2" floppy disks, that can be used by the Zenith drive?

3) The unit comes with password protection. We can short two pins on the EEPROM and reset the machine so it can bypass the password protection. Anyone know which chips to jumper? Zenith describes using a jumper between two pins. I already took out the backup batteries and shorted the CMOS using 2 quarters (fortunately the backup batteries are the size of quarters....) Any info would be helpful and is there a source for technical manuals?

Please help me. Replies can be sent to: lewj@nextnet.ccs.csus.edu. Thanks in advance.

— from James Lew, via Internet

ZILOG Z80: C CROSS-COMPILER SOUGHT

For reasons too ridiculous to explain I am looking for a C cross compiler (ANSI C would be nice, but is not necessary) to executables for the Z80 processor. The compiler need not be freeware or shareware, and can run on a UNIX, Mac, or DOS platform, although DOS is the preferred environment. Any leads or other information would be greatly appreciated.

Many thanks in advance,

— from John Todd West, via Internet

PUBLICATIONS RECEIVED

International Calculator Collector, Volume 2 Number 1, Spring 1994. HP 35; Rockwell; Early advertising; Photo Album; Pricing trends; Novelty Calculators; more. US$8 per year with membership (goes to $10 June 30). From Guy Ball.

Historically Brewed, newsletter of the Historical Computer Society.

Issue #4, Mar/Apr 1994. Apple II part 2; Kaypro Korner; Calculating Computers; My First Computer; more. 16 pp.

Issue #5, May/Jun 1994. Apple II part 3; Kaypro Korner; Atanasoff's Computer; Reviews of Ranade and Nash's *Best of BYTE*, Levy's *Insanely Great*, Cringely's *Accidental Empires*; Computer history bibliography; Computer museums; more. 16 pp.

US$15.00 per year; Can$20.00; International, US$24.00. From David Greelish.

The Z-Letter, newsletter of the CP/M and Z-System community.

Number 28, November/December 1993. Bondwell 2 laptop; Evolution of ZDB Z-System database; correspondence, resources and technical discussion. 20 pp.

Number 29, January/February 1994. HP 125 and 120; HELLO source listing; correspondence, resources and technical discussion. 20 pp.

US$18 for 12 issues (2 years); Canada/Mexico, US$22; International, US$36. From David A. J. McGlone.

ADDRESSES OF CORRESPONDING ORGANIZATIONS

International Association of Calculator Collectors, 14561 Livingston Street, Tustin CA 92680-2618. Guy Ball, Bruce L. Flamm, directors.

Historical Computer Society, 10928 Ted Williams Place, El Paso TX 79934. CompuServe 100116,217. David A. Greelish, director and editor.

Lambda Software Publishing, 149 West Hilliard Lane, Eugene OR 97404. David A. J. McGlone, editor and publisher.

The Perham Foundation, 101 First Street #394, Los Altos CA 94022. Donald F. Koijane, president; Mike Adams, editor-in-chief.

THANKS TO....

Aaron Alpar for copious contributions of space, time and money.

Barrie Grennell for lots of wise advice on fundraising.

Bob Kushner and National Productions for Pomona booth space.

David and Tamara Greelish for generously sharing their booth at the LA Computer Fair — and having a good time doing it.

Erwin Tomash for a working lunch that really worked.

Hilary Crosby for flawless pathfinding through bureaucracy, surgically exact advice on logistics, and that picnic!

Jean at Atkinson Dynamics for coordinating the rescue of the PDS 1020.

Joan Piker for ideas on how to pack 'em in at Pomona.

Joe Schopplein for fabulous photography.

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Jon Herron at A E Press for ENGINE printing.

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Lana Taber for ENGINE cover art and Pomona booth banners.

Max Elbaum for taking part in the latest round of interviews.

Melissa Leventon for much discussion of accession and registration.

Michael Oliver for driving, and loading, and unloading that truck.

Michael Tague et al. for slogging through Kentucky's worst snow in a century, and sitting with the Witchcraft server to keep it up, instead of staying home and keeping warm.

Mike Malone for sharp writing in the NY Times article, research and perseverance.

Roger Sinasohn for qualitative help to the Minicomputer Rescue on about no notice.

Steve Roberts for unbuttoning BEHEMOTH's deep structure.

Sunny Day and her colleagues at the Ontario Doubletree Club for making darn sure we had *what* we needed *when* we needed it.

Tom Ellis and Daphne Gill for scanning.

US Printing for photocopying done quickly, inexpensively and on time.

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The ANALYTICAL ENGINE solicits manuscripts of 600 to 1500 words on the general topic of the history of computing in, or with significant reference to, the State of California. Articles should focus on one interesting or illuminating episode and should be written for a technically literate general audience. Submissions are welcome from both members and non-members of the CHAC. Article deadlines are the first of each month prior to publication: June 1 for the July issue, September 1 for the October issue, December 1 for the January issue, and March 1 for the April issue.

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The preferred document file format is Microsoft Word for DOS or Windows, but almost any DOS or Macintosh word processor file will be acceptable. Submit manuscripts on DOS 5.25" or DOS or Mac 3.5" diskettes. Alternatively, please provide an ASCII file attached to Internet mail. Please avoid submitting on paper unless absolutely necessary.

NINES-CARD

704x/709x TRIVIA CONTEST:

Two real stumpers from Joe Morris, MITRE

1) The IBM 7040 and 7044 had the same basic architecture as did the 704, 709, 7090, and 7094. The 7040/44, however, had two memory reference instructions which involved *37* bits, S,P,1-35. (They are *not* zero-the-accumulator instructions; that's not a memory reference.) For extra credit, what would these two instructions do if executed on a 7090? HINT: the original 7040 WATFOR used these instructions to provide a critical feature in a *very* slick way.

2) The 709x had two fullword integer divide instructions which performed exactly the same operations on the specified data. Another two instructions performed exactly the same floating-point division, and a third pair of opcodes performed integer division on a user-specified divisor bit count. The difference between the two instructions in each pair is the same. What is this difference? (Incidentally, I had completely forgotten the pairing until I noticed it just now.) Hint: one of the instructions in each pair was utterly useless for all but a *very* small number of programmers.

[First correct answer or answers we receive by our September deadline will earn the respondent an extra issue on his or her ENGINE subscription. — Editors]

COVER ART

Drawing of our HP 125 from Dan Swaigen (see next issue's ACQUISITIONS) in ink and marker, by Lana Taber. Scanned by Daphne Gill on an HP ScanJet IIcx.

NEXT ISSUE

Interview: Salad Days at PARC, part one. Techstuff. Letters. Queries. And more and more and more....

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