*J. Tom Badgett*
*400 Albermarle St.*
*Bluefield WV 24701*

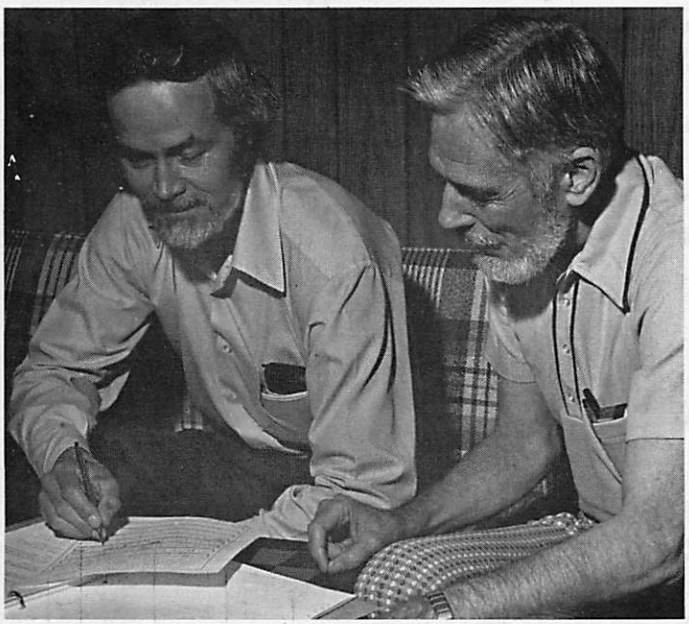
# Visit to OSI . . .

*. . . in which the author reveals everything you've always wanted to know about Ohio Scientific Instruments, but were afraid to ask.*

I heard an apt description of the microcomputer industry the other day: "Like walking on a waterbed—unstable and maybe a little scary." There have been dramatic changes in the field over the past three or four years, changes that have brought us to the brink of a new age in technology. This advancement hasn't occurred without problems, however. Indeed, designers, manufacturers, retailers and users have suffered the growing pains of this newest and most fascinating industry. Until now all of these groups have been little more than pioneers, blazing trails and clearing wilderness for the less intrepid followers.

**Introduction**

Among these pioneers must surely be listed Ohio Scientific Instruments, designers and manufacturers of microcomputers, for their story is a dichotomy of acute insight and severe tunnel vision. In 1975—when a typical microcomputer user was also an engineer, or at least a serious electronics hobbyist—OSI was pitching bareboard and single-board computer devices to the user who delighted in getting into the guts of his machine, who was thrilled by the sight and touch of the hardware and excited if he could hold BASIC in memory long enough to execute some simple programs.



*OSI dealers George Harris (left) and Ed Haigh in their store in Charlottesville, Virginia. H/B Computers was one of the first to join the OSI dealer ranks.*

OSI's 400 series boards apparently didn't receive too much attention beyond a hard core of dedicated OSI enthusiasts. The design basically was OK, but the company was small, and their promotional efforts didn't match those of competitors in the field.

I first heard of Ohio Scientific late in 1976. I was researching an article on new technology word processors and wrote letters to all the companies offering computer-type hardware that might be adapted for word processing. Response to my 50 or so detailed letters ranged from personal replies from high-level company officials who offered specific answers to my questions, through catalogs only, all the way to no response at all.

The simple catalog I received from OSI described what appeared to be lackluster hobbyist hardware, and since they did not provide specific responses to my questions about word processing I didn't pursue the OSI product line further. Within a few months, however, I began reading their advertisements with new interest.

Recall the microcomputer situation at that time: The most popular and most accessible machines probably were the Altair, Imsai and perhaps the SWTP. With the exception of the Southwest Tech equipment, the computers of the day were bedecked with switches and lights, required multiple accessory boards and large memory capacities and carried high prices. OSI continued to run ads with a simple sketch of a simpler box that lacked the eye-catching appeal of others in the marketplace. When I finally read the fine print it looked like the guys in Ohio had something after all.

On a limited budget but extremely interested in getting into microcomputing, I was intensely interested in the OSI model 500 board. At a time when you could spend $500 to $1000 for a pretty box with CPU and a little memory—a box that still wouldn't do anything without the addition of more memory, a cassette interface, BASIC on cassette, I/O boards, etc.—the 500's 8K BASIC in ROM, 4K RAM workspace, built-

1. Menu and Cassette Load Functions
2. Basic Monitor Functions
3. Hex and ASCII Memory Dumps
4. Text Entry Functions
5. Cassette Save Functions
6. Test and Verify Functions
7. Symbolic Dump

The first segment, Menu, should provide for the selection and loading of subsequent segments. It should also contain the most widely used and fundamental subroutines.

One object of this suggestion is to provide for short cassette load segments so that confirmation of successful loading is quickly obtained. One to 15 minutes to have a program loaded and working is not acceptable.

Another object is to provide a reasonable working memory. Eighty bytes, as for RSM-1S, is not sufficient. Furthermore, most of the features of a large monitor are not going to be used immediately anyhow.

Since the Menu should always be resident and callable as a Monitor function, it would be simple to overlay an unneeded capability with a new segment and a desired capability.

Given the ability of the Z-80 to provide for relative as well as absolute calls and jumps, it should be feasible to load and utilize any desired segment within a general 2K space limit. If BASIC's CLOAD and CSAVE operations are temporarily unneeded, even the memory area from 4000 to 4200H could be employed for monitor code or program use.

### Final Suggestions

*Create your own monitor.* One lesson I have drawn from my experiences so far is that a monitor is not only an essential tool for learning machine language and controlling the computer, but it is also an excellent piece of software to use as a starting point to build in whatever features are most important to *you.*

*Learn machine language.* Assembly or machine language is easier to learn than most novices think. A personal computer such as the TRS-80 and a good monitor are invaluable aids in the learning process.

Although several books on 8080 and Z-80 programming exist (from Osborne and Associates, Scelbi and Sams), the right beginner's book (David Lien's *User's Manual for Level I*, for example) doesn't yet exist, as far as I know. You must work with what is available. Learn 8080 language before the Z-80 refinements.

*Start now.* Finally, if you're ready to start learning machine language, buy a monitor now. Don't be afraid to buy more than one if you can afford it.■



✓ Reader Service—see page 179

in RS-232 and 20 mA current loop interfaces looked good indeed.

So, late in 1977 I took a gamble. I couldn't find anyone using the OSI equipment, and my letters to the factory went unanswered. Nevertheless, I bought a 500 board from H/B Computers in Charlottesville, Virginia, hooked it to a surplus power supply and an SWTP CT-64 terminal and was "on the air" with my own computer in a matter of minutes.

**A Question of Support**

The construction of the board seemed good and the unit worked flawlessly from the beginning. At this point there was only one problem: an almost complete lack of documentation. The manual that accompanied my 500 board was Spartan, to say the least, and sometimes even George Harris, the dealer from whom I bought the unit, couldn't shed much light on the darkness of my ignorance.

"The situation is going to change," Harris said in the winter of 1977-1978, "it has got to change and it will change." But months later OSI still was unable or unwilling to respond adequately to hardware and software questions from Harris and other OSI dealers. By spring of that year enough dealers had become so disillusioned they decided to band together in an effort to force the company to be more responsive to their needs.

About 30 dealers joined together in April in what was then —and may still be—a unique approach to the problem of dealer/company relations. These dealers agreed that OSI equipment was sound in design and construction and they wanted to continue to offer the line, but they could no longer suffer the painful lack of company response to their demands for better documentation and software to support the hardware. Each dealer agreed to put up $1000 to hire some full-time programmers to work on applications software for the growing OSI equipment line.

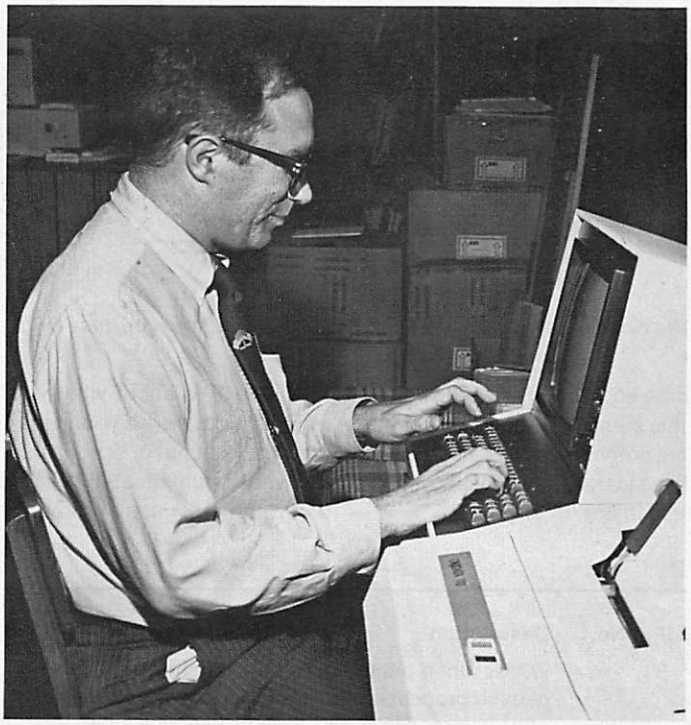
The power of this kind of money—coupled, apparently, with a growing realization by OSI officials that most of their dealers are "businessmen who know what they're doing," according to Harris—caused a quick improvement in relations with the company. OSI agreed that the dealer-supported programmers would be housed at the OSI factory where they could be more effective because of close contact with new equipment changes and operating system software advances. "OSI doesn't look at this as the OSI software group," Harris said, "rather it is an OSI dealer software group housed at OSI, which is the way it ought to be."

**Software Development**

Since then the dealer's software group has turned out a series of business programs for the OSI Challenger III system. The first effort was a package dubbed OS-DMS for Ohio Scientific Database Management System on which has been built inventory, accounts receivable, accounts payable, general ledger and payroll packages.

Wendell Banks, a Duke economics graduate and professional programmer with big-machine experience, is one of the software group programmers. "I'm trying to put on the micros what I've seen on the maxis," he told me. "Whether it is a Univac 1108, an IBM 370/168 or one of these micros, whatever the brand, the machine is a computer, and for business purposes there are certain standards that have to be met or the businessman is not going to buy."

OSI and the dealers are striving for better cooperation in software development, too. They're trying to write their software in logical blocks with common line numbers, for one thing. That way, if an individual dealer or customer needs to modify a package, he knows where to find the disk controller routines, for example, or other system control commands. And dealers are exchanging information about software they have developed themselves in an effort to cut down on duplication.



*OSI software group programmer Wendell Banks hard at work. Banks says he has software running on the OSI equipment that's as good as what he used to put on the IBM 370; it just runs slower. "This OSI hardware will do the job," he says, "and it is easy to work with, but without the proper software it's like running a car without gas."*

"There's no need for one dealer to work on a dental package, for example, and a surveyor package," Harris points out, "if I've already developed a dental package that would meet his needs. Let him work on the surveyor package for me and I'll help him with his dental software needs."

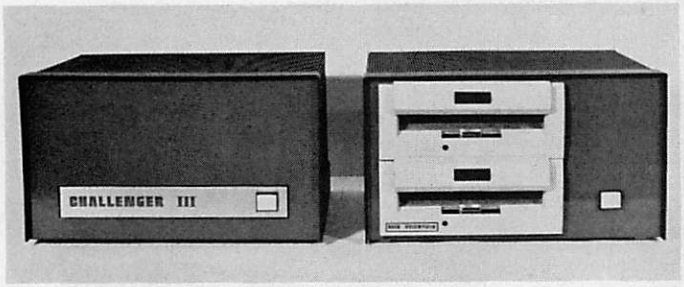
Indeed, OSI apparently is following similar reasoning in developing business software for general distribution. One reasonably priced business package ($995 for disk and documentation if the buyer is willing to put his books on the system himself) includes some impressive features: accounts receivable, accounts payable, general ledger, inventory, payroll, customer files maintenance, mailing label preparation and more. Ohio Scientific recently released a new version of their Word Processor with such features as automatic hyphenation, automatic line numbering, full character or global editing, FIND and CHANGE commands, incremental spacing and other output formatting features.

Also, the company has worked hard to back up its new personal line of computers (more on them later) with cassette and mini-disk software. At the end of 1978 OSI released well over 100 programs for these machines including video games with graphics, checkbook balancing and other "personal" software and business demonstration packages.

**Growing Pains**

So on the surface it appears OSI has met the micro software problem head on. Now the bad news. As with any new field—especially one with the growing pains experienced with microcomputing—this one has its share of problems, and OSI is suffering at least its due percentage of the total. I asked two professional programmers (guys with IBM and DEC experience) to look over the OS-DMS package. They were unimpressed.

"This is definitely not a database manager," one of the fellows lamented. "I don't know what else is out there for mi-




*The Challenger III.* *(Photo courtesy OSI.)*


*OSI's manufacturing plant.* *(Photo by Wayne Green.)*

cros so I don't really know how this stacks up against other micro software, but as a true database management system goes, this is not it."

"OS-DMS is about what you would expect from a young programmer just out of school. It is not very sophisticated," says Dan Smith, Systems Director for Tek-Aids Industries, Inc., a Chicago-based OSI dealer. Tek-Aids and a few other dealers around the country prefer to depend on what software they can write themselves or contract through local professional programmers.

George Harris is, at times, elated over the progress OSI has made in hardware and software; at times he is depressed over how far they have to go. But generally Harris remains optimistic: "We're not going to turn into a Digital Equipment DECUS users group overnight, but it is going to come a heck of a lot quicker than it did for them, that's for sure," Harris says. "Where it took them ten years to do it, I think within a couple of years we're going to have that kind of software."

Other problems, probably best summed under the heading of poor communication, plague OSI dealers. The folks at OSI are a close-knit organization, especially at the top. Mike and Charity Cheiky—husband and wife—are vice-president and president, respectively. Together they own over 60 percent of the company. OSI started small with facilities in the rear of another business in Hiram, Ohio, in 1975.

Apparently a few principals pulled the company together with personal drive and dedication . . . and up by its bootstraps. Now, OSI is housed in a 5600 square foot manufacturing facility in an industrial park in Aurora, Ohio, with around 80 employees. They have hired designers, programmers, a dealer relations expert, technical writers, etc.

Still, many OSI dealers lament that the company makes important decisions on marketing, product changes and prices, advertises those changes, and the dealers hear about them only when customers start asking questions. When a company grows from a small back-room affair to a multimillion dollar outfit in only three or four years, however, these kinds of problems can be expected.

"There are still some problems, and there are going to be some problems," Harris says, "but OSI is listening; they're bending over backwards to try to help us; you can communicate with them." So things are improving.

### Hardware Design

But enough of the bad news. Dealers and OSI employees who apparently are in the know say their company isn't any worse about these problems than most of the other manufacturers. In fact, some people think OSI may be far better than many others. And, many good things can be said about OSI products and the company's business plan.

The OSI hardware alone is capable of transcending some of the most severe organizational problems, making software and documentation problems a little easier to live with. Dealers like George Harris have stayed with OSI through thick and thin because of the hardware.

"I'm really impressed with the design of the hardware," Harris says. "Every board has IC slots laid out for user modification. It's not like buying a color TV set you're afraid to touch. They even give you little hints on how you can modify their products for individual needs."

| Pin No. | Description |
|---|---|
| B1 | WAIT. When pulled low by a system board, causes processor clock to slow down to speed of approximately 500 kHz. Used to service slow memory and I/O devices. |
| B2 | NMI (non-maskable interrupt). When brought low, a non-blockable interrupt occurs, causing the processor to stop its operation and service this interrupt, that is, go to a specific memory location and execute an interrupt service routine. |
| B3 | IRO (interrupt request). An interrupt that can be masked by the processor. The processor can choose to ignore this interrupt under program control. If the interrupt is not masked, it will function as NMI above. |
| B4 | DD (data direction). When pulled low by a system board, it changes the data direction of the 8T26 buffers on the CPU board, switching the processor from outputting data to the bus to listening to the bus. |
| B5-B12 | Bidirectional, eight-bit data bus for communication between the processor and system boards. |
| B13-B16 | Upper data bits on some systems. |
| B17 | Optional reset line used to clear all PIAs and similar I/O circuitry in the system. |
| B18 | Spare. |
| B19-B22 | Memory management address lines (the OSI system can address memory in 64K blocks up to at least 768K). |
| B23 | + 12 volt power connection. |
| B24 | − 9 volt power connection. |
| B25-B26 | + 5 volt power connection. |
| B27-B28 | Ground. |
| B29-B38 | Ten low-order address lines. |
| B39 | Ø2. Used to clock external circuits or external I/O interfaces, such as the A/D converter (see a 6502 data sheet for more details). |
| B40 | R/W (read/write). Originates at the microprocessor and specifies read or write operations on the data bus. |
| B41 | VMA (valid memory address). Only used in conjunction with the 6800. The 6502 always has this line high. |
| B42 | Ø2-VMA. Master timing signal for enabling memory and I/O in the system. |
| B43-B48 | Six high-order address lines. |

*The OSI 48-pin bus.*

"The fact that there is no fan in the thing, the fact that each board is without a heat sink because the voltage is regulated at the bus instead of on each board impressed me," Harris continues. He also says he has no fear about taking OSI computers to dealer shows or for customer demonstrations. The 48-pin Molex connector bus is extremely rugged.

"You can throw their stuff in the trunk of a car, carry it around town, plug it in somewhere else and it works," Harris says. "And you don't have to worry about it bombing out every time you open the refrigerator or the air conditioner comes on."

Wade Stallings, a graduate engineer with considerable design experience with computers and other digital devices, started playing with the OSI model 500 board about the same time I did. He says he is continually frustrated by the lack of in-depth documentation—he has spent hours tracing circuits, drawing diagrams and studying machine-language programming. But he's still impressed: "Whoever did OSI's design work knew what he was doing," Stallings says. "He really had his act together. They've got little things in there a lot of people never think of—especially planning for the future."

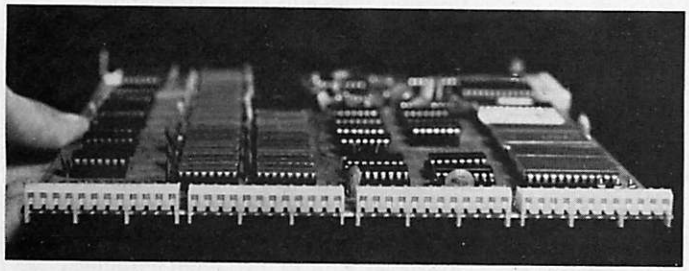
For one thing there are 20 address lines built right onto the motherboard, meaning a potential memory expansion to beyond one megabyte without redesigning. The bus structure is such that 10 MHz data operations are possible. OSI was among the first to put a full 8K BASIC in ROM right on the CPU board. Their choice of a microprocessor chip was progressive.

"I'm always looking for simplicity," Stallings says. "Too many engineers try to do things the hard way. This 6502 microprocessor is simple, and it is fast. It'll run faster at 1 MHz than a Z-80-based machine will at 4 MHz."

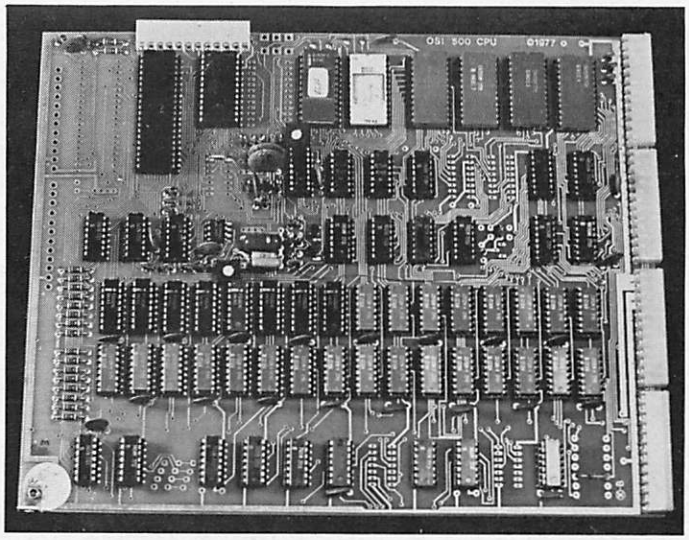
In 1975 the 6502 wasn't a very popular chip. Most micro manufacturers were sticking with the 8080. Most microcomputer software was being written for the 8080, and some people even thought the 6502 was destined to remain a second-rate chip, good only for hobbyists and industry. By late 1978, however, sales of the 6500 series chip had surpassed 8080 series chips' and there already was an increasing library of 6502 software.

That the 6502 lacks Z-80-type registers may even be an advantage, Stallings believes, because it can set up its own registers in a memory location in any way necessary, meaning the 6502 is more versatile. And pipelining—the ability to fetch an instruction while it is carrying out a previous one—makes it very efficient. The top-of-the-line OSI computer—the Challenger III—sports three processors available to run BASIC or machine-language programs. The user can select the 6502, 6800 or Z-80 under hardware or software control.

OSI has a full range of accessory boards designed to add to the basic system's versatility: high-speed analog-to-digital and digital-to-analog converter, a 6100 emulator to run DEC PDP-8 software, PROM programmers, multiple RS-232 ports, voice output board, graphics and graphics with color, high-speed cassette interface (1200 baud), 96 line remote parallel board and more.



*All OSI board connections are via Molex connectors. The 48 bus connectors and 12 interface connectors (up to 30 with a PIA chip installed) provide tight, trouble-free hookup to the outside world and accessory boards.*



*This is the bulwark of the OSI computer line, the model 500 CPU. This single board computer has 8K Microsoft BASIC (in the four PROMs under OSI 500 CPU) and 4K of RAM. RS-232 and 20 mA current loop interfaces are standard. The long chip at the upper left of the board is the 6502 microprocessor. Beside it is space for a user-provided 6520 peripheral interface adaptor (PIA). Some newer versions of this board also have a disk controller built in, but lack the 4K RAM.*

**The Future**

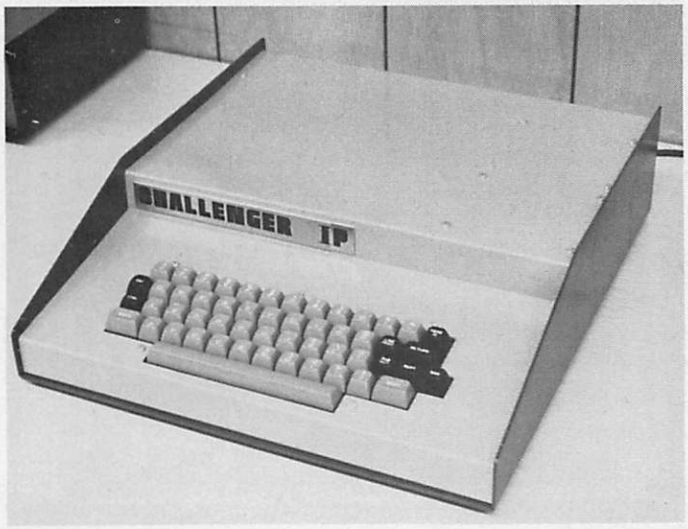
The OSI marketing philosophy is impressive, if somewhat ambitious. They want a piece of every stratum of the micro market: experimenters, hobbyists, educators, small business and big business. Their hardware line already is encroaching into all of these areas.

"We're now ready for the next big step to move us to the very edge of big-machine technology," Mike Cheiky told a recent gathering of OSI dealers at the Aurora, Ohio, factory. "We've got more horsepower than either you or your customers expect from a $4000 box," he said.

The big-machine technology Cheiky was talking about revolves around advanced software (particularly OS-DMS, which may be of questionable value unless it is greatly enhanced over presently available versions) and advanced hardware capabilities. Already available for the OSI Challenger III computer is an OKIDATA 74 megabyte hard disk, perhaps the largest on-line storage available in the micro market. With average read/write times under 50 milliseconds, the computer's statement after reset that more than 72 million bytes of user workspace is available becomes believable. To fill the gap between that large storage device and the standard 250,000 byte 8 inch floppy, OSI is developing a 20-24 megabyte hard disk for the Challenger III. Dual-sided floppies also are an option.

At the other end of the scale is the Challenger IP, a single-board machine housed in a case and with a power supply at a retail price of about $350. It has 8K BASIC, video graphics, 4K RAM (expansible to 8K on-board), can be hooked up to the standard OSI bus and can support up to two minifloppies.

There's a catch, of course. It has a limited video display of only 24 × 24 characters with a standard TV set monitor, but up to 32 × 32 characters "is possible" using a high-quality monitor with underscan. The IP is OSI's entry into the truly personal computer market. Their plans call for selling the IP in large quantities with an eye toward getting large department stores and other retail outlets




*The Challenger IP.* *(Photo by Wayne Green.)*

to handle the machine. Mike calls the IP "the world's lowest cost, full-featured computer."

The OSI VP feels the IP has reached its ultimate design, and there'll be no effort to redesign it ("Could you upgrade the video display?" one dealer wants to know. "What about larger memory?" asks another). "We'll not enhance its features; we'll just make it cheaper and cheaper," Cheiky responds. OSI recently launched a massive, nationwide advertising campaign in leading electronic, scientific and business magazines. The new IP computer will receive "the largest exposure of any OSI hardware." Cheiky expects to move at least 100,000 units by the end of 1979.

**The Present**

OSI is taking a different approach with its C2-4P computer. It is packaged very much like the IP, but the C2-4P is based on the standard OSI 48-pin Molex connector bus. Except that it doesn't have a built-in −9 volt power supply (only 5 volts is provided), the C2-4P is like any other OSI mainframe, just in a smaller case.

The C2-4P has been on the market since early 1977 and has proved itself a good choice for the hobbyist or for education use. Now with the new "MOD2" version, which includes graphics, mini-disk interface as well as some other goodies, OSI believes it has "the ultimate personal portable" computer. "We're going to continuously upgrade the C2-4P to keep it up with the state of the art," Cheiky says. "It is essentially obsolescence proof."

The C2-4P has a 64 character display and can support up to 48K of RAM with dual minifloppy drives. The two other mainstays of the OSI product line—the C2-8P and the Challenger II—fall somewhere between the C2-4P and the Challenger III. The 8P is identical to the C2-4P except it is housed in a full-size case with an eight-slot motherboard (the C2-4P has only four slots). The Challenger II is a full-size computer like the Challenger III, but has only the 6502 processor instead of the three processors of the Challenger III.

Ohio Scientific has one other strong suit: its software. I've already mentioned that some of their new "business" software may not be all it is cracked up to be. OSI systems software, on the other hand, is full of features and fun to use. First are the operating systems: OS-65D and OS-65U.

OS-65D came first and originally was intended as a developmental system only (thus, the "D" suffix). It has gone through several revisions, though, and is the standard operating system for all of OSI's minifloppy-based systems. OS-65D uses named files for disk storage but maintains track designation, too. That means you can save a program on disk by specifying program name and let the computer worry where it is on the disk, or you can put the program on the track of your choice.

The developmental operating system comes with a 9-digit BASIC, assembler/editor and extended monitor. One of the truly useful features of 65D is the way it handles disk data files. It supports either random or sequential files with pre-set record lengths of 128 bytes (the record length may be user changed, too). This means that to write a record on disk the user simply has to open the file and write in the information. There is no complicated head positioning or indexing; the operating system takes care of it all. When using random access files, access the information by record number. You specify record number; the computer finds it on disk and inputs it to memory where you may use it however you want.

Perhaps the best feature of the new 65D is the trend it set toward improved documentation. The manual that comes with the disk is complete and easy to use compared to most other OSI documentation. It takes the neophyte user step-by-step through the orientation procedure.

The user-oriented operating system, OS-65U, is better in some ways than 65D and is designed for far-reaching user applications. There are three versions of OS-65U. Level I is the standard version. It has named disk files, random or sequential data files (including a FIND command that will search a file for a string up to 32 characters long) and multiterminal capabilities with up to 16 terminals in a distributed processing system.

Level II adds a real-time clock and the ability to support 16 terminals operating under one master program. With Level I the multiple computers in the system can call up programs off disk and put programs on disk, but each one must have its own memory and run its program separately. Level II is a useful addition for such tasks as order entry and checking.

The most elaborate of the three, Level III, can support up to 16 totally independent tasks. Level III requires hardwired memory partitions for each terminal, with from 4K to 48K in

| | |
|---|---|
| **Challenger I** | |
| Superboard II | 4K computer on a board. 8K ROM BASIC, 4K RAM, video output with graphics, expansible to 8K on-board RAM, built-in keyboard. |
| C-IP | Superboard II with case and power supply |
| C-IP MF | C-IP with 16K RAM and minifloppy. |
| **Challenger II** | |
| C2-4P | Similar to IP but on standard OSI 48-pin bus and with 64 × 32 video display. 4K RAM. |
| C2-4P MF | A 20K C2-4P with minifloppy. |
| C2-8P | Identical to C2-4P except with eight expansion slots and separate keyboard. |
| C2-8P DF | A 32K C2-8P with dual 8 inch floppies. |
| C2-S2 | A serial version of the C2-8P. No video board or keyboard. |
| **Challenger III** | |
| C3-S1 | Three processors (6502, 6800, Z-80) with 32K RAM and dual 8 inch floppies, two cases. |
| C3-OEM | As above, with everything in one case. |
| C3-A | 48K, dual floppies, 16-slot backplane, rack. |
| C3-B | As above, with 74 megabyte hard disk. |
| C3-C | C3-A with 24 megabyte hard disk. |

*Standard OSI systems.*

each partition. The maximum configuration, then, would be 16 terminals, each with 48K of dedicated RAM, or a total of 768K in the system. When the system becomes this large the 74 megabyte hard disk is a practical necessity.

There are three OSI word processing packages. All feature line editing, a FIND command, formatted output, right margin justification and other standard features. WP-1 is little more than the OSI assembler/editor package, but WP-2 adds automatic hyphenation, additional printing formats, proportional spacing, named disk files and other operator conveniences. With DMS-WP-2 comes data file access or file merging. This means the user has the ability to construct a letter from previously created files, use a mailing list in a data file to type a series of "personalized" letters automatically, etc.

### Perspective

Vice-President Mike Cheiky says of OSI software: "It is very competitive. Indeed, we probably could safely say it is the best in the microcomputer industry." I would say, rather, the *concept* of OSI software *may* be among the best in the industry. Its implementation across the board hasn't quite earned that distinction. OSI business software, particularly, falls short in input data error checking, operator handholding, etc. But they may be on their way. The OSI dealer network is getting stronger all the time with the number of distributors, dealers and associate dealers approaching 200.

The dealer software group is adding new members all the time, and the group is moving beyond the original software concept in mutual support. Working with factory experts, the dealer group is turning out a series of video tape presentations on OSI equipment operation, software and service techniques. A national service policy is evolving, which should give uniformity to the way dealers handle equipment problems nationwide and speed up service to the customer.

The company is publishing what Cheiky calls "the largest and most informative catalog in the industry." And they are continuously beefing up their hardware and software offerings.

"They're going to be number one in the microcomputing field; I have no doubt about it," dealer Harris says during one of his enthusiastic moments.

But in the end the true test will be how well OSI keeps up with the rapidly changing field with hardware, software, improved dealer relations and incisive marketing practices. ■



✓ Reader Service—see page 179

## KIM™ BUS IS A WINNER!

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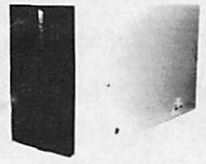

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