BENCHMARK REPORT

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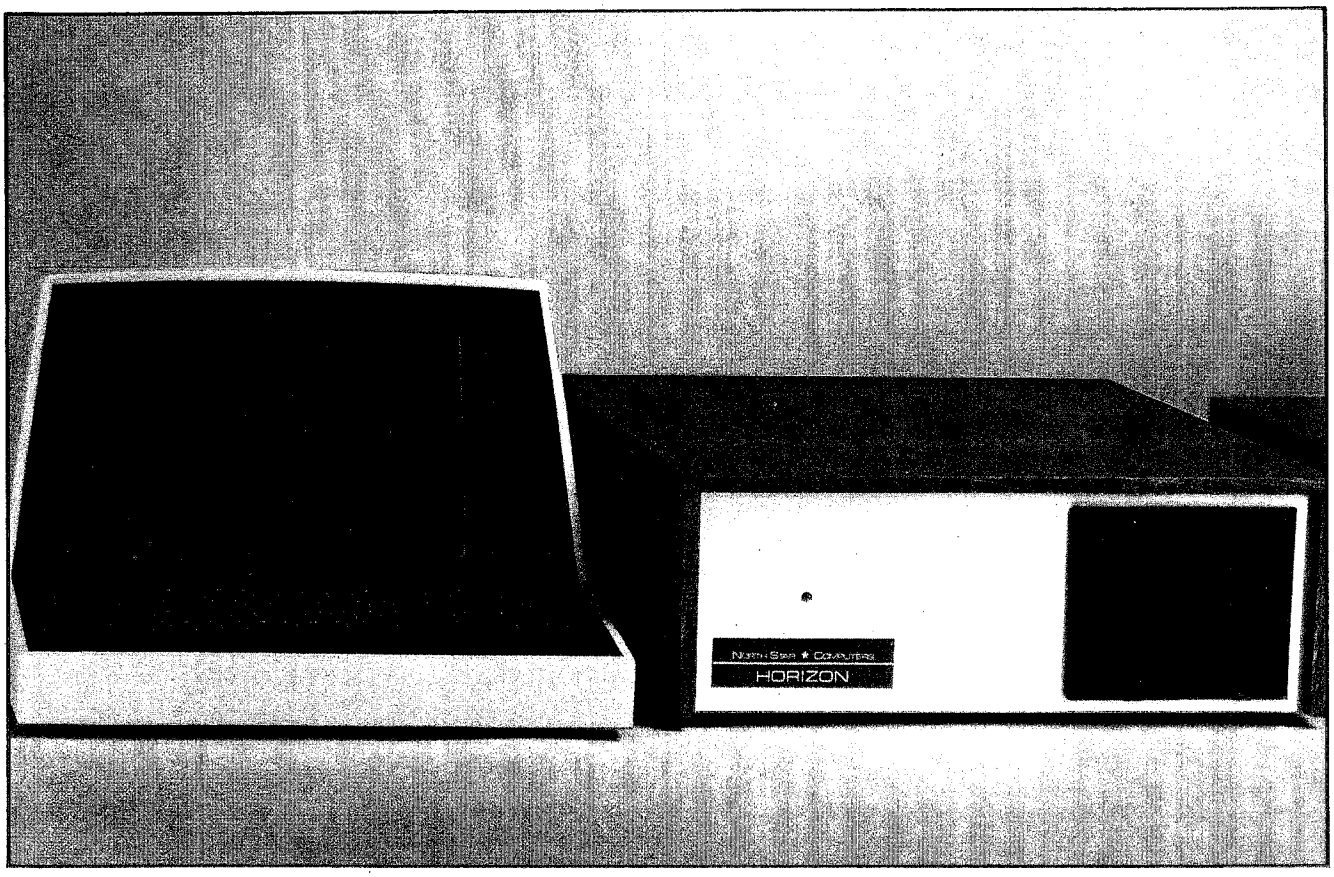

In This Issue:

The NORTH STAR Horizon

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NORTH STAR HORIZON: BENCHMARK REPORT

TABLE OF CONTENTS

	Page
Preface	3
Executive Summary	4
Summary of Benchmark Results	5
Benchmarks:	
The Process: North Star Horizon	6
Overview of Programs and Results	7
Detail Pages	
Pricing Components	13
Hardware Components	14
Software Components	17
Support Services	20
Summary of User Comments	21
Conclusions	23

PREFACE

The North Star Horizon is the third small computer to be evaluated in this series of reports covering computer systems available for under $15,000. The first two reports covered the Texas Instruments 771 and the PERTEC PCC 2000. Our goal in this series is to provide users and prospective users with comparative information on twelve popular small systems, information which can be used in evaluating the many alternatives available in the marketplace.

While many reports are available which compare alternative systems, such reports often contain only technical information supplied by manufacturers--information which is not very useful in determining how well a system will perform in a given application. Additionally, the information given is seldom comparable across different manufacturers.

The best way to compare different systems is to run a set of benchmark programs on each system of interest, programs which represent capabilities needed in an operating environment. Accordingly, the heart of this series of reports is the comparative results of running five such benchmark programs on each of the systems under study. The benchmark programs themselves have been designed to run, without change, on most small computer systems. Thus, differences in performance among systems can be attributed to differences in computing capabilities. The results of these comparisons provide information which is simply unavailable from any other independent source.

In addition to the Benchmark results, these reports contain information on the alternative configurations which can be assembled, internal and external storage and memory capabilities, languages available, the operating system, availability of applications packages, and general comments on the ease of use of the system. Finally, a survey of users is conducted, and their comments on ease of use, relationships with hardware and software suppliers, problems encountered, etc., are included in each report. The experiences of users adds a dimension of reality to the technical details of the system.

The next issue of this series will review the Cromemco Z-2H.

EXECUTIVE SUMMARY

North Star's Horizon is a fast, flexible computer selling for just under $7,000 for the system tested, which included the processor, two floppy disk drives, an Anadex printer, a Soroc terminal, 64 kilobytes of memory, and hardware enhanced floating point arithmetic.

- The performance of the Horizon was excellent, with some of the shortest execution times of the systems tested so far in this Series #1. Its times were better than some of the more expensive computer systems tested in Series #2.

- The floppy disk drives utilized in the benchmark test hold 358 kilobytes of data on each disk. With these larger than usual file sizes, the fast stepping drives, and random access under North Star's BASIC, file oriented business applications should run significantly faster on the Horizon than on comparable alternative systems.

- Because the Horizon is a modular system, a hardware configuration can be uniquely designed for a particular application. The user can choose any standard terminal unit and/or printer to attach to the Horizon. With the S-100 bus system, the user can select from a variety of hardware additions manufactured by North Star and by independent suppliers of S-100 compatible products.

- Because of the flexibility in designing the system configuration, there is a greater burden placed on the user to understand the nature of computing hardware and software. The price for versatility is the time it takes to learn about the Horizon.

- North Star supplies BASIC along with the operating system and PASCAL is available separately. The user can purchase Digital Research's CP/M operating system separately, and can then use FORTRAN and COBOL, as well as other versions of BASIC sold by independent suppliers.

- North Star does not currently supply applications packages, although they are planning to develop some. Users of CP/M will have available a wide variety of applications packages designed to run under this widely used operating system.

The North Star Horizon is being used in a variety of settings from the home hobbiest to computer service bureaus, and a variety of applications from word processing and accounting, to statistical and engineering computations. All of the users we talked to were satisfied with their Horizon, particularly given the price they paid for the computing power received. For those who are willing to take the trouble to understand its special features, the Horizon is a system worth considering.

BENCHMARK REPORT

SYSTEM: NORTH STAR HORIZON

PRICE AS TESTED: $6,911

SPEED TESTS

Benchmark Number		TOTAL TIME * Min.	Sec.
	CPU INTENSIVE		
A-1	N = 500		12.1
A-2	N = 1000		23.7
A-3	N = 2000		46.9
A-4	N = 3000	1	10.1
A-5	N = 500		7.7
A-6	N = 1000		15.0
A-7	N = 2000		29.6
A-8	N = 3000		44.2
	I/O INTENSIVE		
B-1	N = 500		10.1
B-2	N = 1000		15.9
B-3	N = 2000		28.0
B-4	N = 3000		39.9

"REAL LIFE" PROBLEMS

Benchmark Number		TOTAL TIME * Min.	Sec.
C-1	SCIENTIFIC/ENGINEERING	12	1.9
C-1A		4	21.0
C-2	NEW PRODUCT PLANNING		11.7
C-2A		1	6.2
C-3	ACCOUNTS RECEIVABLE	1	57.7
C-3A		3	36.7

EASE OF USE TEST

E-1	NUMBER OF KEYSTROKES REQUIRED	230
E-2	SUBJECTIVE JUDGMENT	Inefficient

THE BENCHMARK PROCESS

All benchmarks were run using North Star Extended BASIC on a North Star Horizon computer configured with 64K (64,000) bytes of memory, two 5-1/4 inch floppy disk units with a total of 716.8 kilobytes of storage capacity, a Soroc CRT terminal, an Anadex printer capable of 112 character per second operation, and hardware enhanced floating point arithmetic. The equipment was shipped to our offices in Boulder, Colorado, where the Horizon computer worked immediately, but the Soroc terminal and Anadex printer would not work. A replacement terminal was provided and, with the help of North Star personnel, the hardware was configured so the printer would operate (this involved a standard wiring change described in the North Star manuals).

Before running the test programs, it was necessary to "personalize" the North Star software system. Because of the many different hardware configurations available on the Horizon (number and type of disk units, memory size, etc.), the operating system provided by North Star must be informed of the particular configuration within which it is running. This process of matching the operating system to the hardware configuration is called "personalization." While this process is more complex on the Horizon than on other systems we have tested, it is a procedure that is required on many small systems, particularly where alternative hardware configurations are available from the manufacturer.

We understand that in most instances the supplier of the Horizon would perform this "personalization" for the user. However, it is clear that purchasers are not buying a "black box" which is simply plugged in and is ready to run (although the supplier can make it look that way when first purchased). Rather, they will be buying a flexible machine that may be adapted to a variety of user needs. In exchange for this versatility, the typical user must invest some time and effort in understanding the nature of the machine itself, as well as the nature of the application.

In entering the programs into the system, some modifications were required to adapt them to North Star's version of BASIC. These modifications were restricted to input/output statements, where syntax varies widely among the different versions of BASIC.

We found the manual for BASIC to be easy to use as a reference guide, and particularly liked the examples of how to use each statement, and the cross-referencing of related statements. For example, the section discussing the DEL (delete line numbers) command also references (1) the section on the SCR (erase memory) command and (2) the section of the manual discussing "Communicating With BASIC." Thus, finding a particular command is easy if you can simply remember some related command or concept.

Additional features of the BASIC system included:

- A line editor that allows the user to make corrections. This editor does not utilize a special editing keypad, but requires the user to memorize instructions which are entered through the standard keyboard.
- The inclusion of an IF . . . THEN . . . ELSE statement allowing limited structured programming.
- Random access to disk files. While this is not a data management system, it does allow the user a great deal of flexibility and speed in accessing data on the disk. The user must keep track of where information is stored relative to the beginning of a file, but the system keeps track of the actual storage location on the disk.
- The ability to link several BASIC programs together through the process of chaining. Thus, a program that is too large for memory can be broken into several smaller programs which are automatically executed in sequence.

These features are not unique to the North Star Horizon since the other systems evaluated have also performed these same functions (and some were even better implemented than they were on the Horizon), but they were nice to see.

All programs were run with output to the CRT screen. To run with output to the printer, a simple change was made in the program. Thus, no global change facility exists in the operating system to redirect output. The programs were entered and stored on disk. To execute, the programs were loaded into memory, the RUN statement typed in, and the stopwatch started when the carriage return was entered. Timing was stopped when the output was complete.

In addition to running the programs in BASIC, North Star personnel accepted our offer to write the programs in PASCAL, another language which they support, and we also timed these versions. It should be noted that PASCAL is a compiled language (as opposed to the interpretive BASIC).

OVERVIEW OF PROGRAMS

The benchmark program set consisted of:

Speed Tests

- A CPU-intensive job of varying parameters
- An I/O-intensive job of varying parameters

"Real Life" Problems

- A scientific/engineering job
- A new product planning problem
- An accounts receivable generation, update and report

Ease of Use Test

- A script-based editing test

SPEED TESTS: CPU-Intensive and I/O-Intensive Jobs

Both the CPU-Intensive and the I/O-Intensive benchmarks were designed to test the speed of specific computing tasks that used repeated, short, individual operations.

A - 1	Results:	N = 500		12.1 seconds
A - 2		N = 1000		23.7 seconds
A - 3		N = 2000		46.9 seconds
A - 4		N = 3000	1 minute	10.1 seconds

Comment: *With the program rewritten in PASCAL (instead of BASIC) by North Star personnel, the results varied considerably: A-1, 16.3 seconds; A-2, 32.2 seconds; A-3, 1 minute 4.2 seconds; and A-4, 1 minute 36.0 seconds.*

Variation: CPU-Intensive Alternate Runs (A5-A8)

This program performs the same number of calculations as the standard CPU-Intensive run but without exponentiation and square root.

A - 5	Results:	N = 500	7.7 seconds
A - 6		N = 1000	15.0 seconds
A - 7		N = 2000	29.6 seconds
A - 8		N = 3000	44.2 seconds

Comment: Again, the results were considerably different in PASCAL: A-5, 4.1 seconds; A-6, 8.1 seconds; A-7, 16.0 seconds; A-8, 23.8 seconds.

I/O-INTENSIVE JOB

This run stores numbers from 1 to N on disks and retrieves the first 50 of them in a factorial fashion (for example, a total of 1275 reads following 3000 writes). Several combinations were run with "N" values of 500, 1000, 2000 and 3000.

B - 1	Results:	N = 500	10.1 seconds
B - 2		N = 1000	15.9 seconds
B - 3		N = 2000	28.0 seconds
B - 4		N = 3000	39.9 seconds

Comment: PASCAL results: B-1, 18.2 seconds; B-2, 20.6 seconds; B-3, 25.6 seconds; B-4, 30.3 seconds.

"REAL LIFE" PROBLEMS: Scientific/Engineering, New Product Planning, Accounts Receivable Generation

The next three benchmarks were designed to test the running time of actual programs that the user might want the computer to perform.

SCIENTIFIC/ENGINEERING

This program solves a system of linear equations, using the Gauss-Jordan method of elimination. The program sets up the following system of "N" equations with "N" unknowns:

$$0.1x_1 + 0.1x_2 + 0.1x_3 + \ldots + 0.1x_N = 0.2$$

$$0.1x_1 + 0.3x_2 + 0.3x_3 + \ldots + 0.3x_N = 0.4$$

$$0.1x_1 + 0.3x_2 + 0.5x_3 + \ldots + 0.5x_N = 0.6$$

$$\vdots \qquad \vdots \qquad \vdots \qquad \vdots \qquad \vdots$$

$$0.1x_1 + 0.3x_2 + 0.5x_3 + \ldots + 9.9x_N = 10.0$$

To show that the run has been executed successfully, the values of x_1, x_2, and x_N are printed at the end of the execution.

C - 1	Results:	12 minutes 1.9 seconds

Comment: In this case the program written in PASCAL by North Star personnel offered a dramatic improvement: C-1, 3 minutes 10.5 seconds.

Variation: C-1 Alternate Run (C-1A)

This program performs the C-1 run with a smaller number of equations and unknowns (35 equations/unknown as compared to 50 in the larger run).

C - 1A	Results:	4 minutes 21.0 seconds

Comment: PASCAL program--C-1A, 1 minute 8.0 seconds.

NEW PRODUCT PLANNING PROBLEM

This program models the relationship between product production costs and profitability over the range of the next four years. A base line run is established and several parameters are varied in a "what-if" mode on subsequent runs. Program output is printed in a standard report format of report line items across column years. The model's display line items are:

- Units Sold
- Selling Price
- Revenue
- Raw Material
- Direct Labor
- Packaging
- Distribution
- Gross Profits
- Fixed Costs
- Net Before Taxes
- Taxes Payable
- Net Income

C - 2	Results:	11.7 seconds

Comment: PASCAL program--C-2, 15.1 seconds.

Variation: C-2 Using Printer (C-2A)

This run reports the timing for the New Product Problem when results are routed to the printer for hard copy output.

C - 2A	Results:	1 minute 6.2 seconds

Comment: PASCAL program--C-2A, 1 minute 1.9 seconds.

ACCOUNTS RECEIVABLE GENERATION

In this job, an accounts receivable file of 50 records is created. Each record has 10 fields: customer number, salesman number, year-to-date sales, prior month sales (five fields), payments and credit limit. The file is updated randomly 10 times by customer number for sales amounts and payments. A report is displayed with billing detail, including company, salesman, year-to-date sales, credit limit, amount outstanding and sales by month.

C - 3	Results:	1 minute 57.7 seconds

Comment: Again, a dramatic improvement using PASCAL--C-3, 1 minute 2.6 seconds.

Variation: C-3 Using Printer (C-3A)

This run reports the timing for the accounts receivable problem when results are routed to the printer for hard copy output.

C - 3A	Results:	3 minutes 36.7 seconds

Comment: PASCAL program--C-3A, 2 minutes 35.2 seconds.

EASE OF USE TEST

The Ease of Use test is a script-based benchmark specifically designed to compare all editors with respect to ease of use. This comparison is accomplished by starting with a 9-line file, changing it to an interim form (in effect, editing in all the errors) and then changing the file back to its initial form. These changes test the editing capabilities when making the errors as well as when correcting them.

The editing tasks are:

- Line deletion
- Line insertion
- Line appendage
- Change/Addition/Deletion of unique words in a line/string
- Change/Addition/Deletion of non-unique words in a line/string
- Change/Addition/Deletion of unique characters (including spaces embedded in and not embedded in words) in a line/string
- Change/Addition/Deletion of non-unique characters (including spaces) in a line/string

E - 1	Results:	Approximately 230 keystrokes were required to edit a nine record test file according to the script.

Comment: We initially found the editor to be difficult to use since the commands used two keys simultaneously pressed (i.e., to display a line, it was necessary to press the CONTROL and letter G keys). However, after a short period of use, the commands became committed to memory and the editor was easy to use.

NORTH STAR HORIZON: PRICING COMPONENTS

COSTS

North Star Horizon (as tested) ..... $ 6,911

Includes:
- 64K (64,000) bytes of central memory
- Floating point arithmetic board
- Dual disk drives, double density, double sided (quad capacity)
- Anadex printer
- Soroc-120 CRT terminal with keyboard
- Disk operating system, BASIC interpreter

Components

Processor, 64K of memory, two quad density disk drives	$ 4,330
Processor, 32K of memory, two quad density disk drives	3,595
Processor, 64K of memory, two double density disk drives	3,830
Processor, 32K of memory, two double density disk drives	3,095
Printers	
Anadex	995
NEC-5510-2	2,915
Terminals	
Soroc-120	995
Disk Drives	
Quad density expansion drive, cabinet, and power supply	824
Double density expansion drive, cabinet and power supply	599
Expansion Boards	
Hardware floating point board	399
Expansion memory, 32 Kilobytes	739

OUR OBSERVATIONS

With a variety of options available, the Horizon offers a system which can be configured for the specific needs of the user. Additionally, it is based on the S-100 bus, and many options are offered by independent manufacturers. The Horizon is sold primarily through local computer stores who provide hardware and software services.

USER COMMENTS

- *The Horizon was in the right price range.*
- *The system is readily expandable, and I like the flexibility.*
- *North Star people are moving in the right direction.*

NORTH STAR HORIZON: HARDWARE COMPONENTS

CENTRAL UNIT .... the North Star Horizon is a small unit containing the central processor, memory and disk drives, with space for adding circuit boards, up to a total of twelve. It is based on the Z80A microprocessor and an S-100 bus.

CPU Memory: 64K bytes (expandable to 512K bytes) with only 56K available to the user.

Terminal: While any standard CRT or printing terminal can be used with the Horizon, North Star supplied us with their standard Soroc-120 terminal

OUR OBSERVATIONS

The Z80A is capable of running faster than many of the other microprocessors, and this capability is one of the factors which makes the Horizon's run times faster than the average.

Additionally, the S-100 bus (the internal communications structure of the computer) makes available a wide range of S-100 compatible products manufactured by other suppliers of computing equipment. These include such items as real time clocks, digital to analog converters, expansion parts, memory, and a host of other products.

USER COMMENTS

- *It was delivered and set up without any trouble.*
- *I've expanded from 32 to 48K memory.*
- *For most applications the speed is sufficient.*
- *The floating point board increases speed considerably.*

NORTH STAR HORIZON: HARDWARE COMPONENTS

STORAGE

The Horizon uses two 5-1/4 inch double-sided double-density (quad capacity) floppy disk drives. Each drive stores up to 358 kilobytes of data. An additional two drives may be added in an external cabinet, for a total of 1.4 megabytes of disk storage.

OUR OBSERVATIONS

The quad capacity disks provide plenty of storage for the average user. Additionally, these drives have a "fast stepping" capability so the time to access a disk file is reduced and average data transfer speed is increased.

Additionally, North Star has announced the availability of an 18 megabyte hard disk system based on the Winchester Technology. This greatly expands the storage capacity of the system and, for input/output oriented programs, will increase the speed at which programs operate since access time on a hard disk is reported to be up to three times faster than on floppy disks.

USER COMMENTS

- *I'm only storing 25 documents per disk, so the storage is adequate.*
- *I'm adding a hard disk to increase storage space.*

NORTH STAR HORIZON: HARDWARE COMPONENTS

OTHER DEVICES

Soroc 120 Terminal	Single compact unit with attached keyboard Standard typewriter layout Separate numeric keypad Special keys to control cursor movement 12 inch diagonal screen 24 lines, 80 characters per line Upper and lower case White letters on black screen Holding down on key causes a repeat of the character at a 15 character per second rate
Anadex Printer	80 characters per line Adjustable paper width up to 8 inches wide Bi-directional printing Dot matrix print head 112 characters per second Adjustable form length and skip over perforations

OUR OBSERVATIONS

The terminal was easy to use, and the standard keyboard layout presented no problems. The numeric keypad is useful for entering data.

The Anadex printer is inexpensive, and adequate for many applications. But it is noisy. While print quality is good, letters on succeeding rows do not always line up because the head is moving in different directions. To remove the last page printed, one additional page is lost. In serial numbered form applications, this could be an inconvenience. While these comments on the printer may seem overly negative, it is nonetheless a reliable printer at an excellent price. The user should carefully review the application; for general occasional use, the Anadex printer appears to be an excellent buy.

Many users surveyed had word processing applications, and they chose more expensive printers which produce a higher quality output.

USER COMMENTS

- *I wish I could tear off the printout without advancing one more page.*
- *I like the cursor control keys.*
- *The ten key pad only has a minus sign and it should have plus, divide, and times.*
- *There is a glare problem on the CRT.*
- *The visibility is great.*
- *From a user of another printer--a dot matrix is faster but I needed better quality.*

NORTH STAR HORIZON: SOFTWARE COMPONENTS

OPERATING SYSTEM, LANGUAGES, UTILITIES

Operating System:	North Star DOS (Disk Operating System)
Languages:	BASIC, PASCAL
Access Methods:	Within BASIC, either sequential or random access is available
Utilities:	The DOS contains the standard file manipulation capabilities, including creating and deleting files, loading programs, directory listing, and reading and writing files. A MONITOR is included which allows the user to access, display and change memory locations, text memory, etc.

OUR OBSERVATIONS

The North Star Horizon comes with DOS, BASIC, and the monitor. PASCAL must be purchased separately.

North Star has developed two versions of BASIC, one for the standard hardware configuration and one, FPBASIC, for users with the floating point board. The floating point board is designed to perform certain mathematical calculations using hardware rather than software, and this greatly speeds up the Horizon's operation. For normal file manipulation and simple calculations, the floating point board's power remains unused. However, for complex calculations, the board can increase the speed of calculation. The CPU intensive test at N = 2000 which took only 47 seconds with the floating point board took 3 minutes and 59 seconds using the standard BASIC, a factor of five difference in run times. However, for the IO intensive run at N = 2000, the times were nearly the same (28 versus 28.6 seconds).

Our only complaint with the North Star BASIC is that the user must predetermine and specify the size of any files created during a program run. The file management capability of the system is limited and it does not perform dynamic allocation of files. If you try to write a larger file than specified, the program will abort, and recovery is difficult.

USER COMMENTS

- *As an inexperienced programmer, it took quite a while to learn the system.*
- *The referencing could be better. I know it's there but I can't find it. Information is not arranged in a logical order.*
- *The documentation is great.*

NORTH STAR HORIZON: SOFTWARE COMPONENTS

NORTH STAR SUPPLIED PACKAGES

North Star does not currently supply applications packages, although they say those being developed include:

Word Processor
Mail List Manager
Data Base Manager
General Ledger
Accounts Receivable
Accounts Payable

OUR OBSERVATIONS

Applications were generally programmed in-house by those interviewed in the survey of users. When purchased packages were used, they were obtained from a local OEM.

While not supported by North Star, the CP/M operating system is available for the Horizon. This opens up the possibility of using any of a wide range of applications packages which have been developed for use under CP/M. Additionally, an extended version of BASIC and FORTRAN are available under CP/M.

USER COMMENTS

- *We had software problems from in-house programming.*
- *The local company I deal with is very good. I hired them to do program modifications.*

NORTH STAR HORIZON: SOFTWARE COMPONENTS

EDITOR

Under BASIC, the editor is line oriented with no global change capabilities. Editing is initiated by using the command "EDIT (line number)" and a series of commands is used to move the cursor, display the line, insert and delete characters and strings, etc.

OUR OBSERVATIONS

With the integrated systems produced by some manufacturers, special editing keys are easily added to a keyboard which can simplify editing. Because the Horizon will operate using any standard terminal, editing functions must be generalized. In Horizon's case, the user must memorize the editing functions. For example, simultaneously pressing "CONTROL" and "G" keys causes the edited line to be displayed. Pressing "CONTROL" and "I" keys starts the insert mode. We taped a small card to the terminal to remind us of all the combinations. However, after an hour or so of entering programs, we had committed these to memory and seldom had to refer to the card.

USER COMMENTS

- *It's really good. I can do editing quickly.*
- *It's great, even though I didn't like it at first because I found it tedious.*
- *The hard part is using two keys for control functions.*

NORTH STAR HORIZON: SUPPORT SERVICES

DOCUMENTATION

A single manual is provided which covers the operating system (DOS), the monitor, and BASIC. PASCAL is covered in a separate manual.

Technical manuals were also provided on the main Horizon computer and on the component assemblies.

MAINTENANCE

Maintenance is provided through the supplier of the Horizon, either the retail dealer or the OEM.

TRAINING

Dealers and OEM's provide the required training in the use of equipment and applications packages. The dealers have been trained by North Star's Training program.

OUR OBSERVATIONS

The documentation can be overwhelming, particularly since the purchaser of a complete system will receive the same documentation as a kit builder. It was difficult to sort out what was relevant from what was irrelevant in getting the system running.

The only manual which should be needed is the System Software Manual which covers the disk operating system, the monitor, and BASIC. It was necessary to read through the manual prior to starting the "personalization" process. However, the various options for "personalizing" were scattered throughout the manual and it was difficult to know where to begin and where to stop. In fact, one change, the specification of quad capacity fast stepping disk drives, appeared on a separate sheet and was not discovered until very late in the benchmark process. We would have appreciated a simple check list that covered the steps and possible options.

USER COMMENTS

- *It took quite a while to "personalize" the system myself.*
- *When I have a problem, the shop I purchased from will have it fixed in four hours.*
- *If I absolutely can't fix it myself, I'll call my dealer.*
- *I didn't take training. I have all the manuals and I'm learning as I go.*

SUMMARY OF USER COMMENTS

Using names supplied by North Star and the Association of Computer Users, we contacted thirteen users of the North Star Horizon and conducted a lengthy telephone interview with each one. The applications ranged from home/hobby use, through business application, to university education/research applications. Most users seemed to have some technical orientation and background in computers.

It is difficult to give a standard configuration since there are such a wide range of possibilities with the Horizon. Five of the users had 32K systems, while six had 64K systems. All were using double density disk drives (generally two such drives). Only one was using the Anadex printer, four were using the NEC Spinwriter, and others ranged from a Texas Instruments 810 to an IBM Selectric. Seven were using the SOROC terminal, while others were using the Lear-Seigler ADM3A, Intertube, and others. Additional features being utilized included floating point boards, video generator, voice generator, music board, and graphics generator.

Nine of the users did programming in-house using North Star DOS (ten users) and/or CP/M (five users). Eleven programmed in BASIC, four in PASCAL, one in FORTRAN, and four in machine ASSEMBLY language.

Three schools included in the survey used the Horizon for class projects with anywhere from 12 to 40 students having access to the equipment. One also used it for preparing dittos and maintaining grade lists. The two high schools used the Horizon five hours per day, while the university used it up to 20 hours per day.

One of the users was a computer service company, and their applications included financial reporting, accounting, word processing, mailing list maintenance, investment counseling, and property management. Another user was an individual who used it at home rather than in a money making capacity.

Of the remaining eight firms in the survey, four use the Horizon for accounting, five for word processing, and two with statistical/engineering applications.

Users reported a variety of problems with the Horizon. Three indicated disk problems (two said the disks pop out and one indicated a read/write problem), three said there were bad integrated circuit chips when they first purchased the system, and one had a problem with the Anadex. Two individuals indicated that the North Star Software had some bugs, and one had problems interfacing the Horizon with his non-standard terminal.

For hardware service, six of the users repair the equipment themselves, and six utilized the shop where they purchased the Horizon. Only one individual was dissatisfied with the service, and others were quite happy. Ten of the users serviced their own software, and the other three were satisfied with the OEM service. Only four of the users had been offered any sort of service/support/ maintenance contract, and none took advantage of the offer.

In most cases, users had not used other computing equipment in their business prior to purchase of the Horizon, although only five users were inexperienced in the use of computers. Only one firm uses another computer in addition to the Horizon. In most cases they were not going to upgrade the Horizon, although one was going to add an additional disk, one more memory, and one a graphics board.

Prior to purchasing the Horizon, users had considered Olivetti, Xerox, IBM, Radio Shack, APPLE, Texas Instruments, Ohio Scientific, Dyna-Byte, and Vector Graphics as alternatives. The two key reasons given for ultimately choosing the Horizon were best price and versatility. In general, users had few problems in installation and start-up of the system.

Users said they were generally satisfied with the speed, memory size and disk capacity. They were unhappy with the documentation, but that is an area that is difficult to satisfy since it must be designed to please the novice as well as the technical expert. Our impression is that the system (DOS) documentation could be improved, but the BASIC documentation is better than average.

CONCLUSIONS

North Star Computers, originally a manufacturer of disk subsystems for other computer companies, entered the computer system market with the Horizon, a low cost Z80A microprocessor based system with an S-100 bus. We found it to be a reliable and versatile system which allows the user to "package" a computing configuration for a specific application.

The Horizon is being used in a wide variety of places--the home, the office, the school. Applications vary from simple text processing to complex mathematical calculations. The users, generally technically oriented, were satisfied with the performance of the Horizon. Their reason for choosing the Horizon over other alternatives was its low cost and its versatility.

The BASIC used for the Benchmark testing was adequate. The only major fault was the file management system. It is not very powerful and the user has to compute the size of a file and specifically allocate enough disk storage units when creating the file. Most other systems utilize dynamic file management where the system automatically allocates additional storage as needed.

The documentation was more than adequate in volume, but was sometimes difficult to follow. It is necessary for the user to "personalize" the operating system for the particular hardware configuration they are using, and the various options seem scattered throughout the manual. The portion of the manual covering BASIC was well written, with examples and good cross referencing to related statements. The hardware documentation is complete and valuable for those wishing to maintain the system themselves.

On the plus side, the North Star Horizon's benchmark performance was excellent, turning in better times than many of the more expensive computers evaluated to date. This fast speed plus versatility make the Horizon a system which should be considered by small business users, scientists and hobbiests. It has been built to satisfy a wide range of users and applications.

BENCHMARK REPORT

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