QUANTUM

ART GEFFON

QUANTUM

Third Edition, April 1984

This book is intended as a reference guide on Quantum Corporation and the Winchester disk drive market. For further information, contact Joseph T. Rodgers, Jr., Vice President, Finance and Treasurer, or Shirley Ann Stough, Manager, Corporate Communications.

QUANTUM CORPORATION
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QUANTUM HISTORY

- Founded February 1980
- 6 founders with over 50 years of combined experience in peripherals industry
  - — Shugart
  - — IBM
  - — Memorex
- $3.0 million of first round venture capital financing obtained in June 1980
  - — Kleiner, Perkins, Caufield, Byers
  - — Merrill, Pickard, Anderson & Eyre
  - — Sutter Hill Ventures
  - — Mayfield Fund III
  - — Continental Illinois Venture Corporation
- Public offering in December of 1982 raised $32 million
  - — Morgan Stanley & Co.
  - — Robertson, Colman, Stephens and Woodman

QUANTUM CORPORATION

BACKGROUND

Quantum Corporation, founded in February 1980, designs, manufactures and markets rigid disk drives based on Winchester technology which are sold exclusively to OEMs for use in small business computers, word processors and intelligent terminals. Quantum is the leading independent manufacturer of 8-inch rigid disk drives for the OEM market. The Company currently offers a product line of 8-inch rigid disk drives with capacities of up to 85 megabytes. Quantum announced a line of 5 1/4-inch rigid disk drives with capacities ranging from 20 to 40 megabytes in November, 1982.

Market Overview

Disk drives are used in computer systems to store and retrieve digital information. Most computer applications require access to a greater volume of information than can economically be stored in the computer's central processing unit. This additional data storage is provided by auxiliary memory systems utilizing reels of magnetic tape or disk drives. Disk drives have a significant advantage over less costly magnetic tape storage in applications where rapid access to data is important.

The development and expanded use of more powerful microprocessors has created the need for larger capacity, higher performance auxiliary storage systems. The application of Winchester technology to rigid disk drives has enabled system manufacturers to address this need by incorporating the capacity, speed and reliability of rigid disks into floppy-based microcomputer systems. Winchester technology uses low-mass heads and lubricated disks in an environment sealed against outside contamination.

In disk drives, read/write heads magnetically record data upon, and retrieve stored data from, selected locations on a disk as the disk rotates within the disk drive. Disk drives may utilize either rigid or flexible ("floppy") disk media. The magnetic heads are positioned over the appropriate track of information on the disk media by an actuator and associated electronics. Several types of actuators are used in disk drives including stepper motors and various moving coil motors. The technology used in actuator electronics includes open loop, where the magnetic heads are positioned over the appropriate track independent of any information on the disk, and closed loop, where recorded information on the disk is used to improve the accuracy of the magnetic head position.

Disk drives employing rigid media generally provide greater storage capacity, faster access time and higher reliability than floppy disk drives. Moving coil actuators typically provide faster access time than stepper motor actuators, and closed loop actuator electronics generally provide greater capacity than open loop actuator electronics. Floppy disk media, stepper motor actuators and open loop actuator electronics tend to be less expensive than the alternative methods and have been predominantly used in small, low cost microcomputer systems.

Computer systems manufacturers select rigid disk drives primarily on the parameters of capacity, access time, reliability and price. At the low end of the market, consisting of the lowest cost single user desktop or portable computer systems, price per drive is the dominant factor. In these systems, floppy disks and/or stepper motor 5 1/4-inch rigid disk drives are typically used. For medium performance systems, including multi-user systems, the importance of capacity and access time increases. Selection of a particular rigid disk drive is generally based on the cost per megabyte of storage. These systems will typically use high capacity moving coil 5 1/4-inch products or low cost 8-inch products. The Company's current products are primarily designed to address this market. For high performance systems, particularly larger multi-user systems, increased capacity and faster access time are critical factors. These systems will generally use 8-inch or 14-inch Winchester disk drives with moving coil closed loop actuators. Quantum's 8-inch 85 megabyte drive also competes in this market.

Data storage capacity is generally measured in terms of megabytes. A "megabyte" is 1,000,000 bytes and a byte is 8 units or "bits" of information grouped together as adjacent binary digits that a computer processes as a single unit.

Product

Quantum offers a product line of 8-inch rigid disk drives called the Q2000 Series®. The Q2000 is a relatively low cost product which may be readily integrated into microcomputer systems requiring greater capacity and faster access time than provided by floppy disk drives or lower capacity 8-inch rigid disk drives. The Q2000 has one to four magnetic disks, two to eight read/write heads, 10 to 40 megabytes of total recordable storage capacity and average access times ranging from 55 milliseconds to 65 milliseconds. The Q2000 has the same physical dimensions, uses the same physical mounting configuration and electrical connectors and requires the same electrical power as industry standard 8-inch floppy disk drives. The electronic interface to the Q2000 is generally compatible with industry standard 8-inch floppy drives.

The Q2000 product line incorporates several innovative design features. The Company has designed a rotary moving coil actuator which permits rapid access to data stored on the disk and relatively low cost manufacturing. The actuator control electronics employ an optical encoder and a closed loop temperature compensation servo technique which assure the accurate positioning of the magnetic heads over the appropriate data tracks on the disk. The combination of Quantum's actuator and control electronics generally provides greater storage capacity per disk and faster access time than competing rigid disk drives using stepper motor actuators and open loop actuator electronics. These technologies provide substantial cost advantages over competing products that have comparable storage capacity but which rely upon other types of moving coil actuators and closed loop control electronics. Quantum has shipped over 65,000 Q2000 disk drives since April, 1981.

To address the expanding market for 8-inch rigid disk drives offering increased data storage capacity and faster access times, the Company has announced a new 8-inch rigid disk drive with a capacity of 85 megabytes, called the Q2080™. Evaluation units were shipped in December 1982 and production shipments commenced

in February 1982. Quantum's 85 megabyte 8-inch rigid disk drive uses four disks and eight magnetic heads. The interface, physical dimensions and electrical connectors of the Q2080 are compatible with the Q2000. The Company has developed an enhanced head positioning system which doubles the storage capacity of the Q2000 product line using the same number of disks and which improves the average access time to 40 milliseconds. The Q2080 provides a cost effective method for OEM customers to upgrade their system products with higher capacity, higher performance disk storage.

Quantum's Q500 Series® of 5 1/4-inch rigid disk drives to address the desktop and portable business computer markets was announced in November, 1982. This product line uses the same actuator and actuator control electronics technology as the Q2000 products with capacities ranging from 20 to 40 megabytes. The physical dimensions, electrical connectors, power requirements and interface are generally compatible with current industry standard 5 1/4-inch rigid disk drives and 5 1/4-inch floppy disk drives. The Q500 5 1/4-inch rigid disk drives are designed to provide greater storage capacity, faster access time and higher reliability than floppy disk drives and are less expensive and significantly more compact than 8-inch rigid disk drives, and are particularly important in multi-user desktop small business computer and word processor applications. Quantum began shipping evaluation units in March 1983 and began volume production and shipment in June.

In February, 1984, Quantum announced the formation of a subsidiary, QEW Corporation, to design, manufacture and market low-cost mass storage subsystems for the personal computer market. The subsidiary will market the products through the retail distribution channel.

Manufacturing

Quantum attributes its success in addressing the OEM market to its ability to quickly achieve high volume production of reliable, cost effective products. The Company's rapid transition from product development to volume production reflects its integrated approach to engineering and manufacturing. This approach involves the development of manufacturing processes concurrently with product design and the application of proven technologies utilizing readily available components. Quantum has developed manufacturing techniques, customized tools, and test equipment which reduce the labor and number of components required to manufacture its products.

The Company's products are manufactured under controlled environmental conditions using various components manufactured by outside vendors to the Company's specifications. The Company's rigid disk drives are manufactured as standard products and are generally not made to the customer's specifications. Subassemblies used in the products are assembled, tested and quality checked prior to introduction to the final assembly line. Printed circuit boards are burned in and functionally tested with proprietary test equipment before final assembly of the disk drive. The final product is burned in at elevated temperatures after final assembly and is then tested to assure conformance to specification.

The manufacture of Winchester disk drives requires a contamination free environment. To address this requirement, Quantum uses clean air tunnels in the final assembly process, as opposed to clean room facilities which are employed by most of the Company's competitors. The use of clean air tunnels provides greater protection against contamination and allows expansion of manufacturing capacity more rapidly with lower capital expenditures.

Most of the components used in Quantum's products are available from more than one supplier. For long lead-time items, such as semiconductors, Quantum contracts directly with the manufacturers in order to assure component requirements are met.

In June of 1983, Quantum entered into an agreement with the government of Puerto Rico to establish an offshore manufacturing operation in the city of Ponce. Production is being set up in an existing 25,000 square foot facility and construction has begun on an adjacent 25,000 square foot building.

Quantum Caribe Incorporated will be chartered to manufacture the Company's mature products. Q2000 production and shipments from Puerto Rico began in December of 1983 and will be in full production of the Q2000 by June, 1984. The establishment of Quantum Caribe Incorporated will provide the company with additional low cost manufacturing capacity and attractive tax advantages.

Quality

Since rigid disk drives are internally incorporated into computer systems, product quality and reliability is essential in OEM decisions to purchase volumes of product from a drive manufacturer. Quantum practices stringent quality assurance methods at every phase of production, as well as for components purchased from outside vendors. Products are designed using proven, mature technologies to assure inherent quality.

During the design phase and throughout the product life cycle, Quantum engages in a series of tests (Design Verification Testing, Design Maturity Testing, Process Maturity Testing and Ongoing Reliability Testing) to identify and correct potential reliability problems in the products. Control and measurement techniques are performed by manufacturing employees to pinpoint decreases in quality levels as they occur in the process.

Quantum uses basic statistical methods of control charting to track daily yields on major assemblies and components. This statistical charting allows management to spot trends in quality levels and modify or correct the process as necessary. The Company is initiating programs with major vendors to conform to the same statistical control methods, thereby further guaranteeing the quality of incoming parts.

Marketing

The Company sells its products exclusively to OEMs. As of March 1, 1984, the Company had delivered approximately 75,000 disk drives to approximately 200 customers. Quantum's largest customers are Altos Computer Systems, Wang Laboratories Inc., Data System Design Inc., Xerox Office Products Division, Convergent Technologies Inc., Nixdorf Computer Corporation, Industrial Micro Systems Inc. and TeleVideo. The Company's OEM customers typically enter into 12 to 24 month agreements providing for volume discounts if certain purchase levels are met. Product deliveries are scheduled upon the Company's receipt of purchase order releases under the agreement. The agreements permit the customer to designate specific quantities of drives of various capacities offered by the Company, provided the minimum unit quantities are satisfied.

Quantum's products are sold domestically through its own sales force and through Arrow Electronics, Inc., which generally handle those customers having annual requirements of less than 250 disk drives. Export sales are made to OEMs in Europe through direct sales personnel as well as independent distributors and in other countries through independent distributors. In January 1984, Quantum opened a sales and service facility in Frankfurt, West Germany.

Warranty and Service

Quantum warrants its products against defects in design, materials and workmanship generally for one year from the date of shipment by the Company. The Company maintains in-house facilities for refurbishment or repair of its products in Milpitas, California, Salem, New Hampshire and Frankfurt, Germany. Quantum also provides parts, training and equipment to a distributor located in London, England which is authorized to provide repair services to the Company's European customers.

Competition

The Company's 8-inch rigid disk drives compete with 8-inch and 5 1/4-inch rigid disk drives of several other manufacturers and, to a lesser extent, with 14-inch rigid disk drives as well as with floppy disk drives. Competition is based primarily upon product availabity, reliability, performance and price.

The Company believes that its product architecture results in cost and manufacturing advantages relative to higher performance, more expensive closed loop moving coil products, as well as capacity and performance advantages relative to stepper motor products. Quantum's Q2000 competes favorably with similar 8-inch products sold by other manufacturers, some of which have substantially greater financial, marketing and technological resources. Quantum's products compete principally on the basis of the Company's ability to provide cost effective, reliable disk drives in very high volumes to satisfy customer demand. For capacities of 20 megabytes and greater, the Company is currently the leading independent supplier of 8-inch rigid disk drives to the OEM market.

The Company's 5 1/4-inch rigid disk drives have been designed to meet the compatibility, price, and performance requirements of small desktop business computers, many of which to date have relied primarily on lower capacity, lower performance 5 1/4-inch and 8-inch rigid disk drives and floppy disk drives. There is intense competition in the 5 1/4-inch market based upon the same factors as in the 8-inch market, although price may be a more significant factor. In this market, competition comes from an increasing number of firms, including several established firms. Some of these firms, including Seagate Technology and Tandon Corporation, have entered the lower capacity, lower performance segment of the 5 1/4-inch rigid disk drive market. In addition, these and other companies, such as Atasi and CMI, also introduced 5 1/4-inch products, offering capacities and performance characteristics similar to those offered by Quantum.

In general, Quantum expects increased competition in the 8-inch and 5 1/4-inch markets in all capacity ranges. The Company also anticipates significant competition in the future from smaller start-up companies whose products may be based on new technologies and innovative designs. Such technological advances could result in the

introduction of competitive products with superior performance or substantially lower prices, but the ability to produce in volume with consistent quality and reliability are major factors in the financial success and growth of these start-ups.

Product Development

The Company operates in an industry which is subject to rapid technological change, and its ability to compete and operate successfully depends on, among other things, its ability to anticipate and react to such change. Accordingly, the Company is committed to the development of new products and the continuing evaluation of new technologies. In addition, production volumes for present as well as new products require a continuing investment of engineering resources to develop tooling, production processes and test equipment.

Patents and Licenses

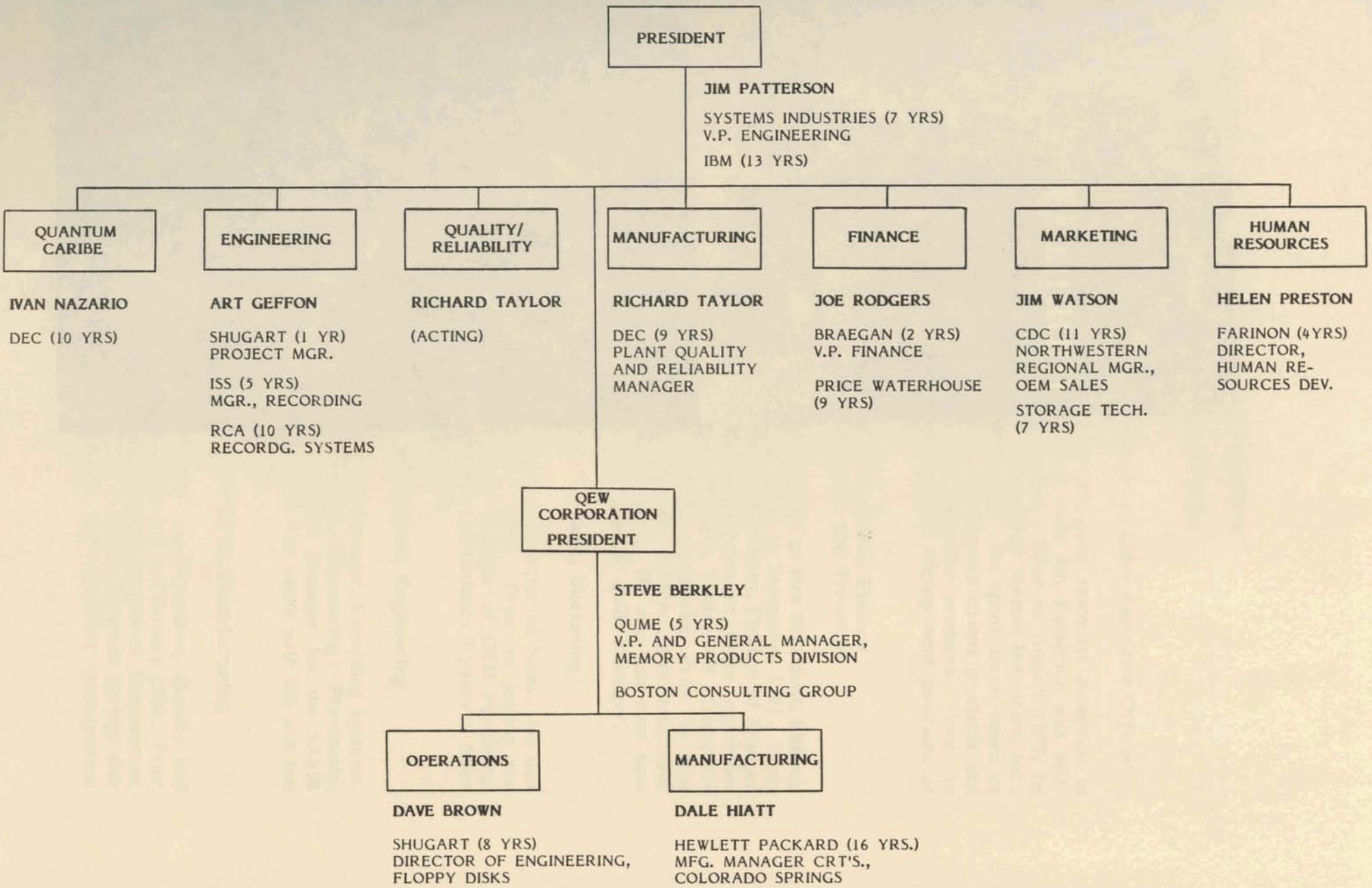
The Company has been granted U.S. patent number 4,396,959 covering its wedge-servo architecture for head-to-track positioning, and has a number of pending United States and foreign patent applications relating to certain of its products. Although the Company believes that these patent applications may have value, the rapidly changing technology in the computer industry makes Quantum's future success dependent primarily upon the technical competence and creative skills of its personnel rather than on its patents.

The Company has granted Nixdorf Computer Corporation, an OEM customer of the Company, a license to manufacture and use in its own systems the Company's Q2000 product line subject to the satisfaction of certain volume purchase requirements.

Employees

At March 2, 1984, the Company employed 610 persons, including 294 in manufacturing, 88 in engineering, 58 in marketing, 23 in finance/administration, 24 in quality and reliability, 10 in human resources, 106 in Quantum Caribe and 7 in QEW Corporation.

QUANTUM ORGANIZATION



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QUANTUM CORPORATION

MANAGEMENT PROFILES

James L. Patterson — President, Chief Executive Officer

Mr. Patterson has been a director of the company since its inception in February 1980. From August 1979 to February 1980, Mr. Patterson was self-employed as a technical and marketing consultant. Prior to August 1979, he served for six years as the Vice President, Engineering of System Industries, Inc., a manufacturer of computer peripheral equipment. He spent three years at Memorex as Director of Product Development for communictions products and Director of Business Planning for disk drive and microfilm products. Prior to that time, Mr. Patterson held various engineering and management positions at IBM.

Joseph T. Rodgers, Jr. — Vice President, Finance
Secretary and Treasurer

Mr. Rodgers joined the company in December 1980 as Vice President, Finance and was elected Secretary in May 1981 and Treasurer in September 1981. From July 1979 to December 1980, he served as the Vice President, Finance of Braegen Corporation, a manufacturer of computer peripheral equipment. From September 1978 to July 1979, he served as Assistant Vice President, Finance of Plantronics Corporation, a manufacturer of telecommunications equipment. Prior to that time, Mr. Rodgers was employed by Consolidated Video Systems, a manufacturer of broadcast equipment, as its Vice President, Finance. He also had over nine years' experience at Price Waterhouse, last serving as an audit manager.

James G. Watson — Vice President, Marketing

Mr. Watson joined Quantum in October 1982 as Director of Sales. He was appointed Vice President, Marketing in February 1984. Prior to joining the company, Mr. Watson was Northwestern Regional Manager of OEM Peripheral Sales for Control Data Corporation. Previous experience includes 7 years in Sales and Marketing with Storage Technology Corporation.

Arthur P. Geffon — Vice President, Engineering

Mr. Geffon joined the company in June 1980 as Manager, Recording Systems. In February 1984, he was promoted to Vice President, Engineering. Previously, Mr. Geffon served at Shugart Associates as Project Manager for the SA850 floppy disk drive program. Other experience includes five years with ISS and ten years with RCA in recording systems engineering.

Richard P. Taylor — Vice President, Manufacturing

Mr. Taylor joined Quantum in June 1983 as Vice President, Quality and Reliability. He was named Vice President, Manufacturing in February 1984. Prior to joining Quantum, he served for 7 years with Digital Equipment Corporation, most recently as Manager, Quality and Reliability at DEC's Colorado Springs disk drive facility. He has also held various quality and reliability management

positions in DEC's storage systems manufacturing, corporate quality assurance, and corporate component engineering groups.

Helen Preston — Vice President, Human Resources

Ms. Preston joined the company in April 1983 as Director, Human Resources, and was promoted to Vice President in February 1984. Prior to joining Quantum, she served for 4 years as Director of Human Resource Development for the Farinon division of Harris Corporation. Previously, she was Personnel Manager for the Heritage Dental Laboratories division of Sybron Corporation.

Ivan Nazario — General Manager, Quantum Caribe

Mr. Nazario joined Quantum in September 1983 as General Manger of Quantum Caribe, the company's Puerto Rico manufacturing facility. Prior to joining Quantum, Mr. Nazario served for ten years with Digital Equipment Corporation, most recently as Area Resources Manager for the establishment of a Digital manufacturing operation in Mexico.

Stephen M. Berkley — President, QEW Corporation

Mr. Berkley joined Quantum in October 1981 as Vice President, Marketing. In February 1984, he was appointed President of the company's new subsidiary. From April 1977 until his employment by the company, he was employed by Qume Corporation, a manufacturer of computer printers and floppy disk drives, first as Vice President, Business Development and then as Vice President and General Manager of the Memory Products division. Mr. Berkley has also held positions as manager of strategic planning at Potlatch Corporation and as a management consultant with the Boston Consulting Group.

David A. Brown — Executive Vice President, Operations QEW Corporation

Mr. Brown is one of the founders of Quantum and served as Vice President, Engineering from February 1980 until February 1984 when he was appointed Executive Vice President, Operations for QEW Corporation. Prior to that time, Mr. Brown was employed by Shugart Associates, a disk drive manufacturing company, from February 1973 to February 1980, last serving as Director of Flexible Disk Engineering.

A. Dale Hiatt, Jr. — Vice President, Manufacturing QEW Corporation

Mr. Hiatt joined Quantum in July 1982 as Vice President, Manufacturing. In February 1984, he was appointed to assume that responsibility for QEW Corporation. Prior to Quantum, he spent 16 years with the Colorado Springs Division of HewlettPackard Company in various positions in Product Design, Marketing, and most recently, as CRT Manufacturing Manager.

Financial Summary ($ Millions except Per-Share amounts):

Fiscal Year	Revenue	Net Income (Loss)	Earnings (Losses) Per Share
1982			
1Q	$ .4	$ (.9)	$ (.49)
2Q	2.1	(.2)	(.10)
3Q	3.3	(.4)	(.21)
4Q	7.9	1.6	.24
Year End	$ 13.7	$ .2	$ .03
1983			
1Q	$ 8.7	$ 2.1*	$ .28*
2Q	10.0	1.6	.21
3Q	11.3	1.9	.23
4Q	11.9	2.2	.24
Year End	$ 41.8	$ 7.8	$ .96
1984			
1Q	$ 12.5	$ 2.1	$ .22
2Q	15.1	2.5	.26
3Q	17.5	2.9	.30

*Includes extraordinary credit of $814,000 or $.10 per share for tax benefit of loss carryforwards.

To our Shareholders:

Quantum's sales in the third quarter of fiscal 1984 continued to grow, rising 55% over the same quarter last year. Net income increased 54% to $2.9 million, compared with $1.9 million last year. Income per share was $.30 compared with $.23 per share in the third quarter of fiscal 1983. For the nine-month period, sales increased 51%, and income, before extraordinary credit for the tax benefit of a loss carry-forward, increased 56% over the same period last year.

Our sales this quarter were 16% higher than last quarter because of the continuing strong demand for our Q2000 Series® 8-inch product line, and the beginning of significant sales of our new Q500 Series® 5¼-inch products. Sales and backlog of our Q2000 Series exceeded our earlier expectation, primarily due to the continuing success of our customers' mature products and also because some of our customers have experienced delays in announcing new products which incorporate 5¼-inch Winchester disk drives.

The transfer of Q2000 manufacturing to Puerto Rico is continuing on schedule. During the quarter, our Quantum Caribe team began final assembly and testing of the Q2000 and made their first shipments directly to customers. Over the next six months, Q2000 production will be completely phased out of our Milpitas facility to Quantum Caribe, making room for the growth of the Q500 production.

During the quarter, we made significant increases in the production capacity of our new Q500 product line, allowing us to meet the growing market demand. To date, we have shipped over 10,000 Q500 disk drives, making Quantum a leading supplier of high capacity 5¼-inch Winchester products. We will continue to expand our production capacity in order to keep pace with our customers' volume requirements.

In addition to the efforts on our current products, we established two new development activities during the quarter. The first program is for the design of "double density products." This will result in products with 40 megabytes of capacity on two 5¼-inch disks (half-height) or 80 megabytes of capacity in the full height 5¼-inch configuration. The other new program calls for development of low cost mass storage subsystems for the personal computer market.

We have established a separate subsidiary to develop and market the subsystem products. This team is headed by Steve Berkley, who has been our vice president of marketing. We elected the subsidiary arrangement in recognition that this business is different than our base OEM business, to continue a highly focused environment, and to provide a means of compensation to retain, and to continue to attract, outstanding people.

The success of these new programs will strengthen Quantum's leadership in existing markets as well as open new markets for our future growth.

Sincerely,

James L. Patterson
President
February 20, 1984

Consolidated Statements of Operations
(In Thousands except Per Share Amounts)

	Three Months Ended		Nine Months Ended	
	January 1, 1983	December 31, 1983	January 1, 1983	December 31, 1983
Sales	$11,311	$17,515	$29,919	$45,131
Cost of sales	6,395	10,761	17,161	27,320
Gross profit	4,916	6,754	12,758	17,811
Expenses:				
Research and development	784	657	1,666	2,129
Marketing	637	958	1,878	2,776
General and administrative	338	789	879	1,899
Interest and dividend income	(266)	(895)	(379)	(2,527)
	1,493	1,509	4,044	4,277
Income before income taxes	3,423	5,245	8,714	13,534
Provision for income taxes	1,551	2,360	3,946	6,090
Income before extraordinary credit	1,872	2,885	4,768	7,444
Tax credit from utilizing net operating loss	—	—	814	—
Net income	$1,872	$ 2,885	$ 5,582	$ 7,444
Net income per share before extraordinary credit	$ .23	$ .30	$ .61	$ .78
Net income per share	$ .23	$ .30	$ .72	$ .78
Common and common equivalent shares	8,026,000	9,524,133	7,843,540	9,527,841

Consolidated Balance Sheets
(In Thousands)

	March 31, 1983 (audited)	December 31, 1983 (unaudited)
Assets		
Current assets:		
Cash, including certificates of deposit	$20,836	$19,013
Accounts receivable, net of allowance for doubtful accounts of $235 and $322	5,859	8,417
Interest and dividends receivable	479	551
Inventories	6,017	11,622
Prepaid expenses	201	223
Other current assets	19	46
Total current assets	33,411	39,872
Property and equipment, less accumulated depreciation	4,190	7,175
Long-term marketable investment securities	18,726	18,541
Other assets	303	333
	$56,630	$65,921
Liabilities and Shareholders' Equity		
Current liabilities:		
Accounts payable	$ 2,172	$ 5,840
Accrued compensation	499	401
Income taxes payable	3,813	1,321
Deferred taxes	888	813
Other accrued liabilities	440	568
Total current liabilities	7,812	8,943
Deferred income taxes	329	455
Shareholders' equity:		
Common stock	43,409	43,716
Valuation allowance for long-term marketable investment securities	(1,175)	(892)
Retained earnings	6,255	13,699
Total shareholders' equity	48,489	56,523
	$56,630	$65,921

Quantum Corporation
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Third Quarter Report 1984
Quantum Corporation

FINANCIAL ANALYSTS' SUMMARY

($ millions except per-share amounts)

FIRM	ANALYST	DATE	REVENUES 1984	REVENUES 1985	INCOME 1984	INCOME 1985	EPS 1984	EPS 1985
Dillon Read Technology (Gartner Group)	P. Wright	11/10/83	65.0	105.5	*	*	.98	1.40
Donaldson, Lufkin & Jenrette	T. Rooney	11/16/83	68.0	110.0	10.7	15.4	1.10	1.50
Shearson/American Express	H. Allison	11/21/83	*	*	*	*	1.10	1.50
Montgomery Securities	D. Lawrence	11/30/83	65.0	100.0	10.55	14.95	1.10	1.50
Morgan Stanley & Co.	D. Moy	1/25/84	65.4	110.0	10.37	14.72	1.09	1.53
Robertson Colman & Stephens	B. Downing	1984 Tech. Conf.	67.1	112.0	10.8	15.6	1.13	1.60

*Projections not included.

QUANTUM CORPORATION

Recent Price	$18
52 Week Range	$35-15
Ticker Symbol	QNTM
Fiscal Year	March
P/E Ratio	
Calendar 84	12.0x
Calendar 85	9.7x

	F1982	F1983	F1984E	F1985E
Revenues (mil.)	$13.7	$41.8	$67.1	$112.0
Pretax Margin	1.4%	30.8%	29.3%	21.5%
Tax Rate	—	45.4%	45.0%	35.0%
Net Income (mil.)	$ 0.2	$ 7.0	$10.8	$ 15.6
EPS	$0.03	$0.86	$1.13	$ 1.60
Shares (mil.)	6.6	8.2	9.6	9.7

Quantum Corporation is a leading supplier of 8- and 5 ¼-inch rigid disk drives to OEMs for use in microcomputer systems. Two years after its founding in 1980, the Company became the leading OEM supplier of 8-inch Winchester disk drives. It now has a 40% share of the 8-inch market. In February 1983, it began shipping high-capacity 5 ¼-inch Winchester disk drives in 20, 30, and 40 megabyte capacities. In the quarter ended December 1983, 5 ¼-inch drives constituted over one quarter of revenues and in the quarter ending March 1984, 5 ¼-inch drives will make up almost half of the estimated $23 million in revenues. Both 8- and 5 ¼-inch product lines use a proprietary, semi-closed loop technology which provides higher capacity and faster access time than the technology used by most of its competitors.

Quantum's current product development effort is in expanding the 5 ¼-inch line. The Company plans to extend the 5 ¼-inch line to higher capacities, and bring out half-height 5 ¼-inch products up to 40 megabytes. These new products will incorporate the same patented, low-cost actuator technology that has proven so successful in its current 8-inch and 5 ¼-inch drives. Quantum's current 8-inch customers include Altos, Convergent Technologies, ROLM, TeleVideo, and Wang. The Company has recently received orders for high capacity 5 ¼-inch drives for existing as well as for new computer systems from some of these same customers, namely Altos, TeleVideo, and Wang.

Quantum has excelled in the Winchester disk drive market by achieving high volume production of reliable, cost-effective products. Product development teams work closely with production groups to develop products which will be "manufacturable." Winchester disk drives must be manufactured in a contamination-free environment. Manufacturing is done in Quantum's innovative "clean tunnel" production lines, which are cleaner than traditional Winchester clean rooms yet flexible so that they can be rapidly expanded with increased production needs.

Quantum recently established a new subsidiary that will develop new exceptionally low-cost 3 ½-inch disk drives and subsystems for the mass storage marketplace. The subsidiary is staffed by several key members of Quantum's senior management team who will receive equity participation in the new corporation: Steve Berkley, former marketing vice president; David Brown, former engineering vice president; and Dale Hiatt, former manufacturing vice president. The new unit gives Quantum the chance to respond to new market opportunities with a separate entrepreneurial team.

Blake L. Downing

Dillon Read Technology

November 10, 1983

Strategic Analysis Report
Peter Wright

Quantum Corporation ($20.00)

Quantum Corporation has been perhaps the most profitable of all the low-end rigid disk drive suppliers. The company began shipping product in F82 (ending March) and by late 1982 had become the leading supplier of 8-inch rigid drive products. Recognizing that the future growth in the 8-inch marketplace could be affected dramatically by high-density 5-1/4-inch disk drives, Quantum decided to enter the high-capacity 5-1/4-inch rigid disk drive business in early 1983. Quantum currently ships about 2,500 5-1/4-inch disk drives per month, which is perhaps 30% of the total supply of high-density 5-1/4-inch disk drives. Only Atasi and Control Data are shipping in any kind of volume in this product class. Like all low-end disk drive suppliers, the company has very mixed customer lists. Its more stable customers include Altos, Arrow Electronics, Convergent Technologies, Nixdorf, Rolm, Televideo, Wang and Xerox. The initial 8-inch product family was very important to Quantum, as it afforded the company an opportunity to penetrate major multiuser system suppliers before their needs for 5-1/4-inch rigid drives became apparent. Now Quantum hopes that it can leverage these relationships to sell its full product line, including the 5-1/4-inch drives. To that end, the company reportedly recently signed a $50 million contract with Wang for its family of 5-1/4-inch disk drive products. The company currently ships upwards of 3,000 8-inch drives per month, though perhaps in the longer term that figure will settle in the 2,000 to 2,500-per-month shipment rate.

The 8-inch market has historically been a disappointing one. Early on, the industry was unable to standardize around one interface, which impeded the progress of the market. As expectations for volumes rose, the market became populated with almost 30 vendors. However, as with most OEM peripheral markets, the industry quickly consolidated, perhaps at an even faster rate, as volume expectations never materialized. While there are still many pretenders in this marketplace, today four or five vendors dominate the business, and Quantum is probably the market share leader. Consequently, revenues exploded in F83 to $41.8 million, tripling F82's $13.7 million. Furthermore, gross margins were an incredible 43.8% and operating margins were 28.4%. Obviously, as a company gets bigger, these margins will come down dramatically. For example, the 5-1/4-inch drive business will not inherently be as profitable. Consequently, as Quantum's product mix shifts toward 5-1/4-inch drives, gross margins will decline. Still, the company is participating only in the high-capacity 5-1/4-inch drive market and therefore may be able to hold gross margins of 5% to 10% above the 27% gross margin target for the high-volume, low-capacity drive suppliers. To partially offset declining gross margins, Quatum is moving its 8-inch production to Puerto Rico, where it will enjoy a 14% tax rate versus a 45% tax rate on that product line. Shipments are scheduled to begin in January, and the company should begin seeing major tax benefits in the June 1984 quarter.

We are impressed with both the quality of Quantum's management and its product focus. Nevertheless, these skills will be well tested as the industry goes through a major consolidation by late 1984 or perhaps in 1985. For F84, we expect revenues of $65 million, a 55% increase from F83, with EPS of about $1.00. Going out to F85, revenues of $105 million and EPS of $1.40 are reasonable targets. While we are negative on the investment prospects for the industry, we think that Quantum certainly deserves longer-term investment merit.

QUANTUM CORPORATION Five-Year Projections
($ in Millions)

	F83A	F84E	% Change	F85E	% Change	Possible 5-Year CGR	F88E
Revenues ($)	41.8	65.0	55.5%	105.5	62.3%	40%	224.8
Pretax Margins (%)	30.8	26.0		20.0			17.0
Tax Rate (%)	45.5	45.0		35.0			32.0
Shs. Out. (Mill.)	8.2	9.5		9.7			12.0
EPS ($/share)	0.86	0.98	14.0%	1.40	42.9%	20%	2.17

Fiscal Year Ends March

QUANTUM CORPORATION
Investment Recommendation

	Long Term (Over 12 mos)	Short Term (Less Than 6 mos)
Recommendation	Buy	Hold
Confidence Factor	Low	

Donaldson, Lufkin & Jenrette

Donaldson, Lufkin & Jenrette Securities Corporation 140 Broadway, New York, N.Y. 10005 (212) 902-2000

Action Recommendation

November 16, 1983
DJIA: 1247.96
SPII: 186.17

QUANTUM CORPORATION (QNTM-17 BID)*

Earnings Per Share			P/E Ratio			Return on Equity			
1983A	1984E	1985E	1983A	1984E	1985E	1983	1984E	1985E	Dividend
$0.86	$1.10	$1.50	19.8	15.5	11.3	27%	20%	23%	Nil

Shares outstanding (mm):	9.5
Market value (mm):	$161.5
6/30 Book value:	$ 5.34
Price/book value:	3.18
52-week range:	35-16

Capitalization as of 6/30/83		
	$ Millions	% Total
Long-term debt	$ 0.329	0.6%
Shareholders' equity	50,685	99.4%
Total	$51.014	100.0%

Summary and Recommendation

We recommend purchase of Quantum Corporation, a leading manufacturer of high-capacity Winchester disk drives, because it sells at a discount to the industry despite its strong and improving fundamentals. Through the use of proprietary technologies, Quantum has rapidly emerged as one of the leading manufacturers of high-capacity Winchester disk drives for use in minicomputer and microcomputer systems, including small business computers, personal computers, and word processors. As those segments become increasingly price sensitive, we expect greater pressure to be placed on disk drive manufacturers to deliver cost-effective products. Key participants will, therefore, be determined by their ability to provide large volumes of high-quality product at cost-competitive prices. Such low-cost drives will allow total systems cost to decline, spawning, in turn, increased demand for systems as well as drives.

At recent prices, the stock is down nearly 50% from its 1983 high, in large part because of its association with high-technology issues whose results have fallen short of expectations in many cases. At 16 times March 1984 and 12 times March 1985 earnings, Quantum's shares are selling at a discount to those of its competitors, as well as to those in DLJ's peripherals universe (Table 1). In our opinion, Quantum should be accorded a higher relative valuation in view of its leading position, which is based on its aggressive pricing, cost leadership, proprietary technology, and timely product introductions—and accelerated growth prospects. We recommend purchase for the following reasons:

Table 1
Quantum Corporation vs. Selected Computer Peripheral Companies
Statistics and Valuation

			Prices 1983		Earnings Per Share			Calendar EPS		Calender P/E	
	FY	SYM	10/31	Range	1982	1983	1984	1983E	1984E	1983E	1984E
Cipher Data	June	CIFR	19	24-11	$0.30	$0.50	$0.80	$0.60	$1.00	32	19
Computer Memories[a]	March	CMIN	11	33-11	.12	.35	.65	.25	.60	48	20
Corvus	May	CRVS	11	22-10	.30	.45	.60	.55	.65	20	17
Micropolis	Dec	MLIS	14	25-14	.01	.45	.75	.45	.75	33	20
Onyx + IMI*	Sept	ONIX	12	19-8	.51	.35	.90	.45	.95	27	10
Priam	June	PRIA	12	23-11	.07	.22	.80	.70	.90	17	13
Quantum[a]	March	QNTM	18	24-16	.86	1.10	1.50	1.00	1.42	18	12
Rodime	Sept	RODMY	20	29-12	.21	.60	1.10	.70	1.20	31	18
Seagate	June	SGAT	14	22-14	.19	.33	.55	.45	.70	32	21
Tandon	Sept	TCOR	19	42-14	.36	.65	1.10	.75	1.35	27	15
								Group average		29	17

[a]Estimates for following fiscal year.

1. *Quantum addresses the large, high-growth market for high-capacity disk drives—the segment between 30 and 100 megabytes.* Driven by the elasticity of microsystems, OEM demand for high-capacity drives has become one of the fastest-growing segments of information processing. Industry shipments of high-capacity units are estimated to grow about 60% a year through 1986 (Table 2); and although revenue growth will lag somewhat because of falling prices, we can expect revenues to increase 40% a year.

2. *Quantum has focused on being the low-cost manufacturer.* The company's strategy from the beginning was to address the basic price/performance issues of the marketplace. Therefore, Quantum did not focus on developing leading-edge technologies, but rather on improving existing technologies with an emphasis on designing "manufacturable products." In our opinion, Quantum's early movement in that direction reflects management's awareness and experience in peripheral-related markets, disk drives in particular. Its operating margins of 24% and pretax margins of 30% are the highest in the industry, more than 45% above those of its competitors.

3. *Incorporation of proprietary technology affords significant price/performance benefits.* Through the use of proprietary, semi-closed-loop technology, the company has realized significantly higher capacity (megabytes/drive) than existing open-loop, stepper-motor systems, while remaining more cost effective than emerging high-end closed-loop systems. The price/performance advantages provided by Quantum's strategy have allowed the company to realize the high unit volume necessary to be the low-cost manufacturer, through design-ins with Wang Laboratories, TeleVideo Systems*, Convergent Technology*, Altos Computer, and Nixdorf Computer. With further downward pressure on systems prices expected for the next 12-18 months, we expect this proprietary technology to continue to provide Quantum with a greater measure of pricing leverage than most others in the industry.

4. *The company is capturing an increasing share of the highly profitable, high-capacity 8-inch marketplace.* Having shipped approximately 24,000 drives in 1982, 45% of which were high-capacity, Quantum became the leading OEM supplier of high-capacity 8-inch drives,

with 25% of the world market. Building on this, the company introduced its second generation of 8-inch products late in 1982, the Q2080. Using increased linear bit as well as track density, the Q2080 stores nearly twice the data as the company's previous high-end product, the Q2040. The resultant penetration of new, high-capacity, vertical markets will help to extend the life of the Q2000 family through the encroachment of low-end, 14-inch markets. As a result of this encroachment, of the company's aggressive marketing, and of reduced competition from vendors, we expect Quantum to expand its market share in high-capacity 8-inch drives to better than 30%. Continued growth in this highly profitable segment is forecast through 1984, when the pace will begin to slow as more cost-effective 5.25-inch drives encroach upon it.

Table 2
Growth of High-Capacity Fixed Disk Drives (30-100mb)
(Units worldwide, in thousands)

		1982	% Total	1984	% Total	1986	% Total
14"	U.S. manufacturers	14.8		13.3		3.0	
	Non-U.S.	.3		.1		—	
	Total	15.1	24.7%	13.4	5.3%	3.0	0.7%
8"	U.S. manufacturers	31.6		76.2		43.0	
	Non-U.S.	14.2		36.7		32.3	
	Total	45.8	75.0%	112.9	45%	85.3	19.9%
5.25"	U.S. manufacturers	.2		108.2		240.0	
	Non-U.S.	—		17.0		84.0	
	Total	.2	0.3%	125.2	49.7%	324.0	75.7%
Sub 5.25"	U.S. manufacturers	—		—		12	
	Non U.S.	—		—		4	
	Total	—	—	—	—	16.0	3.7%
Total market (W.W.)		61.1	100%	251.5	100%	428.3	100%
Compound growth **61%**							

Source: *Disk/Trend.*

5. *Quantum has made a broad-based thrust into high-capacity 5.25-inch drives.* The 5.25-inch market represents the fastest-growing segment of the high-capacity market, as made clear by the influx of entrants over the last year. Despite the proliferation of product announcements, however, only a handful of vendors are in volume production. Problems related to the use of plated media and sophisticated, closed-loop servo-systems have created numerous product delays. Having shipped about 600 5.25-inch drives in August, 1,400 in September, and an estimated 2,000 in October, Quantum has considerable leverage in the vendor/buyer relationships that we believe will have been established before the end of the first quarter of 1984. In addition, new-product announcements include higher-capacity full-height, 5.25-inch drives (Q580) as well as a series of half-height products (Q5000H). Clearly, Quantum's thrust is toward the high-growth, 5.25-inch market, which could account for nearly 70% of fiscal 1985 revenues.

6. *An extremely strong financial position will support high future growth.* Quantum's initial public offering in December 1982 netted the company $31.5 million, all of which remains on the balance sheet. As of October 1, 1983, the company had cash and marketable securities totaling $40 million. With no long-term debt, positive cash flow in excess of $1 million a month, and margins well above industry averages, Quantum appears to be more than capable of financing its growth over the next two to three years.

Table 3
Quantum Corporation
Income Statement, 1982-85E
(Dollars in millions)

	March 1982A	March 1983A	March 1984E	March 1985E
Revenues	$13.7	$41.8	$68.0	$110.0
Operating income (% of revenues)	.2(1.6)%	11.9(28.5)%	16.3(24)%	22.1(20)%
Pretax income (% of revenues)	.2(1.6)	12.9(31)	19.5(29)	25.6(23)
Taxes (rate)	—	5.8(45)	8.8(45)	10.2(40)
Net Income	$ .2	$ 7.8	$10.7	$ 15.4
EPS	0.03	0.96[a]	1.10	1.50
Average shares outstanding	6.6	7.5	9.7	10.5

[a]Includes extraordinary credit of $814,000, or $0.10 per share.
Source: Annual report; DLJ estimates.

7. *Quantum is poised for sustained sales and earnings expansion.* An expanding share of the 8-inch segment, together with an established position at the forefront of the emerging, high-capacity 5.25-inch market will, in our opinion, generate well-above-average growth. For fiscal 1984, we are estimating earnings of $1.10 per share on revenues of $68 million, which would represent respective increases of 28% and 57%. Looking ahead to fiscal 1985, estimated shipments could rise nearly 70% to $110 million, accompanied by a 36% increase in earnings to $1.50 per share. The current year's estimate reflects two quarters of transition. Therefore, to further demonstrate the momentum, we have listed our estimates for the next four quarters.

Table 4
Quantum Corporation
Sales and Earnings Estimates

	Sales		Earnings	
	$ in millions	% decline		% decline
3Q FY 84(Dec)	$18.4 vs. $11.3	62.8%	$0.30 vs. $0.23	30.4%
4Q FY 84(Mar)	22.0 vs. 11.9	84.9	0.34 vs. 0.24	50.0
1Q FY 85(June)	24.0 vs. 12.5	92.0	0.36 vs. 0.22	63.6
2Q FY 85(Sept)	26.0 vs. 15.1	72.2	0.38 vs. 0.26	46.2
	$90.4 vs $50.8	78.0%	$1.38 vs. $0.95	45.3%

Recent pressure on the share prices of high-technology companies, especially those in the disk-drive segment, has created an excellent opportunity for investors to initiate or add to positions in the more established, leading-edge players. A proven, low-cost manufacturer, with experienced management, a strong capital structure, and recognized OEM relationships, Quantum is in position to participate in this growth. We expect annual revenue growth to exceed 40% for the next few years, and that pace could in fact accelerate should additional large OEM contracts be received. We regard the shares, selling at 16 times our March 1984 estimate of $1.10 per share and 12 times our 1985 estimate of $1.50 per share, a discount of more than 35% to the universe, as very attractive. It is our contention that the drive group in general has been oversold after the excessive valuations of earlier this year, and that the more quality-oriented players with clear earnings visibility represent good vehicles for investment at their depressed prices. We believe that Quantum is such a value on the basis of its record, accelerating fundamentals, and clear earnings visibility. As the market focuses on those considerations, we believe that investors will be afforded the opportunity for substantial appreciation in the shares of Quantum.

Thomas Rooney
(212) 902-2919

November 21, 1983

Computer Peripherals
Harvey Allison

QUANTUM CORPORATION (QNTM-OTC)+

11/15/82 Price	52-Week Range	Earnings Per Share* 1983	1984E	1985E	P/E Ratio 1984E	1985E	Dividend	Yield
$20 1/2	$35-16	$0.96	$1.10	$1.50	18.6X	13.07X	---	---

*Fiscal year ends in March. Initial public offering on December 10, 1982. Of the 9.5 million shares outstanding 1,334,200 shares traded in October.

+Shearson/American Express makes a market in this issue.

Investment Conclusion

Quantum is the leading supplier of high-capacity 8" and 5 1/4" disk drives to the OEM market. Their current product line is in the 20-40 megabyte capacity range. Most vendors in the 5 1/4" Winchester disk drive industry are in the 5-15 megabyte range.

Founded three years ago to produce 8" disk drives for the OEM office systems market, Quantum quickly took market share from the existing suppliers to become the market leader. Most of this gain was at the expense of Shugart Associates. Recently, Quantum began volume shipments of new 5 1/4" products aimed at the fast-growing desktop market. Quantum is currently one of the three leading producers of high-capacity 5 1/4" disk drives and should soon be the leader.

Quantum, as a 5 1/4" disk drive company, is an investment in the office automation revolution without the undiversified risks of an investment in a specific systems firm. Unlike many other firms in the 5 1/4" area, the Quantum team has successfully executed disk-drive design and volume production before, in the 8" market. This time, it should be easier for Quantum to secure a leadership position since, unlike the 8" market, they will not have to take market share from others but will participate in developing a new market.

Quantum reported excellent earnings for the second quarter ending September 30. Operating margins are improving as the new 5 1/4" Winchester product line ramps up to full production. The second-quarter results reveal that most of the full earnings impact of the 5 1/4" product line will be realized over the next two quarters, as product momentum catches up to dilution from the initial public offering in December, 1982. We expect strong sequential improvements in earnings over the next two quarters. The estimate for March, 1984 is $1.10. In view of our strong confidence in Quantum's market position, its ability to develop product and its long-term earnings potential, we recommend Quantum as a fundamentally excellent manufacturing company and a good way to play the office automation market. The stock has been added to the Shearson/American Express Emerging Growth Stock List.

Additional information available upon request.

QUANTUM CORPORATION (cont'd)

Operating Review

Earnings per share were up in the second quarter to $0.26 from $0.21 last year on a revenue increase of 52% and a 25% increase in the number of shares outstanding. Sequentially, revenue for the quarter was up 21%. Revenue increases were caused by surprisingly strong 8" disk drive demand, and the initial shipments of the 5 1/4" product from a very small revenue base in the first quarter. Firm backlog continued to grow during the second quarter, and order volume looks excellent.

Pretax operating earnings were up 23.8% on a 21% revenue increase for the second quarter. Rising interest rates more than offset slight decreases in cash balances during the period. The improvement in operating margins reflects the progress Quantum has made ramping up 5 1/4" Winchester disk drive manufacturing. This improvement came in spite of a 43% increase in G & A, largely the result of legal fees related to the suit Quantum brought against Computer Memories this quarter.

Profitability will continue to improve over the next several quarters. During the third quarter, production of the 5 1/4" products will increase and further improve the margin contribution of this product line. Beginning in the fourth quarter, the Puerto Rican facility will begin producing a fraction of the 8" product line. Slight tax benefits will be seen in the fourth quarter as this facility ramps up and the U.S. facility's resources are redirected to the 5 1/4" product line. By the end of the year, 5 1/4" production should match 8" production.

	FY 1983	FY 1984
Q1	$0.28	$0.21
Q2	$0.21	$0.26
Q3	$0.23	$0.30E
Q4	$0.18	$0.32E
Year	$0.96	$1.10E

QUANTUM CORPORATION (cont'd)

Income Statement	1982	Q1	Q2	Q3	Q4	1983	Q1	Q2
Net Sales	$13,656	$8,658	$9,950	$11,311	$11,860	$41,779	$12,473	$15,143
% Sequen. Incr.		10%	15%	14%	5%		5%	21%
% Y-Y Incr.		2143%	372%	247%	50%	206%	44%	52%
Cost of Sales	$10,350	$5,168	$5,598	$6,049	$7,315	$23,498	$7,485	$9,074
% of Sales	75.8%	59.7%	56.3%	53.5%	61.7%	56.2%	60.0%	59.9%
Gross Profit	$3,306	$3,490	$4,352	$5,262	$4,545	$18,281	$4,988	$6,069
% Sales	24.2%	40.3%	43.7%	46.5%	38.3%	43.8%	40.0%	40.1%
Operating Exp.								
Research & Deve	$427	$309	$573	$1,130	$408	$2,420	$770	$702
% of Sales	3.1%	3.6%	5.8%	10.0%	3.4%	5.8%	6.2%	4.6%
Seq. Change %			85.4%	97.2%	-63.9%		88.7%	-8.8%
Marketing	$1,804	$604	$637	$637	$816	$2,694	$787	$1,031
% of Sales	13.2%	7.0%	6.4%	5.6%	6.9%	6.4%	6.3%	6.8%
Seq. Change %			5.5%	0.0%	28.1%		-3.6%	31.0%
General & Admin	$853	$236	$305	$338	$435	$1,314	$457	$653
% of Sales	6.2%	2.7%	3.1%	3.0%	3.7%	3.1%	3.7%	4.3%
Seq. Change %			29.2%	10.8%	28.7%		5.1%	42.9%
Operating Income	$222	$2,341	$2,837	$3,157	$2,886	$11,853	$2,974	$3,683
% of Sales	1.6%	27.0%	28.5%	27.9%	24.3%	28.4%	23.8%	24.3%
% of Pretax	119.4%	98.8%	97.1%	92.2%	82.3%	92.2%	78.8%	81.5%
Seq. Change %	NM	-14.7%	21.2%	11.3%	-8.6%	5239.2%	3.0%	23.8%
Interest Income	($36)	$28	$85	$266	$530	$909	$798	$834
Security Income					$90	$90		
Total Non-Oper	($36)	$28	$85	$266	$620	$999	$798	$834
% of Pretax	-19.4%	1.2%	2.9%	7.8%	17.7%	7.8%	21.2%	18.5%
Pretax Income	$186	$2,369	$2,922	$3,423	$3,506	$12,852	$3,772	$4,517
Income Taxes	$0	$1,073	$1,322	$1,551	$1,882	$5,828	$1,698	$2,032
Tax Rate	0%	45%	45%	45%	54%	45%	45%	45%
Net Income excl.	$186	$1,296	$1,600	$1,872	$1,624	$7,024	$2,074	$2,485
% Seq. Incr		-54.5%	23.5%	17.0%	-13.2%		27.7%	19.8%
% Y-Y Incr.				-622.9%	-42.9%	3676.3%	60.0%	55.3%
% of Sales	1.4%	15.0%	16.1%	16.6%	13.7%	16.8%	16.6%	16.4%
Extr. Income		$814				$814'		
Earnings per Share								
EPS excl. Extr.	$0.03	$0.17	$0.21	$0.23	$0.18	$0.86	$0.22	$0.26
EPS Extr.		$0.11				$0.10		
					(Est.)			
Total EPS	$0.03	$0.28	$0.21	$0.23	$0.18	$0.96	$0.22	$0.26
					(Est.)			
Primary Shares	6,595	7,408	7,599	8,139	8,828	8,172	9,517	9,505

QUANTUM CORPORATION (cont'd)

Assets	1982	Q1	Q2	Q3	Q4	1983	Q1	Q2
Current Assets								
Cash	$258		$5,439	$38,759	$20,836	$20,836	$22,885	$21,306
Accounts Rcvbl.	$4,844		$4,957	$6,244	$6,094	$6,094	$5,589	$6,925
Less Allow.	($201)		($201)	($897)	($235)	($235)	($262)	($262)
Total	$4,643		$4,756	$5,347	$5,859	$5,859	$5,327	$6,663
Interest Rcvbl.					$479	$479	$416	$587
Inventories	$4,696		$4,569	$5,377	$6,017	$6,017	$5,980	$7,935
Prpd Inc. Tax	$22		$228	$292				
Prepaid Exp.	$84		$137	$127	$201	$201	$177	$236
Other	$36		29	$134	$19	$19	$20	$12
Total Cur. Asset	$9,739		$15,158	$50,036	$33,411	$33,411	$34,805	$36,739
Equip. & Lsehld. Imprvmnts								
Leasehold Imprv.	$170				$780	$780		
Const. in Prog.	$71				$183	$183		
Manuf. Equip.	$1,414				$2,444	$2,444		
Tooling	$358				$941	$941		
Office Eq.	$308				$578	$578		
Total	$2,321				$4,926	$4,926		
Less Depr.	$181				$736	$736		
Total	$2,140		$3,033	$3,704	$4,190	$4,190	$4,994	$5,727
Securities					$18,726	$18,726	$18,573	$18,912
Other Assets	$242		$257	$300	$303	$303	$320	$335
Total Assets	$12,121		$18,448	$54,040	$56,630	$56,630	$58,692	$61,713

QUANTUM CORPORATION (cont'd)

Liabilities and Equity	1982	Q1	Q2	Q3	Q4	1983	Q1	Q2
Current Liab.								
Bank Borrowings	$4,385							
Accounts Pbl.	$2,939		$1,931	$2,542	$2,172	$2,172	$2,908	$4,947
Accrued Exp.								
Accrued Comp.	$499		$415	$341	$499	$499	$413	$623
Interest								
Other	$131		$350	$367	$440	$440	$459	$625
Inc. Tax Pbl.			$1,600	$3,163	$3,813	$3,813	$3,010	$622
Def. Inc. Tax					$888	$888	$888	$888
Current Por. LTD								
Total Curr. Liab	$7,954		$4,296	$6,413	$7,812	$7,812	$7,678	$7,705
Def. Inc. Tax			$171	$216	$329	$329	$329	$329
Equity								
Preferred Stock	$5,690		$11,797					
Notes	($75)		($75)					
Common Stock	$135		$132	$43,411	$43,409	$43,409	$43,527	$43,541
Valuation Var.					($1,175)	($1,175)	($1,171)	($676)
Retained Earn.	($1,583)		$2,127	$4,000	$6,255	$6,255	$8,329	$10,814
Total Equity	$4,167		$13,981	$47,411	$48,489	$48,489	$50,685	$53,679
Total	$12,121		$18,448	$54,040	$56,630	$56,630	$58,692	$61,713

INSTITUTIONAL RESEARCH

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MEMBER NEW YORK STOCK EXCHANGE, INC.

QUANTUM CORPORATION (QNTM)

A Successful Product Transition and Strong Earnings Growth

Recent Price	12 Mo. Range	FY Ending	Div./Yield	E.P.S. 1983A	E.P.S. 1984E	E.P.S. 1985E	P/E Ratio 1983	P/E Ratio 1983E	P/E Ratio 1984E
$23	$35-15	3/31	None	$0.86	$1.10	$1.50	26.7x	20.9x	15.3x

Summary and Investment Conclusion

We anticipate that Quantum will be successful in redeploying its production away from its slowing 8" Winchester Drive market segments and into the much faster growing mid/high capacity 5.25" markets. We believe that Quantum has proprietary low-cost, drive technology that will enable it to build reliable, economical drives and increase share in the 5.25" markets, as it did previously in the 8" market.

As evidence of Quantum's progress in 5.25" markets, we believe the company has finalized a very significant agreement with Wang Labs, against which production quantities will be shipped in December. We do not anticipate that this arrangement will be publicized over the short term, since these drives would be for as-yet unannounced new Wang products.

We also believe that Quantum is a likely candidate to supply very large quantities of drives to Digital Equipment. Quantum lost out to a start-up company (Evotek) several months ago in the final rounds of the competition to supply these drives, which at the time were estimated to have a total value of $140 million. Recently, its competitor has suffered from what seems to be unsolvable technical problems with its drives, and as a result, we believe they will be unable to supply Digital's requirements. We also believe that discussions are presently taking place between Quantum and Digital about a new contract and that Quantum is a logical recipient of at least a major part of the requirements.

Quantum is starting up a manufacturing plant in Puerto Rico in December, which will result in labor cost savings, as well as significant tax benefits - the latter perhaps not fully reflected in our forecasted earnings for fiscal 1985. We have used a 35% consolidated tax rate for fiscal 1984, but believe that a 30% rate is also highly likely. This reduced tax rate would increase estimated fiscal 1985 earnings to $1.61 (a gain of 46.4% over fiscal 1984 instead of the forecasted 36.4%). Calendar 1984 earnings would increase with this lower tax rate to $1.51 (instead of the forecasted $1.42), resulting in a gain of 49.5% instead of 40.6%.

We recommend the purchase of Quantum for investors seeking to participate in the very positive developments we believe are unfolding.

Introduction

Three major trends are developing in the Winchester disk drive markets:

- Very strong overall growth due to demand from manufacturers of microcomputers, small business systems, CAD/CAM/CAE, and networking.
- Increasing capacity and declining cost per megabyte in all diameters.
- Displacement of larger form factors by smaller diameters in most applications.

This substitution phenomenon described above is being seen in every size. Even the ubiquitous 5.25" drives are beginning to be threatened by the micro-Winchester drives. The major initial impact is felt first by lower capacity drives, since smaller diameter, less expensive, drives can be substituted which do not require state-of-the-art technology, reducing the risk to OEMS who design them into their systems. As drive technology is perfected, smaller diameter drives of increasing capacity can be used, and even the highest capacity drives in each size class can be eventually displaced.

Many of the established Winchester drive manufacturers (in this young industry those more than three years old) are facing a serious challenge: their customer base will be lost unless they frame the correct responses to the migration towards smaller diameters, and the increasing capacities available within each form factor. For those companies who have been active in 8" (and 14") diameter drives there appears to be three possible strategies:

- The "Priam Approach" - stress development to increase the capacities of their larger diameters (8", 14") to stay ahead of the rising curve of 5.25" capacity, and offer their customer base lower costs per megabyte without form factor changes, while developing higher capacity 5.25" drives so as to have product offerings within the 100-600 MB capacity bands for an extended period of time.
- The "Micropolis Approach" - increase 8" capacities somewhat to prolong the life cycle of their products, but not attempt to raise them high enough to get out of harm's way for the medium-term period, and emphasize 5.25" high capacity development.
- The "Quantum Approach" - deemphasize development of new 8" products, instead devoting full attention towards developing 5.25" products that are within the capacity ranges of the current 8" line to take advantage of the strong current demand for these products from its existing customer base. How well we expect this strategy to work will be discussed the sections that follow.

Quantum: Products and Technology

Quantum's 8" products range in capacity from 10.66-85.45 MB unformatted (8.40-67.41 MB formatted) and all use a proprietary semi-closed loop rotary moving coil actuators. This system provides faster access time than stepper motors, and although slower than closed loop systems, is significantly less expensive to manufacture. Quantum Winchester disk drives all feature glass reticle optical track position encoders, temperature compensation servos and a simplified construction throughout that yields high reliability as well as low production costs.

The important features of Quantum's 8" product line are shown below:

Model #	Q2010	Q2020	Q2030	Q2040	Q2080
Capacity (unform)	10.66 MB	21.33 MB	31.99 MB	42.66 MB	85.45 MB
Capacity (form)	8.40 MB	16.80 MB	25.20 MB	33.20 MB	67.41 MB
Platter(s)	1	2	3	4	4
Heads	21	4	6	8	8
TPI	345	345	345	345	789
Avg. Access Time	55 MS	60 MS	60 MS	65 MS	40 MS

SOURCE: Quantum Corporation.

As can be seen from these specifications, the new Q2080 drive is a significant advancement in capacity and performance. By adding a servo head (to the seven read/write heads), track density can be more than doubled, and total drive capacity almost doubled despite one surface dedicated to servo tracking. The TPI (tracks per inch) of 789 is close to the probable maximum of 900 TPI for semi-closed loop actuators, and the access time (40 MS) also approaches the 35 MS practical limit of this positioning technique. All of the Winchester drives in the Q20XX family use the industry standard SA 1000 interface, for ease of OEM designing.

The Q5XX family of Winchester drives closely follows the specifications of the 8" product family and uses the industry standard ST 506 interface.

Model #	Q520	Q530	Q540
Capacity (unform)	21.33 MB	31.99 MB	42.66 MB
Capacity (form)	16.80 MB	25.20 MB	33.60 MB
Platters	2	3	4
Heads	4	6	8
TPI	591	591	591
Avg. Access Time	45 MS	45 MS	45 MS

SOURCE: Quantum Corporation.

Quantum has achieved the same capacity per platter on the 5.25" as on the 8" drives despite the reduced "real estate" through the increase in TPI. We believe that this indicates the probability of a near-term follow-on product matching the capacity of the Q2080: a Q580. We would also expect this anticipated product to reach a 35 MS average access time as Quantum refines its technology. This combination of capacity and access time would position this new product in the mid/high category of Winchester disk drives, a class that is expected to show strong growth in 1984. We would also expect half-height drives from Quantum in the near term.

Markets and Competition

According to credible estimates, demand for Quantum's 8" <100 MB drives are projected to exhibit a sharply divergent demand picture in 1983 in the two major components (< 30 MB and 30-100 MB), as shown below:

Estimated Worldwide 8" Winchester OEM Disk Drive Shipments
(thousands)

Segment	1982	1983	1984	1985
Less than 30 MB	87	54	35	22
% Change	--	(38.1%)	(35.2%)	(37.1%)
30-100 MB	46	98	113	101
% Change	--	114.2%	15.0%	(11.0%)
Total	133	152	148	123
% Change	--	14.3%	(2.8%)	(17.2%)

SOURCE: Disk/Trend.

According to these estimates the impact of the lower capacity 5.25" disk drives can be clearly seen on the lower capacity 8" drives. The very strong upsurge in higher capacity 8" drives shown in these forecasts for 1983 (which we believe will be revised upwards when the new disk/trend report is published in 1984), is benefiting Quantum and the other 8" manufacturers. Although 5.25" disk drives that span this capacity range are available, the need to design-in storage to current releases by business equipment manufacturers has caused them to use proven, existing drive designs. This is particularly true where the 8" form factor was already being used in previous models, or where form factor is not a limiting factor such as in CAD/CAM/CAE, unlike microcomputer multi-user systems, and total demand has been very strong.

We believe that Quantum has increased its market share during 1983, which we estimate was 20% in 1982. The new Q2080 (introduced approximately three months ago) is not yet a major revenue contributor, although we expect it to increase in importance.

Major Participants in the <100 MB 8" Winchester Drive Markets

Company	Estimated Market Share	Comments
Shugart Assoc. (Xerox)	25-30%	< 30 MB only
Quantum	25-30%	Mainly < 85 MB
Fujitsu	10-15%	All capacities
Micropolis	8-10%	< 30 MB only
Priam	8-10%	> 30 MB only
IMI (Onyx+IMI)	5-8%	< 30 MB

SOURCE: Montgomery Securities estimates.

According to the same forecasting source, demand for 5.25" Winchester drives in the segment of most importance to Quantum (30-100 MB) is projected to grow sharply as shown below.

Estimated Worldwide 5.25" Winchester OEM Disk Drive Shipments
31-100 MB
(thousands)

	1982	1983	1984	1985
Shipments	NIL	79	128	221
% Change	--	N/M	85.0%	64.5%

SOURCE: Disk/Trend.

Many more competitors are present in the 5.25" 30-100 MB Winchester drive markets, and include:

Company	Comments
ATASI	Production quantities
Computer Memories	Production quantities
Control Data	Production quantities
Maxtor	Small scale production
Micropolis	Small scale production
Miniscribe	Evaluation units
Priam	Evaluation units
Rodime	Small scale production
Tandon	Small scale production
Vertex Peripherals	Evaluation units

At present, Quantum is among the quantity leaders in this market, with an annualized production rate of just over 25,000 units and a 1983 market share of 10-15%. At Comdex, which began on November 28th, we expect to see a large number of models introduced in the 5.25" 30-100 MB capacity range from the companies mentioned above, as well as other new entrants. Despite the very strong growth forecasted for this capacity segment we expect the field to become increasingly crowded during 1984 and competition to be intense.

Quantum's Strategies

We would describe Quantum's marketing and sales strategies as follows:

- To deemphasize 8" product development, and to allow this form factor to decline in importance to the company as 5.25" shipments increase.

- To emphasize manufacturing cost reductions through large scale production, simplified design, low-cost facilities expansion, component design and off-shore manufacturing while limiting storage capacities to a range that can be reached with its current technology.

- To take advantage of strong customer relationships in 8" drives to become successful in the 5.25" markets.

At present, we estimate that Quantum is shipping 3,500 8" drives of all models per month, and 2,200 5.25" drives. Because of the differences in price per drive, we project that the 5.25" drives, while being 39% of unit production, are currently 35% of revenue. We expect that by the end of Quantum's fiscal 1985 (March), 8" drive production will fall to 1,000-1,500 per month as the markets shrink. Quantum does not intend to try to maintain 8" unit volumes by moving to capacity ranges above the current 85 MB Q2080 drive for a number of reasons, but most importantly, the practical limitations of its technology. In order to increase 8" drive capacities to the 150-300 MB range where competition with 5.25" drives would be avoided for a time, Quantum would require complete product redesign and high-cost drives which do not meet the company's manufacturing philosophy.

Quantum is emphasizing the large scale production of its 5.25" product line, and amplifying the cost advantages that accrue from its simple design by establishing production in Puerto Rico where significant tax savings can be achieved. Production is scheduled to begin in January, and to ramp up during the quarter. At first, only 8" drives will be manufactured, with 5.25" to follow. The most immediate gain will be a reduction in the corporate tax rate, to 30-35% in fiscal 1985 from the 45% tax rate of fiscal 1984. Although labor rates in Puerto Rico are lower than in the U.S., this benefit is not as significant to Quantum as it might be to other manufacturers. Intensive design effort has been put into simplicity of design, utilization of off-the-shelf components, minimal requirements for post-assembly adjustments, and ease of testing, all of which have made labor cost a small fraction of total cost. Quantum can add this expanded capacity at low

capital cost, since it uses innovative clean tunnels, rather than the much more expensive clean rooms.

Quantum is also gaining great success in selling its 5.25" to its existing customer base, as well as adding new customers.

The company lists (as of October 1983) as its major customers:

Altos Computers	Pixel Computer Inc.
Arrow Electronics	ROLM Corporation
Compu Pro	Scientific Micro Systems
Convergent Technologies	Telesis Systems Corporation
Data Systems Design	TeleVideo
Industrial Micro Systems	Wang Laboratories
Nixdorf Computers	Xerox Corporation

Quantum has established very strong relationships with its customers because of the company's high quality and product reliability and competitive pricing, and has achieved a very good reputation within the industry. We expect that the company will be successful in gaining new customers from among the group of over 50 currently evaluating its new products.

Recently, Quantum has begun to ship increasing numbers of its 5.25" drives to Wang, in what we believe is the start of a very major contract. By December, we anticipate that shipments will reach production quantity levels (over 5,000 annual rate), and increase rapidly thereafter. We do not expect public disclosure of this contract for some time, since the utilization of the 5.25" higher capacity form factor Wang would indicate forthcoming new products by Wang.

Also, another development has taken place which could have a very positive impact on Quantum. The company lost out to a start-up, Evotek, in the competition for the very substantial Digital Equipment 5.25" drive contract, then valued at $140 million. Evotek has run into severe and perhaps unsolvable design problems with its drives, and its future is in doubt at least as a disk drive manufacturer although it could be viable as a supplier of plated media. We believe that Digital is currently holding discussions with Quantum about a contract to provide at least a portion of its requirements. Further, we believe that Quantum has a good chance in the competition to supply Digital, but have not included any part of this potential revenue in our earnings forecasts.

Estimated Earnings Per Share

As shown in Table 1, we expect earnings per share to increase 27.9% to $1.10 per share in fiscal 1984 (year ends 3/31) and increase 36.4% to $1.50 in fiscal 1985. This fiscal 1984 estimate is an increase of $0.05 per share over our prior forecast. On a calendar year basis, we expect earnings per share to total $1.01 and $1.42 in calendar 1983 and 1984 respectively, a gain of 40.6%. These forecasts include an assumption of a 35% tax rate in fiscal 1985. We believe that a 30% tax rate is actually just as probable at this point, which would increase fiscal 1985 earnings per share to $1.61 (an increase of 46.4% over fiscal 1984) and to $1.51 for calendar 1984, a gain of 49.5% over calendar 1983.

In order to reach our forecasted revenue for fiscal 1984 and fiscal 1985, we have estimated that the contribution of 5.25" sales will increase from 25-30% of the fiscal 1984 total ($16.5-19.5 million) to 70% in fiscal 1985 ($70 million). We therefore assume a decline in absolute dollars for 8" revenue from a maximum of $45.5 million in fiscal 1984 to $30 million in fiscal 1985, which we believe may prove to be too conservative an assumption. We estimate that revenue could be $10 million above our forecast, and increase earnings at a lesser rate ($0.08-0.10 depending on tax rate) due to the presumed reduced margins on these incremental sales.

As shown in Table 1, we expect gross margins to decline in fiscal 1985 as markets become more competitive, but earnings before income tax to be at a very respectable level (23.0%) because of Quantum's low-cost manufacturing. We have also forecasted a sharp increase in SG&A, which is speculative on our part, but reflects our estimates of increased costs associated with the Puerto Rican facility in its early stages.

Table 1

QUANTUM CORPORATION

Estimated Revenues and Earnings Per Share
($ millions)

(FY Ending 3/31)	1982	1983	1984E	1985E
Net Sales	$ 13.66	$ 41.78	$ 65.00	$ 100.00
Costs of Sales	$ 10.35	$ 23.50	$ 39.20	$ 64.50
Percent	75.8%	56.2%	60.3%	64.5%
Research and Development	$ 0.43	$ 2.42	$ 3.00	$ 4.55
Percent	3.1%	5.8%	4.6%	4.6%
Marketing	$ 1.80	$ 2.69	$ 4.25	$ 6.65
Percent	13.2%	6.4%	6.5%	6.7%
General and Administration	$ 0.85	$ 1.31	$ 2.70	$ 4.85
Percent	6.2%	3.1%	4.2%	4.9%
TOTAL	$ 13.43	$ 29.93	$ 49.15	$ 80.55
Percent	98.4%	71.6%	75.6%	80.6%
Operating Profit	$ 0.22	$ 11.85	$ 15.85	$ 19.45
Percent	1.6%	28.4%	24.4%	19.5%
Net Interest (Exp.)	($0.04)	$ 1.00	$ 3.30	$ 3.55
EBIT	$ 0.19	$ 12.85	$ 19.15	$ 23.00
Percent	1.4%	30.8%	29.5%	23.0%
Prov. for Income Tax	--	$ 5.83	$ 8.60	$ 8.05
Tax Rate	--	45.3%	44.9%	35.0%
Net Income	$ 0.19	$ 7.02	$ 10.55	$ 14.95
Percent	1.4%	16.8%	16.2%	15.0%
E.P.S.	$0.03	$0.86	$1.10	$1.50
Shares O/S (mil)	6.60	8.17	9.60	10.00

SOURCE: Quantum Corporation; Montgomery Securities estimates.

David S. Lawrence

MICROCOMPUTERS & PERIPHERAL EQUIPMENT PROGRESS REPORT

January 25, 1984

QUANTUM
(QNTM - OTC)

Price		Dividend Rate		Earnings	P/S*	P/E	Est 5-Yr Growth	
On 1/24/84	17	Current	--	1983A	$0.86	19.8	Revenues	33%/yr
52-Wk Range	34-15	12/84E	--	1984E	1.10	15.5	Earnings	25%/yr
S&P 400	187.22	Cur Yld	--	1985E	1.50	11.3	Dividend	--

Common Stock Data		Valuation Benchmarks		Book Capitalization - 10/1/83		
Avg Shs	9.5MM	Bk Val/Sh 1984E	$5.63	Long-Term Debt	--	--
Mkt Val	$200MM	Cash Flow/Sh 1984E	1.20	Other	$ 0.3MM	(1%)
Beta	N/AV	Ret Avg 1984E Eq	18.7%	Shareholders' Eq	53.7MM	(99%)
Options	None	Ret Avg 1978-84E Eq	N/AV	Total Capital	54.0MM	(100%)

*Fiscal year ends in March.

SUMMARY AND INVESTMENT CONCLUSION

After establishing an excellent track record in 8-inch disk drives -- it became the number-one supplier in less than three years -- Quantum is making a successful switchover to the faster growing 5¼-inch market; we believe these products will account for at least 25% of its total unit production by the end of this fiscal year (March 1984), and the transition could be completed by fiscal 1986. Meanwhile, sales of the 8-inch line are surprisingly strong.

Thanks to the Company's leading position in the higher capacity niche (around 40-megabytes), the prospects seem good for expansion of its already impressive customer base. Moreover, because this segment is currently one of the more profitable, Quantum's margins should hold up better than the general industry's against the pressures we anticipate over the next several years (see our industry review dated December 9, 1983). We believe the Company's excellent controls will enable it to manage its earnings growth astutely, and, following a dip to a 27% rate of gain this fiscal year because of the product transition, anticipate a 40% increase in fiscal 1985.

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Thus, we consider Quantum, with its strong financial position, one of the more stable and appealing companies in this volatile industry. The problems of other participants could dampen the performance of the whole group, however, so Quantum shares may do no better than the market short term. Nonetheless, we think the stock can be held by long-term investors.

CUSTOMER BASE

Including Wang, Xerox, Altos, Nixdorf, and Rolm, among others, Quantum's customer base is strong, and the Company's higher capacity leadership should help it expand this list. We believe both IBM and Wang are very close to introducing multi-user systems at least as powerful as the NCR First Step. Although IBM may use Computer Memories's drives, we think Wang will give a substantial amount of its high-capacity business to Quantum. In addition, we understand both companies are developing other products that would require large quantities of 40-megabyte (MB) Winchesters.

Longer term, since value-added is high in the larger capacity drive segment, it is most prone to backward integration. We understand IBM is already buying some components for drives of perhaps 30- to 50-MBs using standard ferrite heads and voice-coil motors; thus, its entry into this field could come before the 1986-1987 time-frame many anticipate. Although Quantum has a remote chance of winning some IBM orders, we think such business is not critical to its success and may not be as valuable as some assume. Moreover, since the Company sells to Rolm, in an indirect way it could be viewed as an IBM supplier.

Ulric Weil, Morgan Stanley's EDP analyst, expects Wang to be a survivor in the office automation wars, and it is not known to be planning backward integration. Therefore, a high-capacity supplier relationship with that company may be more solid long term than one with IBM. Although Wang's volumes would probably be smaller than IBM's (an initial contract might involve little more than 30,000 drives for delivery over 18 months), the multiple on earnings derived from a Wang agreement should be higher than that awarded to a high-capacity IBM supplier, in our opinion.

We expect Convergent Technologies (less than 10% of sales, by our estimate) will eventually migrate away to other suppliers. Quantum's drives are designed into the workstation manufacturer's IWS, which is used as either a stand-alone processor or the controller for a cluster of up to 16 units. As Convergent's NGen production begins to take over (starting in the first quarter of this year), its AWS sales will fall off dramatically. However, if customers want to cluster AWS systems with NGens, they would still purchase the IWS. Thus, the decline in sales of this product is likely to be more gradual. Eventually, NGen should dominate Convergent's workstation sales, because

it can be networked with Miniframe as a host processor or used as a stand-alone and it offers significant price/performance advantages. IWS sales could also be hurt by shortages of the 8085 microprocessor (the heart of Convergent's Comm I/O networking processor), which is on the back burner at Intel because of tremendous demand for the 8088/8086 and the 80186.

While Digital Equipment may be willing to stick by Evotek, which beat out Quantum in the original competition for Digital's Winchester business and some other vendor might make inroads into Quantum's customer base, existing prospects, net of defections, appear attractive.

PRODUCT TRANSITION WELL UNDER WAY

We roughly estimate 5¼-inch drives will account for at least 25% of Quantum's total unit volume production by the end of the fiscal fourth quarter (March 1984), or more than 2,000 out of 7,500 units per month. We believe Atasi, Computer Memories, Control Data, and Maxtor are producing at comparable or lower rates.

One of Quantum's advantages is its ability to "mix and match" volumes of different diameter drives so that customers making the transition from 8- to 5¼-inch products, such as Altos, IMS, and Data Systems Design, can obtain price discounts. In spite of the success of Quantum's 5¼-inch line, sales of its 8-inch products could hold up better than anticipated earlier. Seagate's announcement of a 100-MB, fast-access-time, half-height 8-inch drive led to some qualms about the availability of production quantities of high-capacity 5¼-inch Winchesters, and Quantum subsequently encountered unexpected interest in its 85-MB 8-inch. We estimate this product sells for almost $2,000 and carries a gross margin of about 40%.

The important question in this product changeover is how quickly Quantum's gross margin will deteriorate. If the Company can maintain 40% gross margins on its 8-inch business as competitors like Shugart deemphasize this area and if it can achieve 30% on its 5¼-inch products, we estimate gross profitability will fall from the current 40% to 30%. How gracefully Quantum makes this transition depends on the mix it attains between 5¼- and 8-inch drives.

Table 1 shows two possible scenarios. In the first, the ratio reaches 50%/50% by the third quarter of fiscal 1985, and the transition is complete in the early part of calendar 1986. In the second, Seagate's new product (although one observer called it the "reintroduction of the Studebaker") keeps the 8-inch format going a little longer, and the crossover to a 55%/45% ratio is not attained until the first quarter of fiscal 1986. (Because we assume 8-inch products generate more revenue per drive, 50%/50% unit volume would not produce gross margins of exactly 35%).

Table 1

Quantum

Transition to 5¼-Inch Drives -- Two Scenarios

	Scenario 1			Scenario 2		
	Product Ratio		Implied	Product Ratio		Implied
Quarter*	5¼-Inch	8-Inch	Gross Margin	5¼-Inch	8-Inch	Gross Margin
1984						
Third	0 to 10%	90 to 100%	40.0%	0 to 10%	90 to 100%	40.0%
Fourth	20 to 30	70 to 80	39.6	20 to 30	70 to 80	39.6
1985						
First	30%	70%	37.4%	30%	70%	37.4%
Second	40	60	36.5	35	65	36.9
Third	50	50	35.5	40	60	36.5
Fourth	60	40	34.5	45	55	36.0
1986						
First	75%	25%	32.9%	55%	45%	35.0%
Second	85	15	31.8	60	40	34.5
Third	95	5	30.6	65	35	34.0
Fourth	99	1	30.1	75	25	32.9

Assumptions

(1) 5¼-inch gross margin of 30%
(2) 8-inch gross margin of 40%
(3) Average price of 8-inch drives 10% to 25% above that of 5¼-inch

*Fiscal years end in March.

Morgan Stanley Research Estimates

THE HIGH-CAPACITY MARKET

Quantum's niche in the 5¼-inch disk drive market is the higher capacity Winchesters. It offers 20-, 30-, and 40-MB drives (the 40-MB is the most popular), and management expects this segment to grow about 85% annually for the next two years.

The larger capacity market is actually subdivided into a 20- to 40- and a 40-plus-MB market. The higher range is ideal for multi-user micro-

computers, which we believe is the fastest growing segment of the micro market, not including IBM's stand-alone PC. InfoCorp estimates multi-user volume will increase about 38% annually for the next five years. Other market researchers indicate the same or faster growth for a shorter time.

Although multi-user systems may seem a natural fit with huge-capacity drives like the 380-MB behemoth announced by Maxtor, the 40-MB drive appears to be well-positioned for this market now. Mr. Allen Michels, president of Convergent Technologies, believes that clustering of workstations is not yet well understood or practiced (the typical Convergent cluster is only four or five units). Alpha Micro's AM 1000E, which accounts for about 30% of that company sales, is its smallest multi-user product (one to seven users).

We believe the higher capacity market is more profitable and generates more revenues per drive than smaller systems. At the low end, the price of a 10-MB product could drop below $300. A higher capacity drive may sell for as much as three times that amount and carry margins of 30% to 40%, or even more. The gross profit per drive could be well below $100 at the low end and over $300 at the higher end.

Although low-end vendors are cranking up their high-capacity production, it appears that, for now, the larger capacity market could be a good niche for a small company that does not need big unit volume. For a medium to large firm, the low end is still the major segment of the drive market. Quantum expects unit volume of low-capacity drives will grow faster than that of the higher capacity segment over the next two years. It estimates shipments of 5- to 10-MB drives will reach 663,000 in 1983, rising to 2.3-million by 1985. Both numbers appear very low to us. Volume in the higher capacity market of 30- to 100-MBs could expand from 163,000 to 450,000 units, according to Quantum, which seems reasonable to us, assuming IBM does not cause tremendous self-impact on its PC/XT line with its forthcoming "Hercules" product.

Higher Capacity Competitors

We believe Quantum's real challengers in the higher capacity market are Atasi, Computer Memories, Control Data, and, perhaps at some distant point, IBM. Computer Memories (which is being sued by Quantum for patent infringement on a wedge servo it uses in its 6000 series) has or will receive increases in the amount of its contract for 40-MB drives from Alpha-Micro and Integrated Business Systems (a multi-user, multi-processor company). Atasi's 30-MB, 46-MB, and higher capacity drives also put that company in the loosely defined 40-MB range.

Companies offering much higher capacity drives do not compete head-on with Quantum, although there has been overlap with Maxtor's 67-MB drive in some competitive bids. Evotek may be a factor if it can solve production and financial problems. Rodime's 27-MB drive might

Table 1

Quantum

Transition to 5¼-Inch Drives -- Two Scenarios

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Fourth	99	1	30.1	75	25	32.9

Assumptions

(1) 5¼-inch gross margin of 30%
(2) 8-inch gross margin of 40%
(3) Average price of 8-inch drives 10% to 25% above that of 5¼-inch

*Fiscal years end in March.

Morgan Stanley Research Estimates

THE HIGH-CAPACITY MARKET

Quantum's niche in the 5¼-inch disk drive market is the higher capacity Winchesters. It offers 20-, 30-, and 40-MB drives (the 40-MB is the most popular), and management expects this segment to grow about 85% annually for the next two years.

The larger capacity market is actually subdivided into a 20- to 40- and a 40-plus-MB market. The higher range is ideal for multi-user micro-

computers, which we believe is the fastest growing segment of the micro market, not including IBM's stand-alone PC. InfoCorp estimates multi-user volume will increase about 38% annually for the next five years. Other market researchers indicate the same or faster growth for a shorter time.

Although multi-user systems may seem a natural fit with huge-capacity drives like the 380-MB behemoth announced by Maxtor, the 40-MB drive appears to be well-positioned for this market now. Mr. Allen Michels, president of Convergent Technologies, believes that clustering of workstations is not yet well understood or practiced (the typical Convergent cluster is only four or five units). Alpha Micro's AM 1000E, which accounts for about 30% of that company sales, is its smallest multi-user product (one to seven users).

We believe the higher capacity market is more profitable and generates more revenues per drive than smaller systems. At the low end, the price of a 10-MB product could drop below $300. A higher capacity drive may sell for as much as three times that amount and carry margins of 30% to 40%, or even more. The gross profit per drive could be well below $100 at the low end and over $300 at the higher end.

Although low-end vendors are cranking up their high-capacity production, it appears that, for now, the larger capacity market could be a good niche for a small company that does not need big unit volume. For a medium to large firm, the low end is still the major segment of the drive market. Quantum expects unit volume of low-capacity drives will grow faster than that of the higher capacity segment over the next two years. It estimates shipments of 5- to 10-MB drives will reach 663,000 in 1983, rising to 2.3-million by 1985. Both numbers appear very low to us. Volume in the higher capacity market of 30- to 100-MBs could expand from 163,000 to 450,000 units, according to Quantum, which seems reasonable to us, assuming IBM does not cause tremendous self-impact on its PC/XT line with its forthcoming "Hercules" product.

Higher Capacity Competitors

We believe Quantum's real challengers in the higher capacity market are Atasi, Computer Memories, Control Data, and, perhaps at some distant point, IBM. Computer Memories (which is being sued by Quantum for patent infringement on a wedge servo it uses in its 6000 series) has or will receive increases in the amount of its contract for 40-MB drives from Alpha-Micro and Integrated Business Systems (a multi-user, multi-processor company). Atasi's 30-MB, 46-MB, and higher capacity drives also put that company in the loosely defined 40-MB range.

Companies offering much higher capacity drives do not compete head-on with Quantum, although there has been overlap with Maxtor's 67-MB drive in some competitive bids. Evotek may be a factor if it can solve production and financial problems. Rodime's 27-MB drive might

qualify for a small multi-user system like Fortune, but we think the larger market is for its 40- and 53-MB products, which have not yet proven themselves, especially with customers like Wicat.

Quantum, Atasi, and Computer Memories appear to be well-situated in the higher capacity market. Quantum needs to augment the Wang business it expects to receive with orders from other customers with greater assurance of survival than IMS and Sage, for example. Atasi should probably bring its costs down, although its product's 30-millisecond access time might win some business it would otherwise lose to cheaper and slower units. We do not think the recent termination of this company's proposed merger with Seagate is a critical impediment to its prospects, although a combined entity might have had better marketing and production capabilities than Atasi has alone.

Computer Memories must successfully defend itself against the Quantum lawsuit. Although it claims it did not know that Quantum had or was applying for a patent on the disputed "wedge" servo, Quantum has countercharged that Mr. Irwin Rubin, now board chairman of Computer Memories, gained relevant information while at Sensor Technology, which was being qualified to supply a component to Quantum. (Details of Computer Memories's defense and Quantum's countersuit are not available for public comment.) We believe Quantum's law firm, Lyon and Lyon, is quite competent in infringement matters. To date, no customers have shown reluctance to purchase Computer Memories's product.

Control Data must battle a bureacratic and inflexible marketing approac Although this company has spent significant funds on R&D, embarrassment like its withdrawal of a 6-MB, 3.5-inch drive underscore its apparent lack of understanding of the nuances of the rapidly changing low-end Winchester drive industry. Although one could argue that its SMD interface experience should give it a distinct advantage, it seems that Control Data will merely be a competitor, not a dominant factor.

FINANCIAL

Quantum's cash flow is quite healthy, particularly compared with Tandon's. Potential financial problems in its customer base are small or slow-developing. We believe Ohio Scientific and Vector Graphic, two troubled microcomputer manufacturers, owe the Company less than $100,000 in total. Because the former was recently acquired and the latter has received some financing, we doubt any surprises like Tandon's $12-million receivables write-down are lurking in Quantum's balance sheet. The recent addition of several smaller customers, such as Sage and IMS, will probably stretch out the Company's receivables figure of 40- to 45-days outstanding to perhaps 50 days, but we do not consider this serious. (Even after the $12-million write-down of Victor Technologies's receivables, Tandon's outstanding position is still over 75

Table 2

Quantum

Income Statement Comparisons*

	1984E						
	First Quarter A	Second Quarter A	Third Quarter	Fourth Quarter	Full Year	1985E	1985E/1984E Change
Sales	$12,473	$15,143	$17,250	$20,500	$65,366	$110,000	+ 68.3%
Cost of Goods Sold	$ 7,485	$ 9,074	$10,436	$12,520	$39,515	$ 70,400	+ 78.2%
% of Sales	60.0%	59.9%	60.5%	61.1%	60.5%	64.0%	
Gross Profit	$ 4,988	$ 6,069	$ 6,814	$ 7,980	$25,851	$ 39,600	+ 53.2%
% of Sales	40.0%	40.1%	39.5%	38.9%	39.5%	36.0%	
SG&A	$ 1,244	$ 1,684	$ 1,900	$ 2,200	$ 7,028	$ 12,500	+ 77.9%
% of Sales	10.0%	11.1%	11.0%	10.7%	10.8%	11.4%	
Research & Development	$ 770	$ 702	$ 750	$ 800	$ 3,022	$ 6,700	+121.7%
% of Sales	6.2%	4.6%	4.3%	3.9%	4.6%	6.1%	
Operating Profit	$ 2,974	$ 3,683	$ 4,164	$ 4,980	$15,801	$ 20,400	+ 29.1%
% of Sales	23.8%	24.3%	24.1%	24.3%	24.2%	18.5%	
Interest Income	$ 798	$ 834	$ 800	$ 750	$ 3,182	$ 2,000	- 37.1%
% of Sales	6.4%	5.5%	4.6%	3.7%	4.9%	1.8%	
Pretax Profit	$ 3,772	$ 4,517	$ 4,964	$ 5,730	$18,983	$ 22,400	+ 18.0%
% of Sales	30.2%	29.8%	28.8%	28.0%	29.0%	20.4%	
Taxes	$ 1,698	$ 2,032	$ 2,234	$ 2,650	$ 8,614	$ 7,680	- 10.8%
% of Sales	13.6%	13.4%	13.0%	12.9%	13.2%	7.0%	
Tax Rate	45.0%	45.0%	45.0%	46.2%	45.4%	34.3%	
Net Income	$ 2,074	$ 2,485	$ 2,730	$ 3,080	$10,369	$ 14,720	+ 42.0%
% of Sales	16.6%	16.4%	15.8%	15.0%	15.9%	13.4%	
Earnings Per Share	$ 0.22	$ 0.26	$ 0.29	$ 0.32	$ 1.09	$ 1.53	+ 40.3%
Avg. Shares Outst. (thousands)	9,517	9,505	9,520	9,590	9,533	9,650	+ 1.2%

*Fiscal years end in March.

A = Actual
E = Morgan Stanley Research Estimates

days, despite the fact that about 50% of its sales are going to IBM, a net-30 payer unless an invoice reconciliation or processing cycle is missed.)

Inventory turn will probably remain at 4.0, as the Company increases its stocks of raw materials to avoid further shortages in heads or other critical components, but the finished goods inventory is likely to fall as demand, especially for 5¼-inch products, outstrips supply by a wide margin.

As shown in Table 2, we anticipate revenues will approximate $66-million for fiscal 1984, up 56% from the year-earlier figure. Interest income will be substantially higher both in that year and in 1985 as a result of the late-1982 equity offering. We assume Quantum will spend $10-million to add manufacturing space in Puerto Rico. Our earnings per share estimate for this year is $1.09, an increase of 27% from the $0.86 reported for fiscal 1983.

For fiscal 1985, we forecast sales of $110-million. We expect the Company's gross margin to fall from an estimated 39.5% in 1984 to 36.0% and operating profitability, from 24.2% to 18.5%. However, as a result of the expanded manufacturing operations in the tax haven of Puerto Rico, Quantum's taxe rate should drop from the 45.4% anticipated for 1984 to 34.3%, and we estimate net profitability will be 13.4% versus 15.9% for the prior year and earnings per share $1.53, a 40% year-to-year gain.

David K. Moy
(212) 974-4440
January 25, 1984

Quantum

Statistical Summary
($ Thousands Except Per Share Data)

Fiscal Year[a]	Sales	Pretax Earnings	Pretax Margin	Tax Rate	Return on Avg. Equity	Earnings Per Share	Price Range	P/E Range
1981	--	-$ 1,769	NM	--	NA	-$1.50	--	--
1982	$13,656	186	0.4%	--	4.6%	0.03	--	--
1983	41,779	12,852	29.8	45.3%	26.7	0.86	21-19	700-633
1984E	65,366	18,983	29.0	45.0	16.2	1.09	34-16	40-18[b]

E = Morgan Stanley Research Estimates
NM = Not Meaningful
NA = Not Applicable

[a]Ends in March

[b]Year to date

Summary Balance Sheet
(October 1, 1983; $ Thousands)

Cash and Equivalents	$21,306
Receivables	7,250
Inventories	7,935
Other	248
Current Assets	$36,739
Net Plant and Equivalent	5,727
Other	19,247
Total Assets	$61,713
Current Liabilities	$ 7,705
Deferred Income Taxes	329
Stockholders' Equity	53,679
Total Liabilities and Stockholders' Equity	$61,713

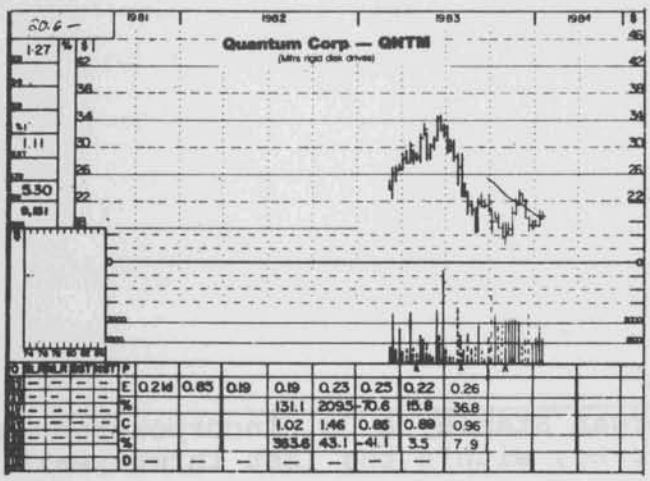


Chart courtesy of
The Mansfield Stock Chart Service

Morgan Stanley & Co. Incorporated comanaged the most recent public offering, within the last three years, of the securities of Quantum.

Morgan Stanley & Co. Incorporated makes a market in the securities of Computer Memories, Hercules, IMS International, Intel, Quantum, Rodime, Tandon, and Xerox.

Morgan Stanley & Co. Incorporated has a trading position in the securities of Control Data, Digital Equipment, IBM, NCR, Wang Laboratories, and Xerox.

Morgan Stanley & Co. Incorporated holds options in the securities of Digital Equipment, IBM, NCR, Wang Laboratories, and Xerox.

CUSTOMERS

COMPETITION

MARKET

PRODUCTS

QUANTUM
MAJOR CUSTOMERS

	8"	5¼"
Altos Computers	X	X
Arrow Electronics	X	X
Bull Sems	X	X
Charles River Data	X	X
CompuPro		X
Convergent Technologies	X	
Data Systems Design	X	X
Industrial Micro Systems	X	X
Nixdorf Computers	X	
Pixel Computer Inc.	X	X
Rolm Corporation	X	
Scientific Micro Systems	X	X
Siemens		X
TeleVideo	X	
Wang Laboratories	X	X
XEROX Office Products Division	X	

PRODUCTS

MARKET

COMPETITION

PRODUCT HISTORY

- First product: Q2000
  - — 10, 20, 30, 40 MB Winchester disk drives
  - — First units shipped in September 1980
  - — Now the best selling 8" OEM Winchester disk drive

- New products announced Fall 1982
  - — 5¼", 20, 30, 40 MB drives: Q500
  - — 8", 85 Mb drive: Q2080

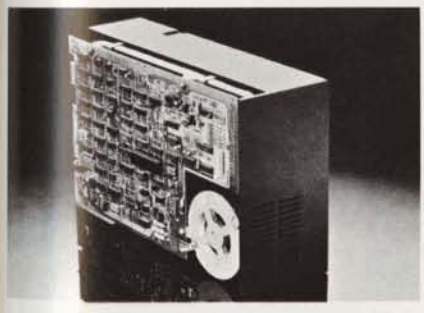
QUANTUM

Quantum 2000 series low-cost 8-inch fixed disk drives

The Quantum 2000 series is a family of 10-, 20-, 30- and 40-megabyte 8-inch fixed disk drives in an 8-inch floppy-size package. These reliable Winchester drives provide OEMs with a low-cost upgrade of floppy disk and lower-capacity Winchester-based systems.

Q2000 drives are fully compatible with the current industry-standard 8-inch Winchester drives, yet provide two to four times the storage capacity, at a lower cost per megabyte.

The higher capacity and low cost are the result of a new track positioning system. Quantum uses a rotary moving coil actuator and temperature compensation servo instead of a conventional stepper motor actuator. This provides twice the track density and per-disk capacity, without increasing cost.



Power supply and mounting requirements are fully compatible with industry-standard 8-inch floppy drives. Drive control and data signals use the same pin assignments as compatible floppy drives, allowing daisy-chaining of fixed and floppy drives.

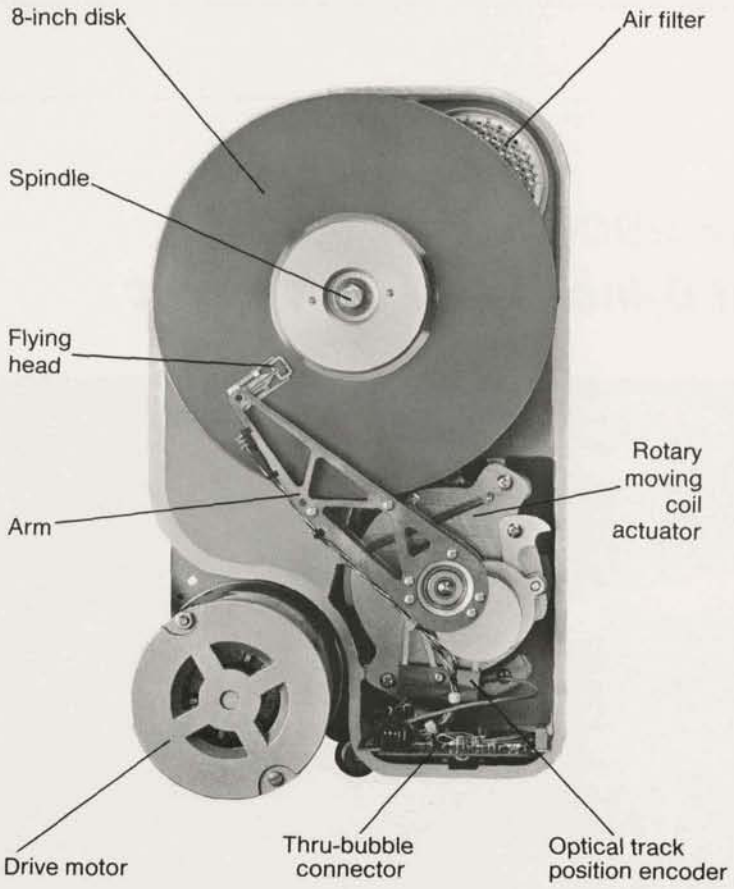
DC voltage requirements are identical to those for standard floppy drives and data cartridge streamers. The same power supply can be used with Quantum 2000 and various back-up drive options.

Key Features

- 10.7, 21.3, 32.0 and 42.7 megabyte (unformatted) storage capacities
- Full interface, format and power supply compatibility with the current industry-standard 8-inch Winchester drives
- Physical dimensions and mounting holes identical to those of standard 8-inch floppy disk drives
- Lowest-cost fixed disk drives in the 10- to 40-megabyte capacity range
- 4.34 megabits per second transfer rate
- Available in AC or DC power options
- Proven Winchester head and media technology
- Rotary moving coil actuator with temperature compensation servo
- Faster access times than stepper motor actuator drives
- Fail-safe head landing and shipping zone
- Half the heat dissipation of comparable drives
- Microprocessor control for drive logic and positioner system—includes self-diagnostics

New DC Motor Option

Q2000 8-inch fixed disk drives



Recording Media
- Winchester lubricated magnetic iron oxide coating on a 200mm diameter aluminum substrate
- 5.33 megabytes of data per disk surface
- 512 tracks per disk surface

Read/Write Heads
- Winchester (IBM 3340) type flying heads
- Low mass/low load force
- Reliable contact start/stop operation
- Heads return to a "fail-safe landing zone" during power-off and shipping

Air Filtration System
- Disks and read/write heads fully sealed in clean air chamber
- Recirculating air system with absolute filter
- Absolute breather air filter permits pressure equalization with ambient air without contamination

Rotary Moving Coil Actuator
- Pure torque motor with balanced forces to maximize bearing life
- Simple construction
  - —Ring magnet and two flat-plate magnetic structure
  - —Single-plane moving coil
  - —Two-bearing structure
  - —Two-phase driver electronics
- Statically-balanced structure for high mechanical stability and maximum vibration resistance
- Low power consumption
- Average access time up to 20% faster than stepper motor actuators

Optical Track Position Encoder
- Track positioning resolution better than 40 microinches
- Reliable glass reticle/LED/photodiode technology

Temperature Compensation Servo
- Direct track position feedback from disk surface
- Transparent to controller and host system
- Track location coding embedded between last inter-record gap and index pulse
- Microprocessor-controlled calibration of optical track position reference from servo feedback once each revolution

Specifications

Performance Specifications

	Q2010	Q2020	Q2030	Q2040
Capacity				
Unformatted				
per drive	10.66 Mb	21.33 Mb	32.00 Mb	42.66 Mb
per surface	5.33 Mb	5.33 Mb	5.33 Mb	5.33 Mb
per track	10.40 Kb	10.40 Kb	10.40 Kb	10.40 Kb
Formatted (MFM)				
per drive	8.40 Mb	16.80 Mb	25.20 Mb	33.20 Mb
per surface	4.20 Mb	4.20 Mb	4.20 Mb	4.20 Mb
per track	8.20 Kb	8.20 Kb	8.20 Kb	8.20 Kb
per sector	256 bytes	256 bytes	256 bytes	256 bytes
sectors/track	32	32	32	32
Transfer rate	4.34 Mbits/sec	4.34 Mbits/sec	4.34 Mbits/sec	4.34 Mbits/sec
Access time*				
Track to track	15 ms	15 ms	15 ms	15 ms
Average	55 ms	60 ms	60 ms	65 ms
Maximum	100 ms	100 ms	100 ms	105 ms
Avg. latency	10 ms	10 ms	10 ms	10 ms

Functional Specifications

	Q2010	Q2020	Q2030	Q2040
Rotational speed	3000 RPM	3000 RPM	3000 RPM	3000 RPM
Recording density	6600 bpi	6600 bpi	6600 bpi	6600 bpi
Flux density	6600 fci	6600 fci	6600 fci	6600 fci
Track density	345 tpi	345 tpi	345 tpi	345 tpi
Cylinders	512	512	512	512
Tracks	1024	2048	3072	4096
Read/Write heads	2	4	6	8
Disks	1	2	3	4
Index	1	1	1	1

*Typical at nominal temperature and power

Physical Specifications

Environmental limits
- Ambient temperature = 50° to 115°F (10° to 46°C)
- Relative humidity = 8% to 80%
- Maximum wet bulb = 78° non-condensing

AC power requirements (AC power option only)
- 50/60 Hz ± 0.5 Hz
- 100/115 VAC installations = 90–127V at 1.0A typical
- 200/230 VAC installations = 180–253V at 0.5A typical

DC voltage requirements
- +24 VDC ± 10% 3.0A typical (DC power option only)
- +24 VDC ± 10% 1.25A typical (AC power option only)
- +5 VDC ± 5% 1.0A typical
- −5 VDC ± 5% (−7 to −16 VDC optional) 0.2A typical

Mechanical dimensions
- Height = 4.50 in. (114.3 mm)
- Width = 8.55 in. (217.2 mm)
- Depth = 14.25 in. (362.0 mm)
- Weight = 17 lbs. (7.7 Kg)

Heat dissipation = 235 BTU/hour typical (70 watts)

Reliability Specifications

MTBF: 8,000 POH typical usage
PM: not required
MTTR: 30 minutes
Component ife: 5 years
Error rates:
- Soft read errors: 1 per 10^{10} bits read
- Hard read errors: 1 per 10^{12} bits read
- Seek errors: 1 per 10^{6} seeks

QUANTUM

Quantum Corporation
Corporate Headquarters: 1804 McCarthy Blvd., Milpitas, CA 95035
(408) 262-1100 TWX 910-338-2203
Eastern Region Sales Office: (603) 893-2672
Western Region Sales Office: (408) 980-8555

QUANTUM

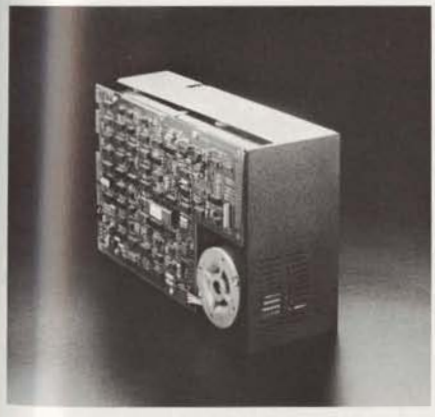
Quantum Q2080™ low-cost, 85 megabyte, fixed disk drive.

The Quantum Q2080™ is the latest addition to the Q2000™ family of low-cost, 8-inch fixed disk drives, and is fully compatible with the other 10-, 20-, 30- and 40-megabyte Q2000 products available.

The Q2080 has a capacity of 85 megabytes in an 8-inch floppy-sized package, and has an average access time of 40 milliseconds.

Like the other members of the Q2000 family, the Q2080 uses the industry standard interface to take advantage of the wide availability of low-cost controllers and multiple sources of supply.

All Q2000 Series products are available in either an AC power version or a DC power version.



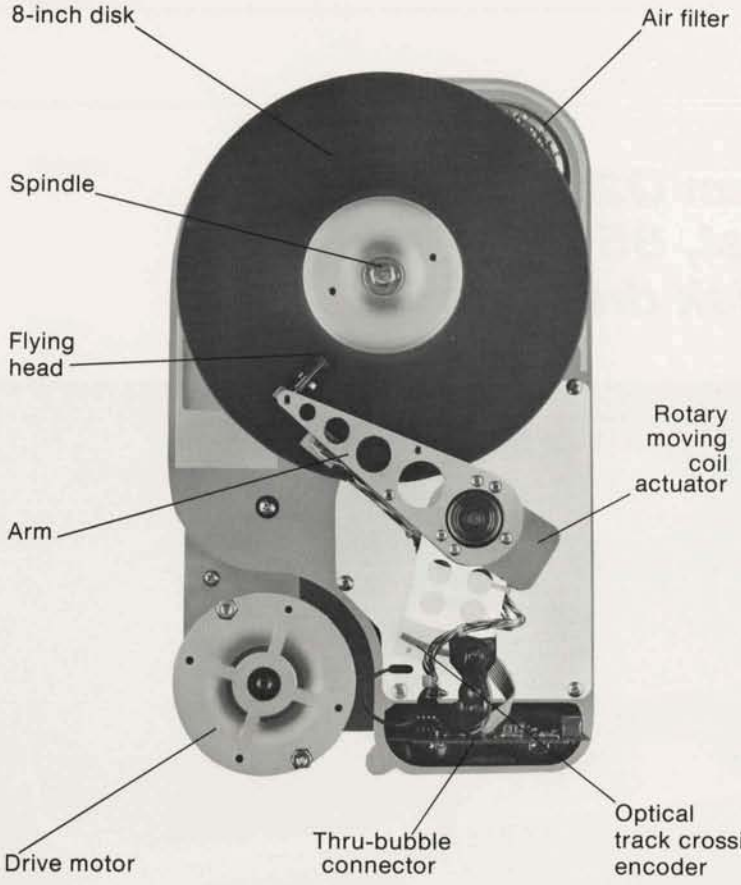
Mounting requirements are fully compatible with industry-standard 8-inch floppy drives. Drive control and data signals use the same pin assignments as compatible floppy drives, allowing daisy-chaining of fixed and floppy drives.

Key Features

- 85.45 megabyte (unformatted) storage capacity
- Full interface and format compatibility with the current industry-standard 8-inch Winchester drives
- Physical dimensions and mounting holes identical to those of standard 8-inch floppy disk drives
- Lowest-cost 85 Mb fixed disk drives
- 4.34 megabits per second transfer rate
- Available in AC or DC power options
- Proven Winchester head and media technology
- Rotary moving coil actuator
- 40 millisecond average access time
- Fail-safe head landing and shipping zone
- AIRLOCK™—automatic shipping lock*
- Microprocessor control for drive logic and positioner system—includes self-diagnostics

85 Mb capacity / 40 ms average access time

Q2080 8-inch fixed disk drive



Recording Media
- Winchester lubricated magnetic oxide coating on a 200mm diameter aluminum substrate
- 12.21 megabytes of data per disk surface
- 1172 tracks per disk surface

Read/Write Heads
- Winchester (IBM 3340) type flying heads
- Low mass/low load force
- Reliable contact start/stop operation
- Heads return to a "fail-safe landing zone" during power-off and shipping

Air Filtration System
- Disks and read/write heads fully sealed in clean air chamber
- Recirculating air system with absolute filter
- Absolute breather air filter permits pressure equalization with ambient air without contamination

Rotary Moving Coil Actuator
- Pure torque motor with balanced forces to maximize bearing life
- Simple construction
  - —Dual ring magnet/return plate magnetic structure
  - —Single-plane moving coil
  - —Two-bearing structure
- Statically-balanced structure for high mechanical stability and maximum vibration resistance

Optical Track Crossing Encoder
- Reliable glass reticle/LED/photodiode technology

Closed Loop Servo System
- Direct track position feedback from disk surface
- Transparent to controller and host system
- Microprocessor-controlled servo system

Specifications

Performance Specifications

Capacity	85.45 Mb
Unformatted	
per drive	85.45 Mb
per surface	12.21 Mb
per track	10.42 kb
Formatted (MFM)	
per drive	67.41 Mb
per surface	9.60 Mb
per track	8.20 kb
per sector	256 Bytes
sectors/track	32
Transfer rate	4.34 Mbits/sec.
Access time*	
Track to track	10 ms
Average	40 ms
Full stroke	75 ms
Avg. latency	10.0 ms

Functional Specifications

Rotational speed	3000 RPM
Recording density	6600 bpi
Flux density	6600 fci
Track density	789 tpi
Cylinders	1172
Tracks	8204
Data heads	7
Servo heads	1
Disks	4
Index	1

*Access time values are typical at nominal temperature and voltage.

Physical Specifications

Environmental limits
- Ambient temperature = 50° to 115°F (10° to 46°C)
- Relative humidity = 8% to 80%
- Maximum wet bulb = 78° non-condensing

AC power requirements (AC power option only)
- 50/60 Hz ±0.5 Hz
- 100/115 VAC installations = 90-127V at 1.0A typical
- 200/230 VAC installations = 180-253V at 0.5A typical

DC voltage requirements
- +24 VDC ±10% 3.75A typical (DC power option only)
- +24 VDC ±10% 2.0A typical (AC power option only)
- +5 VDC ± 5% 1.0A typical
- −5 VDC ± 5% (−7 to −16 VDC optional) 0.2A typical

Mechanical dimensions
- Height = 4.50 in. (114.3 mm)
- Width = 8.55 in. (217.2 mm)
- Depth = 14.25 in. (362.0 mm)
- Weight = 17 lbs. (7.7 kg)

Heat dissipation = 320 BTU/hour typical (95 watts)

Reliability Specifications

MTBF: 8,000 POH typical usage
PM: not required
MTTR: 30 minutes
Component life: 5 years
Error rates
- Soft read errors: 1 per 10^{10} bits read
- Hard read errors: 1 per 10^{12} bits read
- Seek errors: 1 per 10^{6} seeks

*Patent pending safety latch feature protecting Quantum disk drives.

*Q2000, Q2080 and AIRLOCK are trademarks of Quantum Corporation.

QUANTUM

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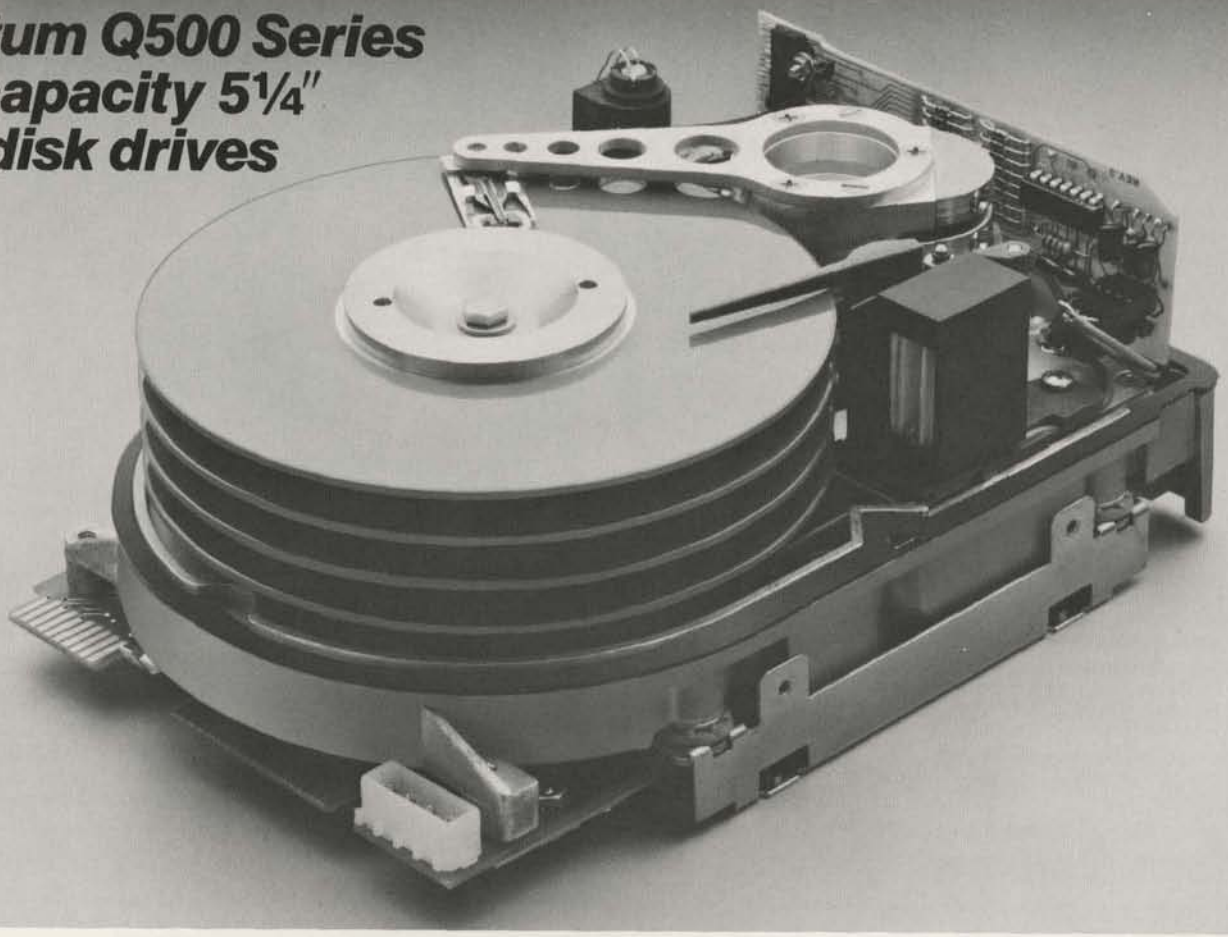
QUANTUM

Quantum Q500 Series high capacity 5¼" fixed disk drives



A compatible, cost-effective upgrade

These reliable 20-, 30- and 40-megabyte Winchesters are the cost-effective way to upgrade from floppy or lower-capacity Winchester disk drives. They fit within the standard 5¼" disk drive envelope, and are fully compatible with Winchester industry standards for electrical interface, power requirements and mounting.

Like all Quantum disk drives, the Q500 series offers the economy inherent in simple, clean, highly manufacturable design based on proven technology. And because the Q500™ is compatible with the industry standard ST506/412 interface, it can be integrated with any number of low-cost controllers.

High-volume availability

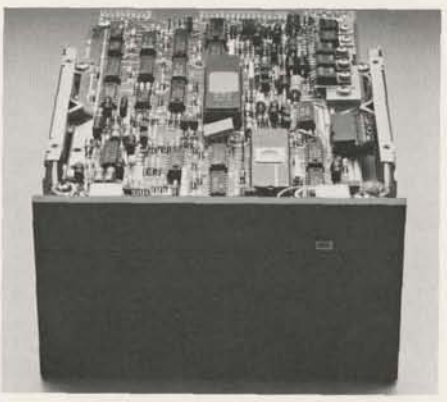
Quantum, the leading high-volume supplier in 8" disk drives, can confidently promise the same high-volume availability for our 5¼" products. As many as you need, when you need them.

Consistently High Quality

We can also promise, based on the record, that the disk drives we deliver, in whatever quantities you order, will perform consistently well. The head positioning system, evolved from the rotary torque actuator used in our Q2000™ 8" drives, enables the Q500 to achieve higher capacity and much faster access times than stepper motor drives.

Key Features:

- Competitively priced high capacity drives (21.33, 31.99 and 42.66 megabyte unformatted storage)
- High volume availability
- Consistently high quality
- Full interface, format and power supply compatibility with ST506/412 standards
- Physical dimensions and mounting holes identical to ST506/412 and standard 5¼" floppy disk drives
- 5.0 megabits per second transfer rate
- Proven Winchester head and media technology
- Rotary moving coil actuator with temperature compensation servo



- Faster access time than stepper motor drives
- Head landing zone for shipping and storage
- AIRLOCK™ automatic mechanical shipping lock (patent pending)

Recording Media
- Standard Winchester lubricated magnetic iron oxide coating on a 130 mm diameter aluminum substrate

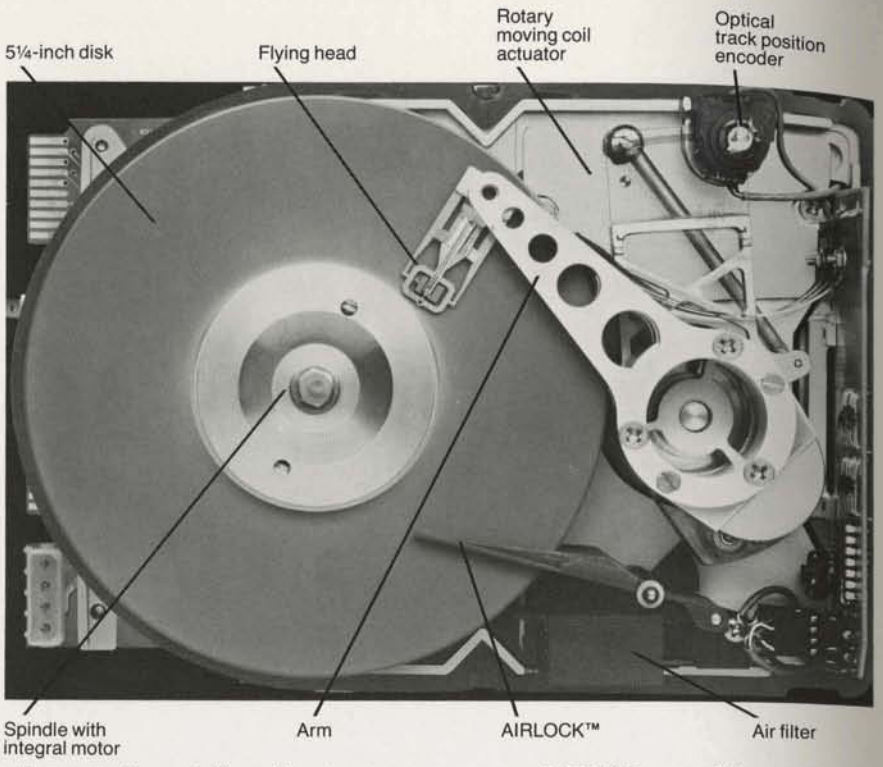
Read/Write Heads
- Monolithic manganese zinc Winchester (IBM 3350) heads
- Low mass/low load force design
- Reliable contact start/stop operation
- Heads automatically return to a landing zone during power-off and shipping

Air Filtration System
- Disks and read/write heads fully sealed in clean air chamber
- Recirculating air system with internal filter
- Absolute breather filter permits pressure equalization without contamination

Rotary Moving Coil Actuator
- Pure torque motor with balanced forces to maximize bearing life
- Simple construction
  - —Ring magnet segments with two flat-plate magnetic structure
  - —Single-plane moving coils
  - —Two-bearing structure
- Statically-balanced structure for high mechanical stability and maximum vibration resistance
- Low power consumption
- Average access time half that of stepper motors

Optical Track Position Encoder
- Provides lowest cost, reliable servo system
- Reliable glass reticle/LED/photodiode technology

Temperature Compensation Servo
- Direct track position feedback from one disk surface



- Transparent to controller and host system
- Track location coding embedded between last inter-record gap and index pulse
  - —Data rate, track capacity and unrestricted format the same as ST506/412
  - —ST506/412 compatibility retained by increasing flux reversal density and reducing rotational speed
- Microprocessor-controlled optical servo system is updated once per revolution from the disk

Specifications

Functional Specifications

	Q520	Q530	Q540
Storage Capacity			
Unformatted	21.33	31.99	42.66 Mb
Formatted	16.80	25.20	33.60 Mb
Data Tracks	2048	3072	4096
Disks	2	3	4
Data Surfaces	4	6	8
Read/Write Heads	4	6	8
Capacity per Surface			
Unformatted		5.33 Megabytes	
Formatted		4.20 Megabytes	
Capacity per Track			
Unformatted		10,416 Bytes	
Formatted		8,192 Bytes	
Capacity per Sector		256 Bytes	
Sectors per Track		32	
Transfer Rate		5.0 Megabits/second	
Rotational Speed		3529 rpm, ±1%	
Recording Density		9200 bpi	
Flux Density		9200 fci	
Track Density		591 tpi	
Cylinders		512	
Index		1	
Access Time		Typical Values (msec)	
Track-to-Track		10	
Average		45	
Full Stroke		80	

Access times specified at the minimum buffered step time of 3 μsec per step pulse.
Typical values are measured at nominal steady state temperatures and voltages.

Reliability Specifications

MTBF: 10,000 POH, typical usage
Preventive Maintenance: Not required
MTTR: 30 minutes
Component design life: 5 years

Error rates:
Soft read errors: 1 per 10^{10} bits read
Hard errors: 1 per 10^{12} bits read
Seek errors: 1 per 10^{6} seeks

Physical Specifications

Environmental Limits	Operating	Non-Operating
Ambient Temperature	10°C to 50°C (50°F to 122°F)	−40°C to 66°C (−40°F to 151°F)
Relative Humidity*	8% to 80%	
Maximum Wet Bulb*	26°C (78°F)	46°C (115°F)
Altitude	2.4 km (8000 ft.)	9.1 km (30,000 ft.)
Temp. Gradient	11°C/hr (20°F/hr)	20°C/hr (36°F/hr)

Nominal Mechanical Dimensions
Height 3.25 inches (82.55 mm)
Width 5.75 inches (146.05 mm)
Depth 8.05 inches (204.47 mm)
Weight 7 pounds (3.18 kg)

Power Requirements
+12VDC ± 10%
Typical Currents: 1.2A not seeking; 2.0A seeking.
Maximum Running Currents: 1.5A not seeking; 2.4A seeking.
Maximum Motor Starting Current: 4.5A not to exceed 14 seconds.
+5VDC ± 5%, 0.7A typical, 1.0A maximum
Ripple
5V: 50mV peak-to-peak
12V: 100mV peak-to-peak
Power Sequencing: None required.

Heat Dissipation
Typical: 23W (79 BTU/hr)
Determined using nominal voltages and currents and with a 50 percent seek duty cycle.
Maximum: 31W (106 BTU/hr)
Determined using a 50 percent seek duty cycle and maximum voltages and worst case currents.
Worst Case: 37W (126 BTU/hr)
Determined using maximum voltages, worst case currents and continuous seeking.

*Without condensation
Specifications subject to change without notice.

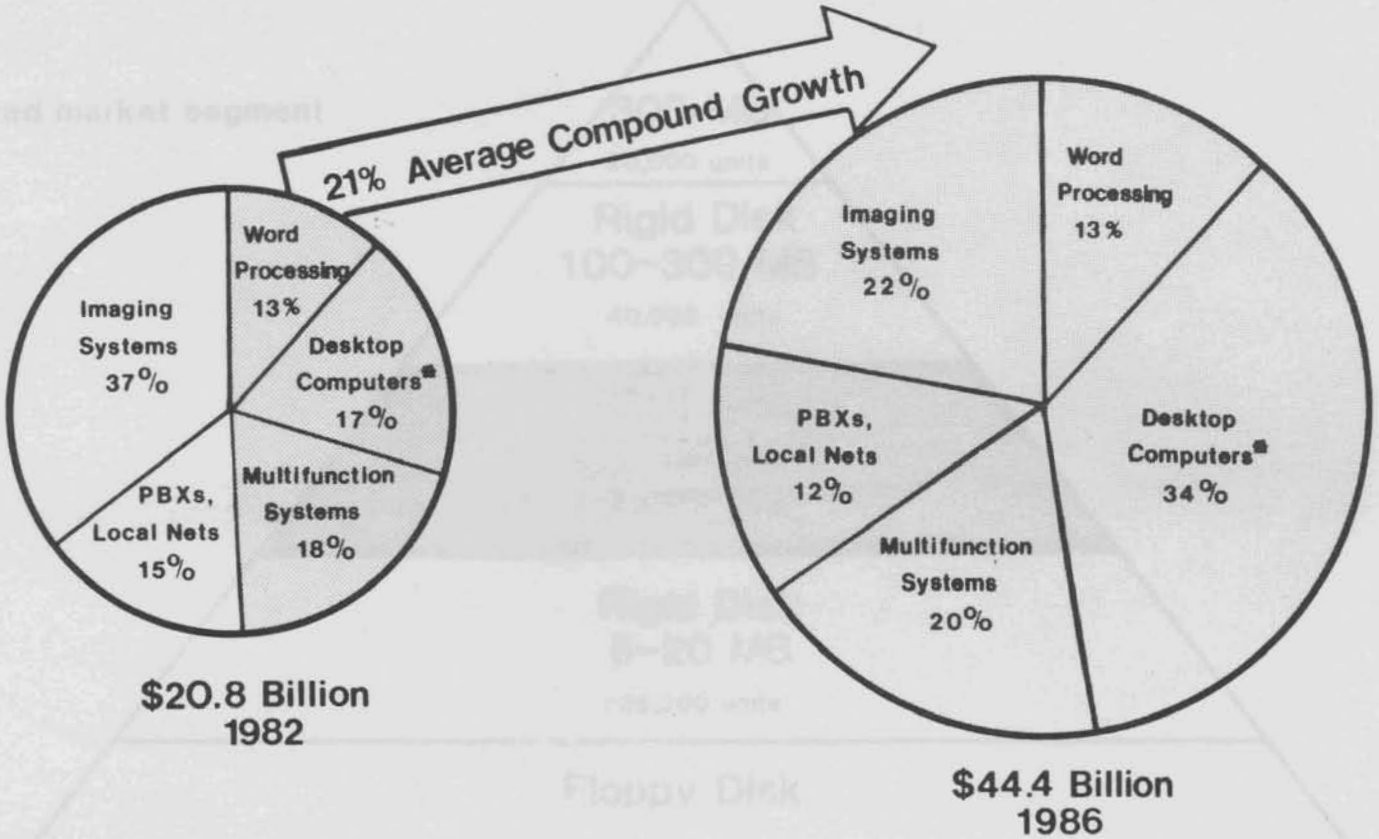
QUANTUM

Quantum Corporation
Corporate Headquarters: 1804 McCarthy Blvd., Milpitas, CA 95035
(408) 262-1100 TWX 910-338-2203
Eastern Regional Sales Office: (603) 893-2672
Western Regional Sales Office: (408) 980-8555
International Sales Office: (408) 262-1100

003 11/83 10M

U.S. OFFICE AUTOMATION MARKET

(U.S.-Based vendors only)



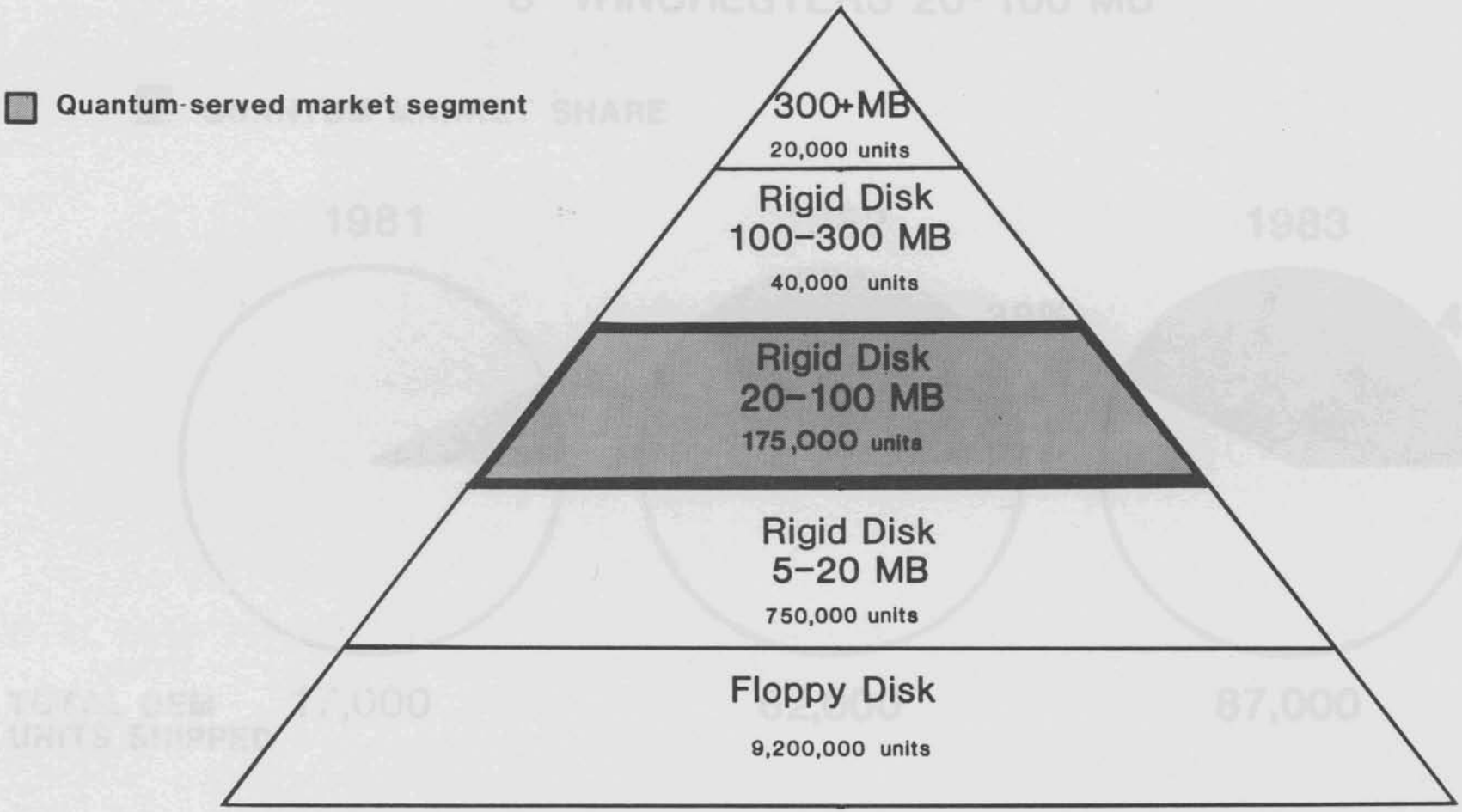
☐ Quantum-served market segments

*Business & Professional only

Source: IDC

THE STORAGE PYRAMID

UNFORMATTED CAPACITIES, ALL FORM FACTORS

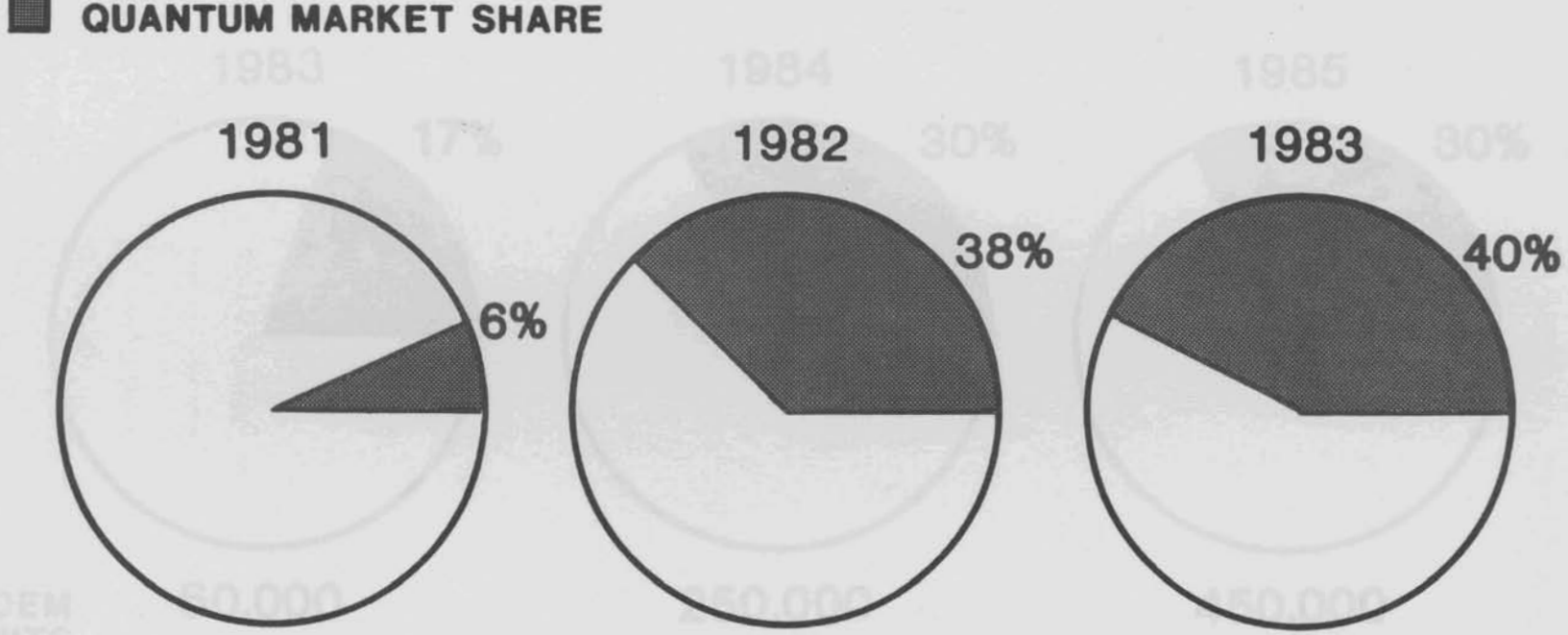


ESTIMATED OEM SHIPMENTS 1983

SOURCE: QUANTUM Market Research

QUANTUM'S MARKET LEADERSHIP

8" WINCHESTERS 20-100 MB



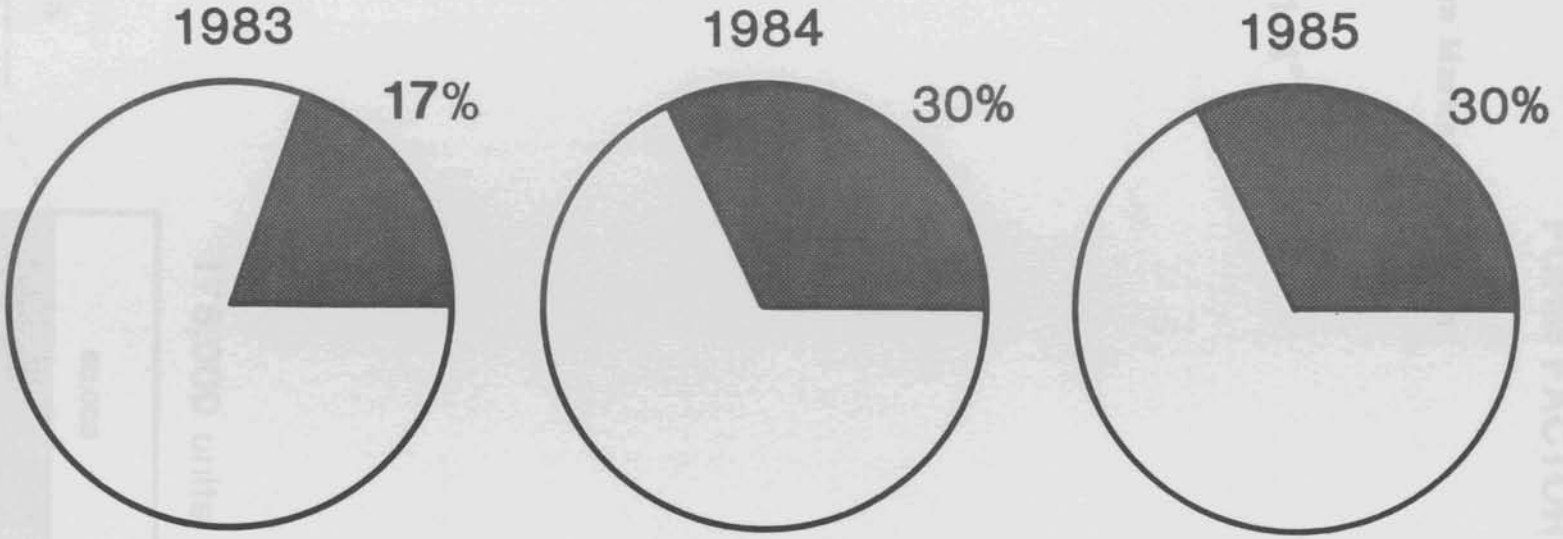
SOURCE: QUANTUM Market Research

QUANTUM'S TARGETED MARKET SHARE

5 1/4" WINCHESTERS 20–100 MB

(Includes half-height products)

QUANTUM MARKET SHARE

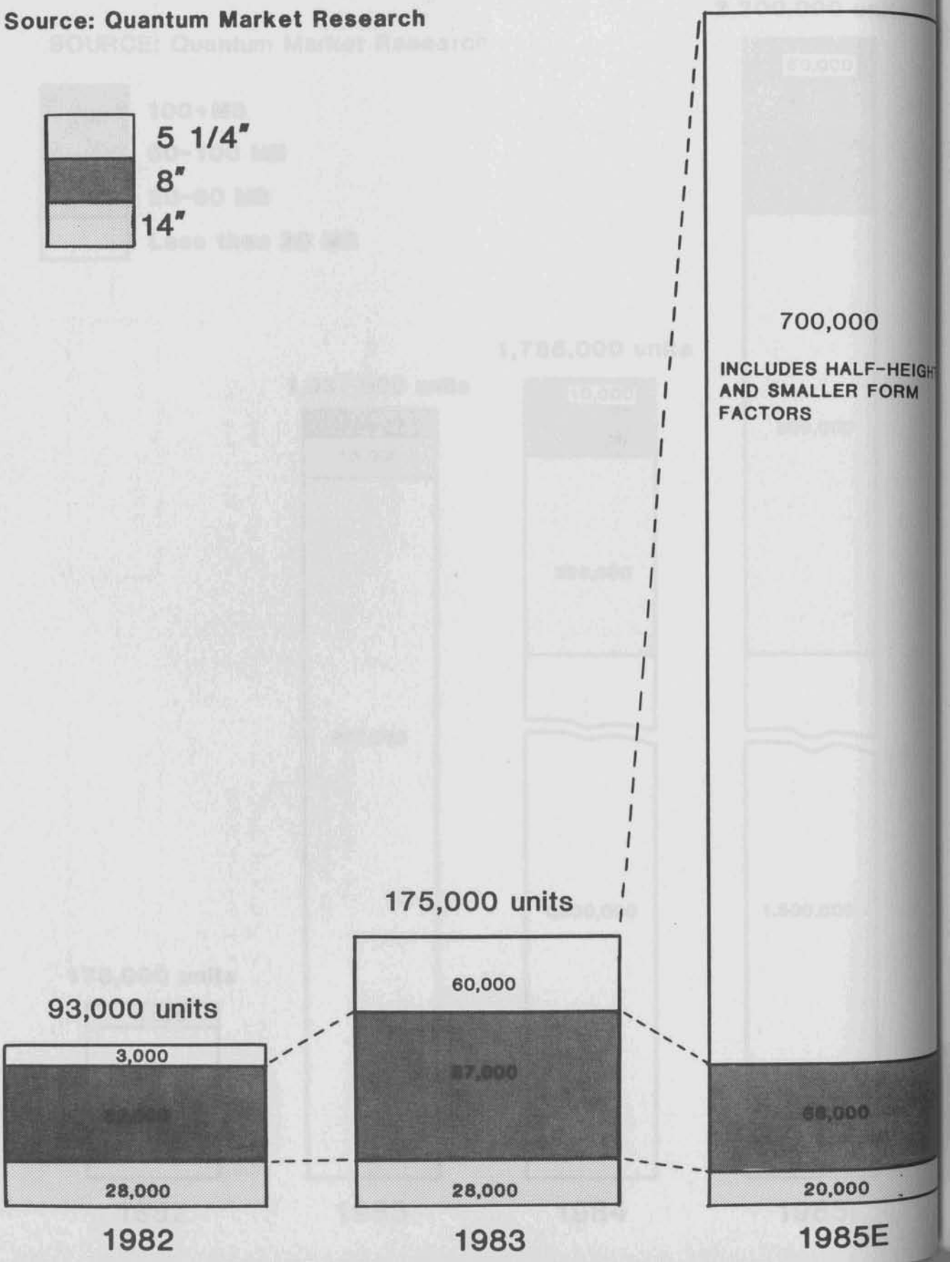


	1983	1984	1985
TOTAL OEM UNITS	60,000	250,000	450,000

SOURCE: QUANTUM Market Research

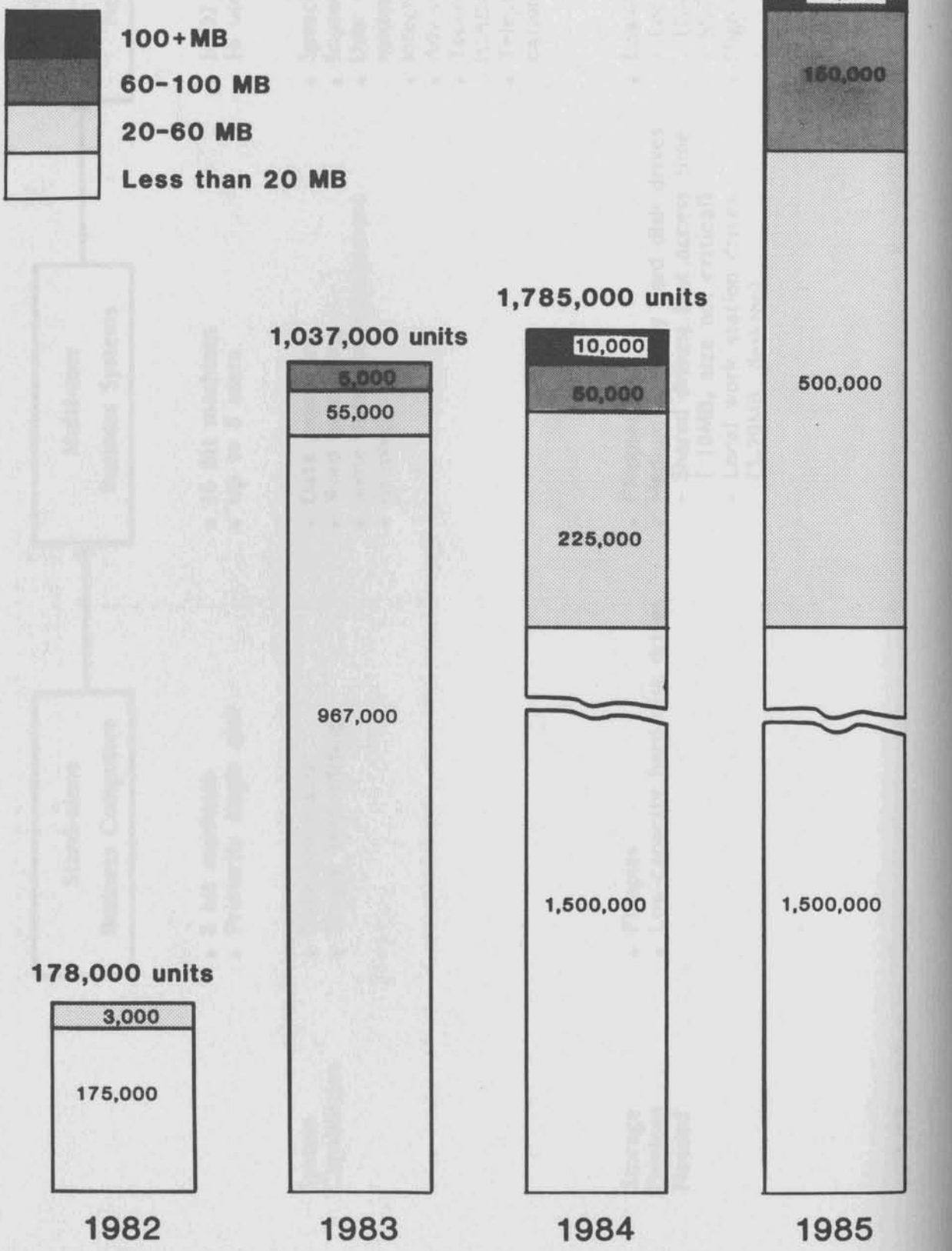
OEM WINCHESTER DISK DRIVE MARKET
20-100 MB
FORM FACTOR MIX

Source: Quantum Market Research

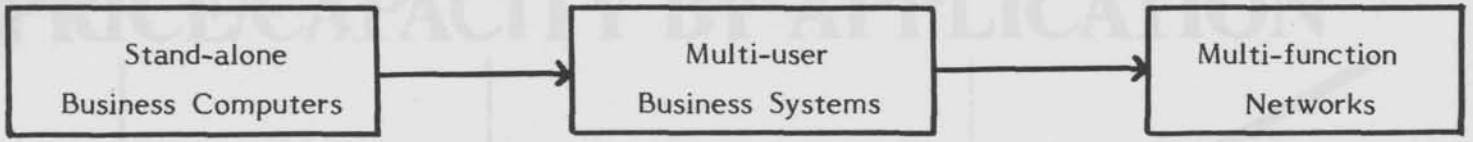


5 1/4" OEM MARKET BY CAPACITY SEGMENT
(Including half-height products)

SOURCE: Quantum Market Research



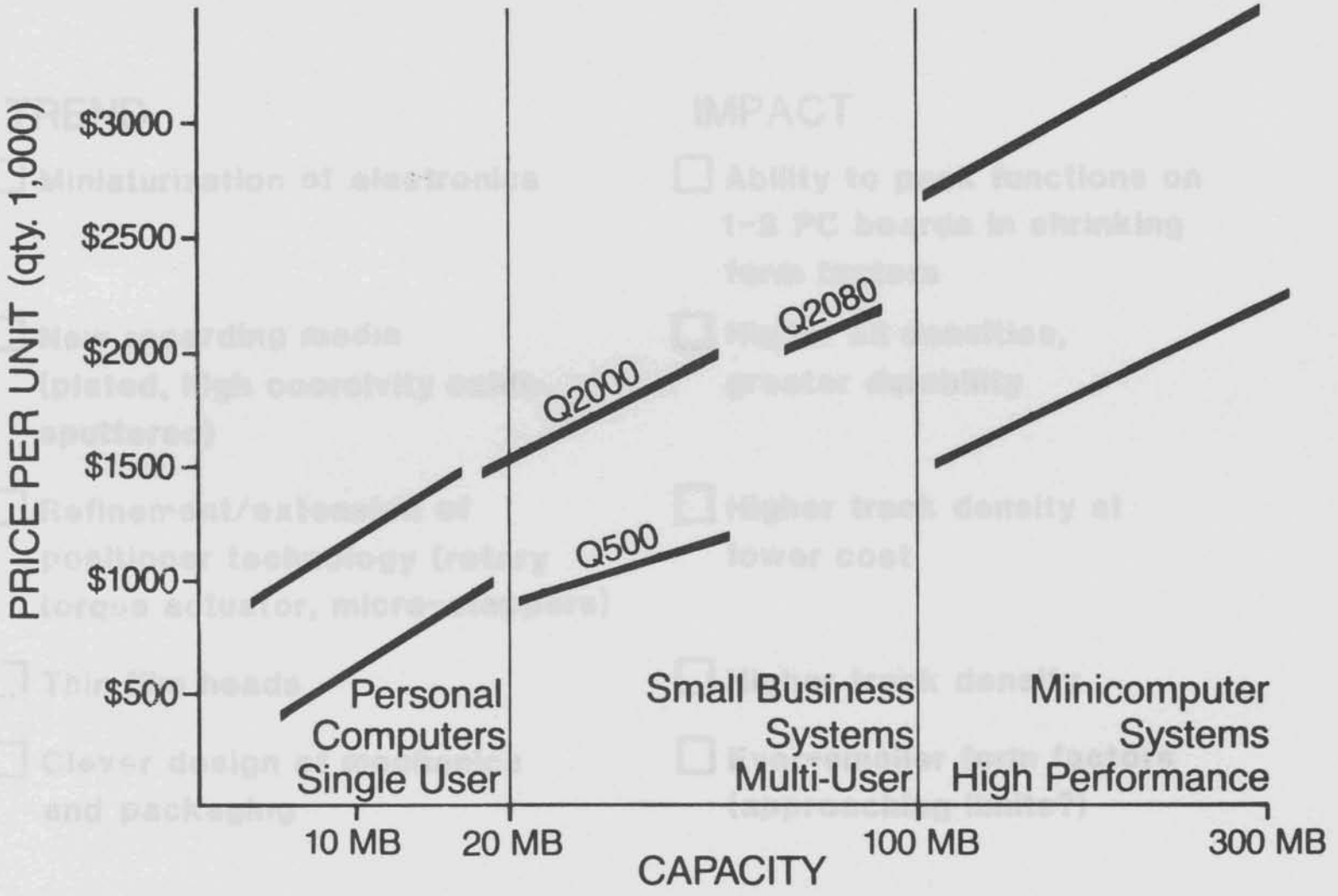
OFFICE SYSTEM EVOLUTION



	Stand-alone Business Computers	Multi-user Business Systems	Multi-function Networks
	• 8 bit machines • Primarily single user	• 16 bit machines • Up to 8 users	• 16/32 bit machines • 16 users and up
System Capabilities	• Data processing • Simple text editing	• Data processing • Word processing • Some database management • Graphics	• Speech synthesis • Improved graphics • User friendly input features - mouse, touch screen, etc. • Integrated applications program • Advanced database management • Technical functions (CAD/CAM, MRP, etc.) • Telephone and network communications
Storage Devices Needed	• Floppies • Low-capacity hard disk drives	• Floppies • Medium capacity hard disk drives - Shared drives; fast access time (10MB, size not critical) - Local work station drives (5-20MB, desktop)	• Low-medium capacity drives - Local work station drives (10-20MB, desktop) - Shared drives (40-300MB) • High capacity drives (300MB)

10/4/83 - RB:rh

PRICE/CAPACITY BY APPLICATION



TECHNOLOGY TRENDS AFFECTING WINCHESTER MARKET

TREND	IMPACT
☐ Miniaturization of electronics	☐ Ability to pack functions on 1-2 PC boards in shrinking form factors
☐ New recording media (plated, high coercivity oxide, sputtered)	☐ Higher bit densities, greater durability
☐ Refinement/extension of positioner technology (rotary torque actuator, micro-steppers)	☐ Higher track density at lower cost
☐ Thin film heads	☐ Higher track density
☐ Clever design of mechanics and packaging	☐ Ever-smaller form factors (approaching limits?)

COMPETITION - 5 1/4" OEM WINCHESTER DISK DRIVES

Less Than 20 MB

Company	Product	Unformatted Capacity (MB)	Media	Actuator Technology	Average Positioning Time (ms)	OEM Qty. 100 Price
(H) = Half High						
Atasi	3020	19	Oxide	Linear Voice Coil	33	$ 1598
Cogito	CG906	6	Oxide	Band Stepepr	85	695
	CG912	13	"	Band Stepper	85	795
CMI	CM4123	13	Oxide	Rotary Torque	75	880
	CM5206	6	"	Rotary Stepper	130	750
	CM5412	13	"	Rotary Stepepr	130	880
	CM5619	19	"	Rotary Stepper	130	1010
	CM6213	13	"	Rotary Torque	40	1050
Evotek	ET5510	8	Plated	Band Stepper	49	1125
	ET5520	16	"	Band Stepper	49	1350
	ET5810	13	"	Band Stepper	49	1295
IMI	2306 (H)	6	Plated	Band Stepper	85	725
	2312 (H)	13	"	Band Stepper	85	850
	5018	19	"	Band Stepper	100	975
MiniScribe	2006	6	Oxide	Stepper	85	562
	3006	6	Plated	Stepper	85	500
	2012	13	Oxide	Stepper	85	674
	3012	13	Plated	Stepper	155	602
Rodime	RO201	7	Oxide	Rotary Stepper	90	650
	RO202	13	"	Rotary Stepper	90	800
	RO203	20	"	Rotary Stepper	90	950
Seagate	ST206 (H)	6	Oxide	Band Stepper	85	750
	ST406	6	"	Band Stepper	85	720
	ST412	13	"	Band Stepper	85	900

COMPETITION - 5 1/4" OEM WINCHESTER DISK DRIVES

Less Than 20 MB

Company	Product	Unformatted Capacity (MB)	Media	Actuator Technology	Average Positioning Time (ms)	OEM Qty. 100 Price
Shugart	SA607	6	Oxide	Rotary Band Stepper	92	$ 532
	SA612	13	"	Rotary Band Stepper	92	665
	SA706 (H)	6	"	Rotary Band Stepper	99	500
	SA712 (H)	13	"	Rotary Band Stepper	99	---
Tandon	TM501	6	Oxide	Rotary Stepper	206	440 (Qty. 2500)
	TM502	13	"	Rotary Stepper	206	550 "
	TM503	19	"	Rotary Stepper	206	660 "
	TM251 (H)	6	Plated	Rotary Stepper	100	---
	TM252 (H)	13	"	Rotary Stepper	100	---
Tulin	TL213 (H)	13	Plated	Rotary Stepper	95	650

Source: 1983 Disk/Trend Report

COMPETITION - 5 1/4" OEM WINCHESTER DISK DRIVES

20 - 100 MB

Company	Product	Unformatted Capacity (MB)	Media	Actuator Technology	Average Positioning Time (ms)	OEM Qty. 100 Price
Atasi	3033	33	Oxide	Linear Voice Coil	33	$ 1776
	3046	46	"	Linear Voice Coil	33	1954
CMI	CM6426	27	Oxide	Rotary Torque	40	1180
	CM6640	40	"	Rotary Torque	40	1310
CDC	Wren	36	Oxide	Rotary Voice Coil	40	1660
		86	"	Rotary Voice Coil	30	
Evotek	ET5530	23	Plated	Band Stepper	49	1390
	ET5820	26	"	Band Stepper	49	1475
	ET5540	31	"	Band Stepper	49	1600
	ET5830	39	"	Band Stepper	49	1750
	ET5840	52	"	Band Stepper	49	1995
IMI	5650	51	Plated	Band Stepper	49	---
Maxtor	XT1065	67	Plated	Rotary Voice Coil	30	1890
	XT2085	89	"	Rotary Voice Coil	30	2080
	EXT4075	76	"	Rotary Voice Coil	30	1610
Micropolis	1302	26	Oxide	Rotary Voice Coil	30	1199
	1303	43	"	Rotary Voice Coil	30	1518
	1304	52	"	Rotary Voice Coil	30	1698
MiniScribe	4020	20	Oxide	Stepper	120	733
	5338	38	"	Stepper	95	
	5451	51	"	Stepper	95	
Priam	502	55	Plated	Linear Voice Coil	32	1780
	503	71	"	Linear Voice Coil	32	2160
	504	86	"	Linear Voice Coil	32	2340

COMPETITION - 5 1/4" OEM WINCHESTER DISK DRIVES

20 - 100 MB

Company	Product	Unformatted Capacity (MB)	Media	Actuator Technology	Average Positioning Time (ms)	OEM Qty. 100 Price
Quantum	Q520	21	Oxide	Rotary Torque	45	1245
	Q530	32	"	Rotary Torque	45	1365
	Q540	43	"	Rotary Torque	45	1485
Rodime	RO204	27	Oxide	Rotary Stepper	90	1150
	RO206	40	"	Rotary Stepper	50	1550
	RO208	53	"	Rotary Stepper	50	1935
Seagate	ST425	26	Oxide	Band STepepr	60	1270
Tandon	TM703	30	Plated	Rotary Voice Coil	39	945 (Qty. 2500)
	TM705	50	"	Rotary Voice Coil	39	---
Tulin	TL240 (H)	40	Plated	Rotary Stepper	95	1055
	TL226 (H)	27	"	Rotary Stepper	95	850
Vertex	V130	31	Plated	Rotary Voice Coil	30	1480
	V150	51	"	Rotary Voice Coil	30	1880
	V170	72	"	Rotary Voice Coil	30	2200

Source: 1983 Disk/Trend Report

COMPETITION - 5 1/4" OEM WINCHESTER DISK DRIVES

Over 100 MB

Company	Product	Unformatted Capacity (MB)	Media	Actuator Technology	Average Positioning Time (ms)	OEM Qty. 100 Price
Maxtor	XT1105	105	Plated	Rotary Voice Coil	30	$ 2660
	XT1140	144	"	Rotary Voice Coil	30	3430
	XT2140	140	"	Rotary Voice Coil	30	2930
	XT2190	191	"	Rotary Voice Coil	30	3775
	EXT4175	178	"	Rotary Voice Coil	30	2595
	EXT4280	280	"	Rotary Voice Coil	30	3665
	EXT4380	382	"	Rotary Voice Coil	30	4715
Priam	505	111	Plated	Linear Voice Coil	32	$ 2860

Source: 1983 Disk/Trend Report

COMPETITION - 8" OEM WINCHESTER DISK DRIVES

Under 20 MB

Company	Product	Unformatted Capacity (MB)	Media	Actuator Technology	Average Positioning Time (ms)	OEM Qty. 100 Price
Fujitsu, Ltd.	M2301B	12	Oxide	Band Stepper	70	$ 1610
IMI	7710	13	"	Linear Voice Coil	35	--
Micropolis	1221-MII	9	"	Rotary Voice Coil	42	2048
Shugart	SA1004	11	"	Band Stepper	70	$ 1061

Source: 1983 Disk/Trend Report

COMPETITION - 8" OEM WINCHESTER DISK DRIVES

20 - 100 MB

Company	Product	Unformatted Capacity (MB)	Media	Actuator Technology	Average Positioning Time (ms)	OEM Qty. 100 Price
Disctron	DP-400	46	Oxide	Linear Voice Coil	60	$ 1770
Fujitsu, Ltd.	M2302B	24	Oxide	Band Stepper	70	2090
	M2303BE	48	"	Band Stepper	70	2250
	2312	85	"	Rotary Voice Coil	20	3400
IMI	7720	21	"	Linear Voice Coil	35	---
	7740	42	"	Linear Voice Coil	50	---
Micropolis	1202ANSI	27	"	Rotary Voice Coil	42	2192
	1202SA	21	"	Rotary Voice Coil	47	1975
	1222-MII	27	"	Rotary Voice Coil	42	2481
	1203ANSI	46	"	Rotary Voice Coil	42	2607
	1203SA	34	"	Rotary Voice Coil	47	2390
	1223-MII	45	"	Rotary Voice Coil	42	2896
	1403	83	"	Rotary Voice Coil	22	2517
NEC	D2220	26	Oxide	Rotary Voice Coil	25	2375
	D2230	43	"	Rotary Voice Coil	25	2375
	D2246	85	"	Rotary Voice Coil	25	3200
Priam	7050	70	Oxide	Linear Voice Coil	42	2920
	803	86	"	Linear Voice Coil	35	3065
	3430	35	"	Linear Voice Coil	42	2325
Quantum	Q2020	21	Oxide	Rotary Torque	55	1625
	Q2030	32	"	Rotary Torque	60	1950
	Q2040	43	"	Rotary Torque	65	2275
	Q2080	85	"	Rotary Torque	40	$ 2800

COMPETITION - 8" OEM WINCHESTER DISK DRIVES

Over 100 MB

Company	Product	Unformatted Capacity (MB)	Media	Actuator Technology	Average Positioning Time (ms)	OEM Qty. 100 Price
Disctron	D1100	122	Plated	Linear Voice Coil	35	$ 1980
Fujitsu	M2322K	168	Oxide	Rotary Voice Ciol	20	----
Micropolis	1406ANSI	166	Oxide	Rotary Voice Coil	22	3195
	1406SMD	166	"	Rotary Voice Coil	22	3203
NEC	D2257	168	Oxide	Rotary Voice Coil	20	3675
Priam	804	106	N/A	Linear Voice Coil	42	3280
Seagate	MUMS	100	Oxide	Linear Voice Coil	38	1900

Source: 1983 Disk/Trend Report

Art Geffon