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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 system 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.

Products

Quantum offers a product line of 8-inch rigid disk drives called the Q2000. 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 60,000 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 1983. 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 line 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.

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 are scheduled to begin by December of 1983. 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 October 2, 1983, the Company had delivered approximately 60,000 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 independent distributors, principally 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.

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 and Salem, New Hampshire. 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 availability, 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 June 30, 1983, the Company employed 346 persons, including 71 in engineering, 207 in manufacturing, 46 in marketing and 22 in general management and administration. Competition for highly skilled employees is intense. Quantum believes that its future success will depend in large measure on its continued ability to attract and retain qualified employees. None of the Company's employees is represented by a labor union, and the Company has experienced no work stoppage. Quantum has a corporate commitment to providing a creative and motivating work environment and promoting education and career growth to its employees.

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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 communications 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.

David A. Brown — Vice President, Engineering

Mr. Brown is one of the founders of Quantum and has served as Vice President, Engineering since February 1980. 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.

Stephen M. Berkley — Vice President, Marketing

Mr. Berkley joined Quantum in October 1981 as Vice President, Marketing. 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.

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 has also had over nine years' experience at Price Waterhouse, last serving as an audit manager.

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

Mr. Hiatt has served as Vice President, Manufacturing since joining Quantum in July 1982. Prior to that time, he spent 16 years with the Colorado Springs Division of Hewlett-Packard Company in various positions in Product Design, Marketing, and most recently, as CRT Manufacturing Manager.

Richard P. Taylor — Vice President, Quality and Reliability

Mr. Taylor joined Quantum in June 1983 as Vice President, Quality and Reliability. 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 — Director, Human Resources

Ms. Preston joined the company in April 1983 as Director, Human Resources. 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.

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QUANTUM NEWS RELEASE

Contact: Joseph T. Rodgers, Jr.
Vice President, Finance
408/262-1100

QUANTUM CORPORATION REPORTS

SECOND QUARTER, FIRST HALF EARNINGS

Milpitas, Calif., October 20 -- Quantum Corporation (OTC-QNTM) today announced that net income for the second quarter ended October 1, 1983 rose 55% to $2,485,000 compared to net income of $1,600,000 for the comparable period in fiscal 1983. Sales for the quarter were up 52% to $15,143,000, compared to $9,950,000 in the second quarter of the prior year. Income per share was $.26 for the quarter compared to $.21 per share in the second quarter of fiscal 1983.

Net income for the six months ended October 1, 1983 rose 57% to $4,559,000 compared to income, before extraordinary credit for the tax benefit of loss carryforwards, of $2,896,000 for the same six-month period last year. Sales for the first half of fiscal 1984 increased 48% to $27,616,000 compared to $18,608,000 for the previous year. Income per share was $.48 compared to $.38 per share, before extraordinary credit, in fiscal 1983. The extraordinary credit in the prior year was $814,000, or $.11 per share.

Per-share earnings were computed on 9.5 million outstanding shares compared to 7.6 million in fiscal 1983.

"The demand for Quantum's Q2000 8-inch Winchester disk drives remains strong," said James Patterson, president. "We continue to

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ship the Q2000 in volume while steadily increasing production on the new Q500 5 1/4-inch drives. During the quarter, contracts were signed for both product families with a total value in excess of $24 million."

Quantum Corporation is a leading independent supplier of high-capacity, small Winchester disk drives for microcomputer-based small business systems and personal computers.

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1983.

Consolidated Balance Sheets
(In Thousands)

	March 31, 1983	July 2, 1983
Assets		
Current assets:		
Cash, including certificates of deposit	$20,836	$22,885
Accounts receivable, net of allowance for doubtful accounts of $235 and $262	5,859	5,327
Interest and dividends receivable	479	416
Inventories	6,017	5,980
Prepaid expenses	201	177
Other current assets	19	20
Total current assets	33,411	34,805
Property and equipment, less accumulated depreciation	4,190	4,994
Long-term marketable investment securities	18,726	18,573
Other assets	303	320
	$56,630	$58,692
Liabilities and Shareholders' Equity		
Current liabilities:		
Accounts payable	$ 2,172	$ 2,908
Accrued compensation	499	413
Income taxes payable	3,813	3,010
Deferred taxes	888	888
Other accrued liabilities	440	459
Total current liabilities	7,812	7,678
Deferred income taxes	329	329
Shareholders' equity:		
Common stock	43,409	43,527
Valuation allowance for long-term marketable investment securities	(1,175)	(1,171)
Retained earnings	6,255	8,329
Total shareholders' equity	48,489	50,685
	$56,630	$58,692

Quantum Corporation
1804 McCarthy Blvd.
Milpitas, CA 95035

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To Our Shareholders:

Revenue in the first quarter of fiscal 1984 reached a record level of $12.5 million. This represents a 44% growth over the period a year ago. Net income for the quarter rose 60% to $2.1 million, compared with $1.3 million, before extraordinary credit for the tax benefit of loss carryforwards, for the same period last year. Income per share was $.22 compared with $.17 per share, before extraordinary credit, in the first quarter of fiscal 1983. The extraordinary credit in the prior year's first quarter was $814,000 or $.11 per share.

Compared with the previous quarter, revenue increased 5%, with a decrease of 8% in net income. This decline in profit margins, as previously projected, results from Quantum's investment in the introduction of the new Q500 family of 5¼-inch Winchester drives.

This first quarter marks the beginning of a transition for Quantum. While shipments of our mature Q2000 products remain strong, we have begun volume production of the Q500. These products, with storage capacities from 20-40 megabytes, provide a significant price/performance improvement for our customers. Product development and manufacturing ramp-up of the Q500 family have proceeded on schedule. With several major new contracts signed and evaluations in process with over 60 prospective customers, Quantum is now positioned as a leading supplier of higher capacity, 5¼-inch products. This outstanding market reception for the Q500 should accelerate our sales growth in the latter half of this fiscal year.

As an indication of the strength of our overall market presence, in the last three months Quantum has signed new contracts with an aggregate value exceeding $55 million. These OEM contracts cover both 5¼-inch and 8-inch products.

To maintain our position as a low-cost supplier, we have begun implementation of an offshore manufacturing program. In June, an agreement was executed between Quantum and the Puerto Rican government to establish a production facility in the city of Ponce. Our expansion to Puerto Rico will provide us access to a new pool of trained people and offer attractive tax benefits. We look forward to building a significant business in Puerto Rico for high volume, lower cost manufacturing.

Through this transition, Quantum continues to build on our reputation as a leading supplier of cost effective, quality products. In this quarter, we initiated new programs in quality training and measurement, and product testing, to further improve the products and services provided to our customers. As a result of this ongoing commitment, the quality of our products ranks with the best in the world.

Sincerely,

James L. Patterson
President
August 15, 1983

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

	Three Months Ended	
	July 3, 1982	July 2, 1983
Sales	$8,658	$12,473
Cost of sales	5,168	7,485
Gross profit	3,490	4,988
Expenses:		
Research and development	309	770
Marketing	604	787
General and Administrative	236	457
Interest and dividend income	(28)	(798)
	1,121	1,216
Income (loss) before income taxes	2,369	3,772
Provision for income taxes	1,073	1,698
Income (loss) before extraordinary credit	1,296	2,074
Tax credit from utilizing net operating loss	814	—
Net income (loss)	$2,110	$ 2,074
Net income (loss) per share before extraordinary credit	$ .17	$ .22
Net income (loss) per share	$ .28	$ .22
Common and common equivalent shares	7,408,155	9,517,008

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INSTITUTIONAL RESEARCH

Blake L. Downing
April 22, 1983

QUANTUM CORPORATION

Price Data		Earnings Data			Trading Data		Other Data	
		FY						
Current Price	$28-3/4	Mar	EPS	P/E Ratio	Shares Outstanding (mm)	9.2	Market Capitalization (mm)	$264.5
		F1982	$0.03	NM				
52 Week Price Range	$31 - 20	F1983E	$0.85	33.8x	Estimated Float (mm)	3.0	Current FY Est. Revenues (mm)	$ 61.9
		Calendar 1983	$1.00	28.8x				
Ticker Symbol	QNTM	F1984E	$1.05	27.4x	Average Daily Trading Volume (shs)	47,400	1982-85 Est. EPS Growth Rate	45%

Summary Comment

Quantum Corporation is an extremely well managed supplier of 8-inch and 5¼-inch Winchester disk drives. In 1982, the Company surpassed market-leader Shugart Associates, and emerged as the leading supplier of high capacity 8-inch Winchester disk drives. In February 1983, Quantum began to deliver 21, 32, and 43 megabyte (MB) high capacity/high performance 5¼-inch Winchester disk drives. Quantum drives use the industry-standard ST 506 interface in one of the industry's first high capacity 5¼-inch drives. These drives use the same proprietary actuator technology (semi-closed loop) that Quantum successfully pioneered for the 8-inch market. The semi-closed loop design provides higher capacity and faster access time than open loop, yet at substantially lower cost than closed loop. Manufacturing is done on the same unique "clean tunnel" production lines used for the Company's 8-inch drives. We expect Quantum to successfully market the new 5¼-inch drives to large OEM customers, including its current 8-inch customers -- particularly Altos Computer Systems, Convergent Technologies, Nixdorf Computer, TeleVideo Systems, and Wang Laboratories.

Priced currently at less than 28 times our fiscal 1984 (ending March) earnings estimate of $1.05 per share, and less than 20 times our fiscal 1985 estimate of $1.50 per share, we consider Quantum to be underpriced relative to comparable high quality microperipheral companies.

Background

Quantum Corporation was founded in 1980 by a team of seasoned managers from the OEM computer peripherals industry. At that time, Shugart Associates (a Xerox subsidiary) was successfully marketing a 10 MB, 8-inch Winchester disk drive, the SA 1000. The 8-inch market, however, suffered from a lack of industry standards which seriously hampered market growth. Quantum was founded with the strategy of bringing standards to the market by developing a family of high capacity 8-inch drives that would be fully compatible with the popular SA 1000 products.

Quantum's family of SA 1000 compatible drives were well received and helped to solidify the SA 1000 interface as an industry standard. Furthermore, the Company's proprietary, semi-closed loop actuator technology had superior capacity potential. This enabled it to rapidly develop higher capacity drives and usurp Shugart's market leadership position. Simultaneously, Quantum pioneered a "clean tunnel" production line, which allowed it to rapidly increase manufacturing capacity.

With this two-pronged attack, the Company captured such key OEM customers as Altos Computer Systems, Convergent Technologies, Nixdorf Computer, TeleVideo Systems, and Wang Laboratories. By the end of 1982, Quantum had emerged as the volume leader of high capacity 8-inch Winchester disk drives.

QUANTUM PRODUCT LINE

Disk Size	Quantum Series	Unformatted Capacity (megabytes)	Average Access Time (milliseconds)
8-inch	Q2010	10.7 MB	55 ms
	Q2020	21.3	60
	Q2030	32.0	60
	Q2040	42.7	65
	Q2080	85.0	40
5¼-inch	Q520	21.3 MB	45 ms
	Q530	32.0	45
	Q540	42.7	45

5¼-Inch Strategy

With explosive demand for 5¼-inch Winchester disk drives, and a lack of suppliers in the high capacity segment of the market, Quantum devised a 5¼-inch strategy tailored to take full advantage of two of its key strengths: (1) a proven, low-cost actuator technology, and (2) large OEM customers of 8-inch disk drives with immediate needs for 5¼-inch products. As a result, the Company's 5¼-inch Winchester disk drives utilize the same proprietary semi-closed loop actuator that has proven cost-effective and reliable on its 8-inch products. Several of Quantum's major 8-inch customers are currently at the forefront of multi-user architectures for microcomputers which need the small 5¼-inch form factor, yet require higher capacities and faster access times than the popular open loop drives from Seagate Technology, Tandon Corporation, and others. Quantum's new 5¼-inch drives meet these new market requirements by providing 21, 32, and 43 MB capacity with 45 ms access time.

Manufacturing

From inception, Quantum's management has emphasized manufacturing. As a result, product development teams work closely with the production organization, and focus on developing manufacturable new products. For example, the 8-inch and 5¼-inch semi-closed loop drives require only one manual adjustment in production, and a unique head/arm lock on the 5¼-inch drives utilizes only one moving part. Another Quantum innovation is the "clean tunnel" production line. This new production concept is: (1) demonstrably cleaner than traditional Winchester clean rooms, and (2) rapidly expandable with minimal fixed costs.

We believe that volume manufacturing will prove to be the pivotal competitive issue for large OEM contracts for high capacity 5¼-inch Winchesters. Quantum's experience in producing semi-closed loop drives should give it a competitive edge over suppliers which do not have any production history in closed loop drives.

The Market For 8-Inch Winchester Disk Drives

Eight-inch Winchester disk drives are utilized with low-end minicomputers and high-end microcomputers. However, the boom in desktop microcomputers puts a premium on the smaller size and lower power requirements of 5¼-inch drives. As a result, 8-inch drive capacities must increase steadily to achieve the 19% annual growth projections shown on the following page. Even with Quantum's new 85 MB drive in the 30-100 MB range, and the expectation of future products in the 100-300 MB range, we do not look for further growth in Quantum's market share. Thus, if the Company's unit growth in the 8-inch sector matches the 19% annual rate of the overall market, with expected price declines, the Company's 8-inch revenues should be roughly flat.

8-INCH WINCHESTER DISK DRIVES
WORLDWIDE UNIT SALES

1982E	1983E	1984E	1985E	82-85 CAGR
179,400	216,500	229,100	302,600	19.0%

Source: Disk/Trend

The Market For 5¼-Inch Winchester Disk Drives

5¼-inch Winchester disk drives are used with business-oriented microcomputers. Whereas three years ago no microcomputer had a 5¼-inch Winchester, today many of the new 16-bit microcomputers are sold with installed 5¼-inch Winchester disk drives. In addition, numerous computer and subsystem suppliers have begun to offer 5¼-inch Winchester subsystems, which can be retrofitted onto microcomputers in the field. A particularly important trend in 16-bit business microcomputers that bodes well for the 5¼-inch Winchester market is the increasing use of very large software bases stored on Winchester disk drives. These large software bases include: (1) operating systems like UNIX, VisiOn, and Apple's Lisa operating system; (2) integrated applications (word processing/spread sheet/graphics) like "1-2-3" and "MBA"; (3) data base management systems like "dBase II" and "InfoStar"; and (4) high resolution bit-mapped graphics.

As shown on the following page, Disk/Trend projects the 5¼-inch Winchester disk drive market to grow at a 47% annual rate from 250,200 units in 1982 to 801,200 units in 1985. Others have made substantially higher forecasts. Sanford Bernstein & Co., for example, projects 102% annual growth from 200,000 units in 1982 to 1,650,000 units in 1985. As a reality check, International Data Corporation projects sales of two million desktop microcomputers in 1985. If 50% have a 5¼-inch Winchester (a reasonable estimate, we think), then a one million unit 5¼-inch Winchester market in 1985 sounds reasonable before taking into account the substantial market for 5¼-inch Winchester subsystem add-ons. In fact, we believe that both the Disk/Trend and Bernstein estimates are significantly low and that 5¼-inch Winchester shipments could reach two to three million units by 1985.

Disk/Trend projects that the 30-100 MB segment of the market that Quantum is focused on will grow at an annual rate of 271%, from 1,900 units in 1982 to 97,000 units in 1985.

5¼-INCH WINCHESTER DISK DRIVES
WORLDWIDE UNIT SALES

	1982E	1983E	1984E	1985E	82-85 CAGR
0-30 MB	248,300	562,000	589,600	666,200	39.0%
30-100 MB	1,900	33,000	58,300	97,000	271.0
100-300 MB	--	1,000	18,000	38,000	NM
Total 5¼-inch Winchester Market	250,200	596,000	665,900	801,200	47.4%

Source: Disk/Trend

	1982E	1983E	1984E	1985E	82-85 CAGR
Total 5¼-inch Winchester Market	200,000	550,000	1,000,000	1,650,000	102.1%

Source: Sanford Bernstein & Co.

OEM Customers

Although the 5¼-inch Winchester disk drive market is still exploding, most large OEM microcomputer manufacturers have already made their vendor selections. We expect that these established OEM relationships will remain largely intact. However, Quantum's 5¼-inch Winchester products address an emerging demand for high capacity, semi-closed loop drives. Because closed-loop involves a fundamentally new technology for 5¼-inch manufacturers, we believe that most customers will undertake new evaluations and establish new OEM purchasing relationships. As a result, we believe that Quantum is uniquely well positioned to make a rapid entry into the market. Additionally, each of the Company's top five 8-inch customers listed below is an early candidate for high capacity 5¼-inch Winchesters:

Altos Computer Systems
Convergent Technologies
Nixdorf Computer
TeleVideo Systems
Wang Laboratories

Since most large OEM customers must undertake a completely new evaluation before selecting a high capacity 5¼-inch Winchester disk drive, and since Quantum is already a vendor to several key OEMs, we expect the Company to fare well in this

new market segment. Large microcomputer manufacturers that want to ship systems with high capacity 5¼-inch drives in 1984 must make their vendor selections in 1983. To minimize technical and manufacturing risk, many will prefer a vendor with experience in manufacturing closed loop drives. This was implied in a recent trade press article which indicated that DEC had just completed an evaluation of high capacity 5¼-inch Winchester disk drives for several microcomputer and minicomputer products. The article indicated that Quantum will sign a major contract with DEC for high capacity 5¼-inch Winchesters. While we are unable to confirm the accuracy of this article, we consider Quantum a strong candidate to win early OEM contracts for high capacity/high performance drives.

Competition

Competition in the 8-inch Winchester market is segmented in two ways: (1) by interface (there are three industry standard electrical and mechanical interfaces), and (2) by storage capacity. Quantum drives use the widely accepted SA 1000 interface and are not directly competitive with the more expensive SMD-interface drives from CDC, or ANSI-interface drives from NEC and 3M. Quantum and Shugart Associates together dominate the SA 1000 market segment, with 55% of the unit market volume -- Shugart leads in older, low capacity drives (under 20 MB), while Quantum dominates the 20 MB and over category. By the end of the fourth quarter of 1982, we estimate that Quantum's overall market share had grown to 30%.

8-INCH WINCHESTER DISK DRIVE MARKET SHARE

	1980	1981	1982	1983E
Quantum	--%	5%	25%	30%
Shugart	60	50	30	25
Others	40	45	45	45
Total	100%	100%	100%	100%

Demand for high capacity 5¼-inch Winchesters has developed so rapidly that several major OEM customers will be forced to select vendors this year. As a result, successful suppliers must have evaluation units out very soon. We believe that the key competitive issues for major OEM customers will be high volume production capability, price, performance (access time), and reliability. Unproven startup suppliers will have a credibility gap when contending for major OEM orders in the face of proven production capability from Quantum.

Although several competitors have announced high capacity, closed loop 5¼-inch drives, very few have delivered evaluation units. The competitive delivery status of high capacity 5¼-inch drive vendors at the end of March 1983 is summarized on the following page.

ANNOUNCED HIGH CAPACITY/HIGH PERFORMANCE WINCHESTER DISK DRIVES

Supplier	Capacity	Delivery Status
Atasi Corporation	33.7 MB 46.3 MB	Low Volume Production
Control Data Corporation	32.0 MB	Evaluation Units
Computer Memories, Inc.	26.0 MB 40.0 MB	Low Volume Production
DMA Systems Corporation	26.0 MB 39.0 MB	None
Evotek Corporation	25.9 MB 31.2 MB 38.9 MB 51.7 MB	None
Maxtor Corporation	67.0 MB 105.2 MB 143.6 MB	Evaluation Units
Micropolis Corporation	34.6 MB 51.9 MB	None
Quantum Corporation	21.3 MB 32.0 MB 42.7 MB	Evaluation Units
Rodime PLC	26.7 MB 40.0 MB 53.3 MB	Evaluation Units
Tandon Corporation	31.0 MB 53.0 MB	Evaluation Units
Vertex Peripherals Corporation	30.8 MB 51.4 MB 72.0 MB	None

Financials

As shown below, our financial projections for Quantum assume flattening revenues from 8-inch Winchester disk drives and gradual growth in 5¼-inch shipments. Large contracts from DEC or other major OEMs are not assumed in our fiscal 1985 projections, and would be additive to sales and earnings.

QUARTERLY PROFILE

	Revenue			Pretax	Pretax	Tax	Net	
	8-inch	5¼-inch	Total	Income	Margin	Rate	Income	EPS
	($ in millions except per share data)							
F1983E								
Q1A	$ 8.6	--	$ 8.6	$ 2.4	27.4%	45.3%	$ 1.3	$0.17
Q2A	10.0	--	10.0	2.9	29.4	45.3	1.6	0.21
Q3A	11.3	--	11.3	3.4	30.3	45.3	1.9	0.23
Q4E	11.6	--	11.6	3.8	33.1	45.3	2.1	0.24
	$41.5	--	$ 41.5	$12.5	30.2%	45.3%	$ 6.9	$0.87
F1984E								
Q1E	$12.0	$ 0.3	$ 12.3	$ 3.5	28.5%	45.0%	$ 1.9	$0.20
Q2E	11.5	2.0	13.5	3.9	28.9	45.0	2.1	0.22
Q3E	11.0	5.1	16.1	4.9	30.6	45.0	2.7	0.28
Q4E	10.0	10.0	20.0	6.2	31.0	45.0	3.4	0.35
	$44.5	$17.4	$ 61.9	$18.5	29.9%	45.0%	$10.2	$1.05
F1985E	$35.0	$75.0	$110.0	$26.3	23.9%	45.0%	$14.5	$1.50

SUMMARY BALANCE SHEET
JANUARY 1, 1983

Assets		Liabilities & Shareholders' Equity	
	($ in thousands)		
Current Assets	$50,036	Current Liabilities	$ 6,413
Net Plant & Equipment	3,704	Deferred Taxes	216
Other Assets	300	Shareholders' Equity	47,411
Total Assets	$54,040	Total Liabilities & Shareholders' Equity	$54,040

Conclusion

Quantum is solidly positioned as a leading supplier to the 8-inch Winchester disk drive market, which we expect to grow in unit volume by 19% annually through 1985. The Company has leveraged its strength in the 8-inch market into a leadership position in a new segment of the exploding 5¼-inch Winchester disk drive market. Quantum's 21, 32, and 43 MB semi-closed loop 5¼-inch drives fill the emerging requirements for high capacity/high performance 5¼-inch Winchester disk drives for multi-user distributed logic workstations.

BLAKE L. DOWNING
April 22, 1983

DJIA - 1196.30

NOTE: Robertson, Colman & Stephens maintains a market in this stock, and has been an underwriter manager, co-manager or has previously placed securities of this company within the last three years, or was a previous underwriter of this company. Additionally, Robertson, Colman & Stephens owns restricted common stock in this company, acquired prior to the November 1982 public offering.

EDP PURCHASE RECOMMENDATION

QUANTUM

Another Way To Invest In The Micro/Work Station Market

Ulric Weil
(212) 974-4396
December 16, 1982

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QUANTUM
(QNTM - NASDAQ)

Price		Dividend Rate		Earnings	P/S*	P/E	Est 5-Yr Growth	
On 12/16/82	20	Current	--	1982A	$ 0.03	NM	Revenues	45%/yr
52-Wk Range	--	12/83E	--	1983E	0.85	23.5	Earnings	40%/yr
S&P 500	135	Cur Yld	--	1984E	1.05	19.0	Dividend	--

Common Stock Data		Valuation Benchmarks		Book Capitalization - 10/2/82**		
Avg Shs	8MM	Bk Val/Sh 1983E	$ 5.70	Long-Term Debt	--	(0%)
Mkt Val	$ 178MM	Cash Flow/Sh 1983E	1.00	Other	--	(0%)
Beta	--	Ret Avg 1983E Eq	26.5%	Shareholders' Eq	$45.5MM	(100%)
Options	--	Ret Avg 1981-83E Eq	NM	Total Capital	45.5MM	(100%)

* Fiscal year ends March 31 NM = Not Meaningful
** As adjusted for recent equity issue

SUMMARY AND INVESTMENT CONCLUSION

Quantum has accomplished much in its three-year lifespan. It devoted its first 18 months following incorporation (February 20, 1980) to developing a line of 8-inch rigid disk drives. Then, impressively, in the second half of fiscal 1982 (ended March 31), it turned profitable; for the full year it reported marginal earnings on sales of $13.7-million. In the current fiscal year (ending March 1983), the Company is operating solidly in the black on anticipated revenues of approximately $40-million.

This success has been achieved largely because management, which came out of Xerox's Shugart Associates, perceived the need for greater capacity than offered by the 8-inch rigid disk drives of Quantum's primary competitors (e.g., Shugart, Micropolis, and Priam). The Company has developed certain quasi-proprietary technologies that permit it to record higher densities (megabytes of on-line storage) on magnetic media (disk platters) as well as providing more reliable reading of such data.

Today, management is still alert to changes in the marketplace and the demand for more cost-effective disk drives with expanded storage capacity. Accordingly, in November this year, Quantum introduced an 85-megabyte 8-inch drive (capacity of its present 8-inch models is 20-40 megabytes), with volume shipments slated to commence next April. It also entered the lower end, 5¼-inch rigid disk drive segment with a product offering 20- to 40-megabyte on-line storage (the top of this range is higher than the capacities presently produced by competitors like Seagate and Tandon); volume shipment of this line should begin next summer.

Provided these product introductions proceed without a major hitch, Quantum's revenue growth should start to accelerate significantly by late fiscal 1984. Once inevitable start-up costs and unfavorable

manufacturing variances have been absorbed, operating profitability should stabilize -- probably in the second half of that fiscal year -- and thereafter we estimate earnings will rise in line with revenues, perhaps 50% or better.

For much of fiscal 1984, however, profit growth will be significantly restrained, as the Company evolves into a multiproduct vendor. During this phase, operating margins will drop substantially, and we think Quantum's quarter-to-quarter earnings profile will very likely be irregular -- sometimes even sequentially flat to down. In other words, investors have to look out to late fiscal 1984 for potential rewards.

Risks in this industry are manifold: product life cycles are short; technological advances mandate frequent new designs; cost/performance and reliability must quickly match leading competitors' standards; and pricing is set in a highly competitive market. The industry's OEM customers -- the vendors of small business systems and personal computers -- do not tolerate failure on any of these counts.

Furthermore, rigid small disk subsystems must be categorized as high-technology, quasi-commodity products. The trick is to ramp-up into volume manufacturing within a few months of completion of the design. Here is where management and manufacturing expertise pay off, and it is on this score that Quantum holds an edge, in our opinion: an experienced management team with an admittedly brief but impressive track record. We recommend purchase of Quantum shares, although the nature of the product and the possibility of price instability argue against the stock's receiving an ultra-high P/E multiple, relative to the substantial estimated trendline growth.

The Company made an initial public offering of 2,500,000 shares at $20.50 each on December 10, 1982. The issue will not be dilutive.

INDUSTRY REVIEW

The Small Disk Drive Market

The development of the so-called "information appliance," or work station -- desktop microcomputer, word processor and intelligent terminal, or very small business system -- has brought with it the need for a physically small, low-cost, random access storage device, namely, a disk subsystem (drive and controller). Small physical size is essential, for the drive is either integral to the information appliance itself or, if it is cable-connected, must not unduly enlarge the footprint (physical size) of the desktop configuration. Random access, which is what mainly differentiates a disk from a tape drive, is required to access business-related data files in a reasonably efficient manner. And the price of the disk drive must be in balance with the cost of the rest of the system.

In recognition of the immense market potential for small disk subsystems, an entire subindustry has sprung up in recent years, led by firms like CMI (16), Control Data (37), Corvus (IMI), Memorex, Onyx (11), Priam, Quantum, Seagate (19), Shugart, and Tandon (30). These companies have been joined by a flock of followers, numbering literally in the dozens; venture capitalists are funding more start-ups all the time.

It all started in 1978, with the development of the 5¼-inch floppy disk drive attachable to the Apple II. (Small disk drives are divided into two major categories: floppy, or flexible, with limited storage, and higher function rigid, or fixed.) By now there is a plethora of such floppies: single- and double-sided 5¼-inch drives (using single- and double-density platters) and 8-inch floppies with similar characteristics.

More recently, the Winchester technology, long used on the 14-inch rigid disks that support the medium- to large-scale mainframe systems, has been applied to develop cost-effective, larger capacity drives for the low-performance segment of the computer market, i.e., information appliances. Shugart Associates introduced the first 8-inch Winchester drives in 1980; Quantum followed in 1981, with an upgraded 8-inch drive. In 1981, Seagate and Tandon began to produce 5¼-inch Winchester drives. Control Data, Memorex, and Quantum also are entering this market. By now, half-height, 5¼-inch Winchester drives -- space is important in integrated work stations -- have begun to come into the market.

The storage capacity of a given disk drive -- floppy or rigid -- significantly determines its value to the user, although other factors like data transfer rate, access time, and relative physical size also matter a great deal. Thanks to new technologies like thin film heads, plated or sputtered disks (as opposed to the present ferrite heads and particulate coated disks), recording densities (tracks per inch and bits per track) are steadily improving.

At the low-end, 5¼-inch floppies are available today, capable of storing one megabyte (MB) on a single platter; 2MB to 4MB capacity appears achievable within approximately two years. The 5¼-inch rigid drives, which once could store "only" 5 to 10MB are already being offered with capacities of up to 50MB (on several platters). The 8-inch rigids, which initially recorded up to 40MB, can now provide up to 160MB capacity (again on several platters).

Over the horizon is the revolutionary vertical recording concept. If, as appears likely, this technology can be developed successfully in the next five years, the storage capacity of a single platter would be vastly expanded. Clearly, the small disk drive industry has flowered, although not yet matured, into a complex, multiproduct business using a variety of advanced semiconductor-based technologies.

Technology is also bringing down prices. Soon, a single floppy disk will be priced as low as $200 (versus $500 today). It will attach to a microcomputer costing about $600 (versus $1,000 today). Higher performance fixed disk drives presently carry a $2,000 tag, but their prices will probably fall as low as $600 in the next couple of years. At that level their use on a multifunction microcomputer costing $5,000 to $7,000 will be readily justifiable.

As costs comes down, rigid 5¼-inch and 8-inch drives are likely to gain favor over the less reliable, less functional floppies. At the same time, 5¼-inch drives will encroach on the lower capacity 8-inch models, forcing the vendors of 8-inch units (such as Quantum) to enhance their products (read: enlarge capacities) to serve markets currently using the physically larger (and more costly) 14-inch drives. Of course, effective use of the rigid drives presupposes availability of some low-cost back-up device, such as a streaming tape or a floppy drive. Most suppliers will offer such products in the near future.

Market Size

Looking ahead to the mid- to late 'Eighties, the market potential for the small floppy and fixed disk drives is truly astounding. For example, market studies predict that, in 1986, well over 5-million desktop computers, intelligent terminals, or word processors will be sold or leased for business/professional use in the United States alone. In addition, at least 100,000 very small business systems will be shipped, plus over 200,000 traditional minicomputers.

Actually, by that time there will no longer be a meaningful technical distinction between small business systems and minicomputers; the differentiation will be on the basis of applications -- i.e., software. Word processors will increase the effectiveness of the approximately 5-million secretaries/typists working in the United States; the desktop, or intelligent, terminal will enhance the productivity of the 26-million or so professional/clerical employees whose daily work routines involve financial modeling, data inquiry/retrieval, and data manipulation. Typical clerical tasks ripe for automation are order entry and inventory control, airline reservations, accounting, banking, and retailing.

Clearly, if these predictions are accurate, disk drives (floppies or fixed) shipped over the next several years will number in the millions. While the vast majority, of course, will be of the cheaper, floppy variety, possibly 25% of the almost 6-million information appliances expected to be installed in 1986 alone will require the high-capacity, fixed disk drives. Even at this ratio, we estimate U.S. demand for the rigid drives will be over 1-million in that year. When worldwide market requirements are included, the number should be doubled.

The forecast of 50% average annual growth in shipments of information appliances over the next five years supports our assumption of high growth for this product segment. On an if-sold value basis, small disk subsystems will represent an increasing percentage of advanced information appliances -- from 12% in 1981 this ratio is forecast to rise to 26% by 1986. The reason growth in this area is expected to be superior to that predicted for the basic unit (central processors plus main memory) is the increasing need for on-line, low-cost storage as well as the fact that relative prices for the all-electronic central processor complex are dropping faster than for the partially electro-mechanical disk subsystems.

More specifically, Disk Trend estimates shipments of fixed disk drives on an if-sold-value basis, with capacities ranging from 30MB to 100MB (primarily 8-inch drives) will rise 22% a year, versus over 60% a year for drives with capacities ranging from 100MB to 300MB. The market for drives with less than 30MB capacity (primarily 5¼-inch rigid drives) is expanding 47% a year (see accompanying figure).

Consolidated Worldwide Disk Drive Shipments

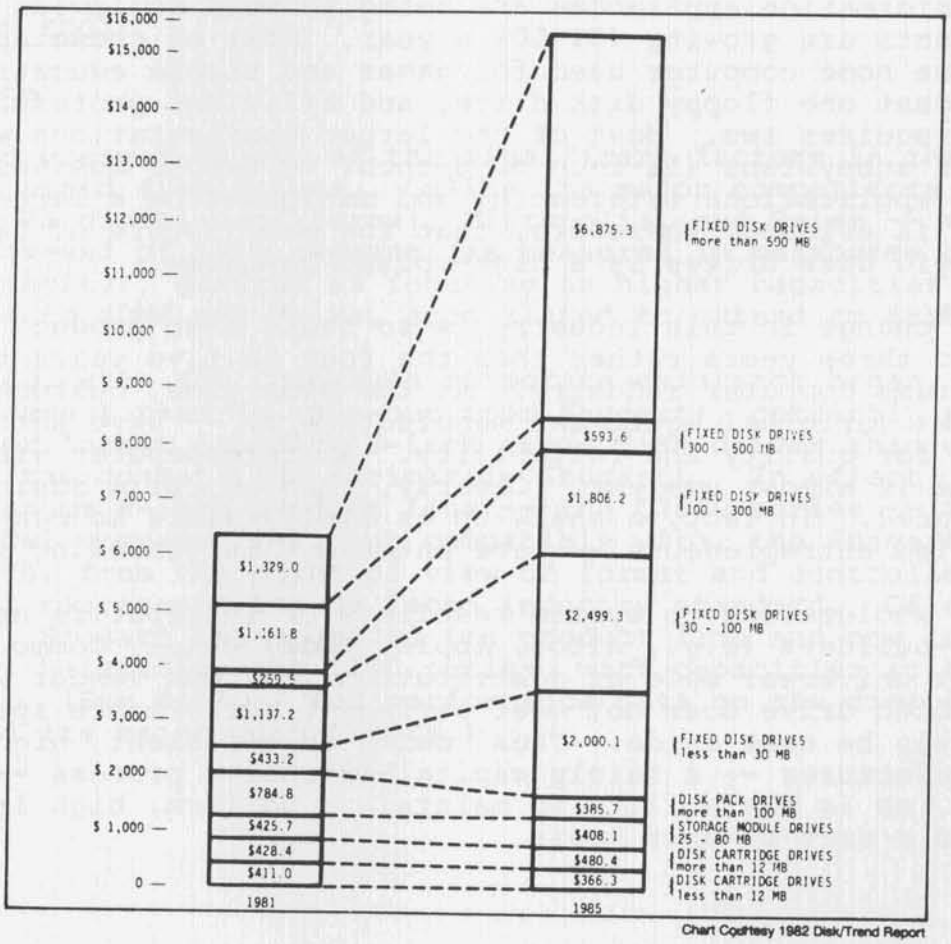

Chart Courtesy 1982 Disk/Trend Report

Obviously, the newer, more advanced rigid drives using much more complex technologies offer greater capacity ranges (and higher data transfer rates). The cost of implementing these technologies, however, is considerable. The design cycle is often two years versus the few months needed to develop a drive based on off-the-shelf technologies. Also, the risk of exceeding cost targets relative to competitively determined price points is substantial.

Currently, the competition is mounting, as the leading large-volume producers (like Tandon) cut prices to maintain, if not enlarge, their market shares. In addition, these well-funded firms are using their superior product/market position to push technology, thereby further pressuring their less well-endowed rivals. Obviously, even though the market potential is huge, investors must select their vehicles carefully. Still, the profit opportunities for companies that survive are extremely attractive.

Volume Manufacturing and Quality are Key

Volume manufacturing at consistently high quality is an absolute requirement for survival in this product segment. Currently, several million information appliances are being shipped worldwide each year, and shipments are growing 40%-50% a year. Most of these appliances (except the home computer used for games and simple educational tasks) need at least one floppy disk drive, and efficient professional use probably requires two. Most of the larger configurations will require rigid disk subsystems (5¼-inch or 8-inch) to handle business or professional applications referencing and manipulating a large body of data. It is evident, therefore, that the manufacture of 5¼-inch and 8-inch rigid disk drives is a high-volume business.

Technical change in this industry is so rapid that product life cycles are two to three years rather than the four to five years typical of the mainframe computer industry. At the same time, customers -- mostly OEMs (original equipment manufacturers) -- have set high standards for quality and reliability. A microcomputer with a failing disk drive is almost useless. Clearly, this is not a business for the inexperienced. In fact, a shake-up is likely since so many -- some very untried entrepreneurs -- have entered this demanding industry.

OEMing -- wholesaling to system resellers or integrators as well as to the micro-builders (e.g., Altos, Apple, Radio Shack, Commodore) -- is the almost universal mode of distribution. An OEM vendor whose mass-produced drive does not meet stringent performance specifications will quickly be cast aside. Thus, being an efficient, highly automated manufacturer -- a fairly capital-intensive process -- is also essential, as is the ability to maintain a uniform, high level of quality on a unit-by-unit basis.

Pricing in a Commodity Product Environment

Small fixed disk drives are high-technology commodities; widely known, off-the-shelf technologies produce a drive that, provided it meets published interface standards, readily plugs into a minicomputer or an information appliance. A substantial number of vendors (about 30 by the latest count) operate in this demanding market segment, each fighting to preserve or gain market share, often using price as the chief weapon.

Established firms that already produce one or several disk drive products in substantial quantities (e.g., Tandon, Priam, Quantum, Seagate, Shugart Associates) have an advantage; they can, and frequently do, price on the basis of actual or expected economies-of-scale and learning curve benefits. The newer entrants have to live under the price umbrella set by the leaders -- like it or not. In other words, newcomers venturing into this market segment had better be well-financed in order to have the staying power to reach volume production and, thereafter, profitability.

THE QUANTUM EDGE

Product Line

Quantum has emerged as one of the significant factors in the market for 8-inch rigid disk drives. Unlike its major competitors -- Shugart Associates (a division of Xerox), Micropolis, and Priam -- who emphasize the low-end of this segment (as measured in megabytes of rated storage capacity), Quantum is focusing on higher capacities -- currently 20MB to 40MB per drive, soon slated to extend to 85MB.

Back in 1980, when the Company's corporate existence began, an experienced management team (a spin-out from Shugart), correctly perceived the need for larger capacity 8-inch rigid disk drives than were offered by the competition (primarily Shugart). In effect, the current Quantum 8-inch product line -- the Q2000 series -- is a technological upgrade from, but compatible with, the Shugart 1000 series which, from the point of view of format and controller interface, still represents the de facto industry standard. Of course, since 1980, Shugart has upgraded its product line and now is delivering, albeit belatedly, the 1100 series, with capacities in the 20MB to 30MB range. (See Table 1 for performance data on the disk drives of Quantum and its major competitors.)

Table 1

OEM Rigid Disk Drives Offered for Sale in the United States

Manufacturer	Model	Unformated Capacity (Megabytes)	Number of Data Surfaces	Bytes Per Track	Average Access Time Incl. Latency (Milliseconds)	Transfer Rate (Kilobytes/ Second	Actuator Type	Interface Type
8-Inch and 10½-Inch Fixed Disks								
Control Data	9410-8 Finch	8.13	1	13,440	58.3	806.0	R, VC	Modified floppy-disk
	9410-24 Finch	24.39	3	13,440	58.3	806.0	R, VC	Modified floppy-disk
	9410-32 Finch	32.50	4	13,440	58.3	806.0	R, VC	Modified floppy-disk
IBM	680	64.50(a)	11	16,384(a)	36.6	1,031.0	R, VC	IBM
Micropolis	1221-I, 1201-I	8.91	1	15,364	50.3	922.0	R, VC	Micropolis, ANSI
	1222-I, 1202-I	26.73	3	15,364	50.3	922.0	R, VC	Micropolis, ANSI
	1223-I, 1203-I	44.56	5	15,364	50.3	922.0	R, VC	Micropolis, ANSI
Quantum	Q2010	10.66	2	10,400	65.0	543.0	R, TM	SA1000
	Q2020	21.33	4	10,400	70.0	543.0	R, TM	SA1000
	Q2030	32.00	6	10,400	70.0	543.0	R, TM	SA1000
	Q2040	42.66	8	10,400	75.0	543.0	R, TM	SA1000
	Q2080	85.45	7	10,420	50.0	543.0	R, TM	SA1000
Shugart	SA1002	5.33	2	10,400	79.6	542.5	B, SM	SA1000
	SA1004	10.67	4	10,400	79.6	542.5	B, SM	SA1000
	SA1104	20.30	3	10,400	34.6	542.5	R, VC	SA1000
	SA1106	33.90	5	10,400	34.6	542.5	R, VC	SA1000
5¼-Inch Fixed Disks								
Quantum	Q520	21.33	4	10,416	53.5	500.0	R, TM	ST506/ST412
	Q530	31.99	6	10,416	53.5	500.0	R, TM	ST506/ST412
	Q540	42.66	8	10,416	53.5	500.0	R, TM	ST506/ST412
Seagate	ST506	6.38	4	10,417	178.3	625.0	B, SM	ST506
	ST412	12.76	4	10,417	178.3	625.0	B, SM	ST506
	ST538	38.25	6	10,416	--	625.0	B, SM	ST506
Shugart	SA602	3.33	2	10,400	84.6	542.5	B, SM	SA1000
	SA604	6.66	4	10,400	84.6	542.5	B, SM	SA1000
	SA606	10.00	6	10,400	84.6	542.5	B, SM	SA100
Tandon	602	6.38	4	10,400	176.3	625.0	R, SM	SA1000, ST506
	602E	9.60	4	10,400	233.3	625.0	R, SM	SA1000, ST506
	603	9.57	6	10,400	176.3	625.0	R, SM	SA100, ST506
	603E	14.30	6	10,400	233.3	625.0	R, SM	SA1000, ST506

(a) formated
R = Rotary; B = Band; VC = Voice Coil; TM = Torque Motor; SM = Stepping Motor

Source: Mini-Micro Systems Magazine, February 1982; Morgan Stanley Research

Last November, Quantum introduced a new 85MB 8-inch disk drive (the Q2080), priced about 25% higher than its current 40MB Q2040. Questions have arisen about the longer term viability of the 8-inch market. Some believe that the 5¼-inch Winchester disk drives will seriously erode the growth potential available for the larger drives. Disk Trend, however, forecasts substantial growth for high-performance (more than 30MB capacity) 8-inch drives: 40% a year in the dollar value of such noncaptive OEM shipments from the present, admittedly small, base (see Table 2).

Table 2

8-Inch Rigid Disk Drives

Forecast; 1982-1985
($ Millions)

	1982	1983	1984	1985	Compound Growth Rate
Total	$226	$316	$398	$440	25%
>30MB Capacity Only	124	192	285	346	41

Source: Disk Trend Report

Another study (this one from the Venture Development Corporation) comes up with a similar overall conclusion; namely, total shipments of 8-inch rigid disk drives (captive and noncaptive) will grow 24% a year over the 1981 to 1986 period. In other words, concern about the maturing of the 8-inch Winchester market is unwarranted, particularly in regard to the new high-capacity drives.

At the Comdex show, the Company announced its entry into the 5¼-inch rigid disk product segment; these are being offered in 20MB-, 30MB-, and 40MB-capacity versions (two, three, or four platters per drive) and are priced 25% to 30% below Quantum's 8-inch disk drives of corresponding capacity. In addition, the new 5¼-inch drives offer average access times of no more than 45 milliseconds (versus 65 on the comparable 8-inch drives). Data transfer rates will be 625KB per second (versus 543KB on the 8-inch models).

Again, as in the case of the 8-inch product, Quantum's new 5¼-inch rigid disk drives will abide by established de facto industry standards (in this case set by Tandon and Seagate). Particularly for a new entrant like Quantum, compatibility is essential in an industry where business is done almost entirely on an OEM basis.

As it did in breaking into the 8-inch disk market, Quantum has elected to address the high-capacity end of the 5¼-inch rigid disk segment, whereas its major competitors (primarily Seagate and Tandon) serve the low end of the product range in terms of storage capacity. Needless to say, both of these major companies are talking of introducing higher capacity 5¼-inch drives in the foreseeable future. In fact, Tandon has already announced a 31MB drive.

As is not uncommon in the small peripherals equipment industry, Quantum's manufacturing is limited to assembly and testing operations. However, the standards established and the working conditions imposed are rigorous indeed. Virtually all components are procured from the outside and, being mostly standard types, are generally available from multiple sources.

Some observers perceive an industrywide trend toward vertical integration as a means to control sources of supply and achieve the lowest unit costs. The latter is critical in what is essentially a commodity product environment. In Quantum's case, vertical integration -- as opposed to OEMing the components comprising the end product -- is probably not appropriate at this time. The underlying technologies are still unstable, so it may be uneconomical to "freeze" on a given approach that would require substantial capital investment for in-house manufacturing facilities and equipment. Furthermore, the Company is not yet shipping at a monthly rate that would generate lower unit costs by manufacturing in-house. Still, the day may come when this will be a cost-effective solution, for certain items at least.

Product Strategy

Why is Quantum getting into the already well populated 5¼-inch rigid disk market at this stage, rather than contenting itself with being a leading and currently fast-growing participant in the 8-inch market? The answer is found in the rapid advancement of disk technology, which permits ever-increasing recording densities on any size of storage media -- 5¼-inch, 8-inch, and 14-inch sized platters (3½-inch disk drives are on the way). Soon, storage capacities that today require an 8-inch media, which implies a larger physical enclosure or frame, will be recorded on a 5¼-inch platter with equivalent reliability, probably delivering lower average access time and a higher data transfer rate.

Clearly, to continue to prosper in the dynamic, OEM-oriented small disk subsystem market, alert vendors must ride the technology curve or be doomed to oblivion. While not a technology leader in the truest sense -- i.e., first with the most advanced idea (say thin film heads or plated media) -- Quantum seems to be operating at the knee of the curve, applying new technology when its commercial feasibility has been pretty well proven under conditions of volume production.

The Company's current product strategy can be summarized in the following way. Proven technology (closed loop, voice coil, or rotary, motor-driven access techniques) permits increases in recording density, yielding 85MB capacity on an 8-inch drive (four platters per drive). This is near the top of the practical, price-constrained capacity range, given the relatively small physical size of the unit.

Control Data, Hitachi (30), and certain other smaller competitors are offering 160MB capacity on a physically larger, more costly 8-inch drive, which also requires substantially more power than the new Q2080 (Quantum's 85MB). Hence, on a cost/performance basis, we think the Q2080 will offer a very attractive solution, relative to both the currently marketed Q2000 series (20-40MBs per drive) and competitive products. Shipment of the currently marketed Q2020-Q2040 drives, will continue for several more years but will plateau, and, by fiscal 1985, may begin to decline.

The new 5¼-inch rigid disk drive is superseding Quantum's present Q2000 (up to 40MB capacity) 8-inch products. In other words, as always in the information processing industry, small is beautiful, be it in terms of physical size or cost/performance. If Quantum did not offer 5¼-inch drives, its OEM customers (Altos, Convergent Technology, Vector Graphic, Wang Labs, and others) over time would seek alternative, more cost-effective sources of supply for disk subsystems to be integrated into their work stations. At the same time, those OEM customers that continue to design 8-inch rigid disk subsystems into their configurations will insist on the higher storage capacities they know are possible.

For this reason, Quantum developed and is about to manufacture the Q2080, with volume shipments to begin next April. In effect, we are seeing here a bifurcated product strategy: an upward extension of the 8-inch drives to significantly higher capacities, while technologically advanced 5¼-inch disks are usurping the 20- to 40-MB market segment currently occupied by the Q2000 8-inch family. Quantum's 5¼-inch new drives, however, are unlikely to enter volume shipment until the summer of 1983. Thus, it will be fiscal 1985 (beginning April 1, 1984) before the Company enjoys the full benefit of its major new-product introductions.

Quantum's corporate and financial history, a related discussion of its R&D, manufacturing, and marketing operations, and management profiles are contained in the final prospectus on the recent equity offering dated December 10, 1982. The prospectus, attached hereto, is an integral part of this report.

FINANCIAL ANALYSIS

The new-product introduction strategy puts the Company into a transition phase, beginning with the first quarter of fiscal 1984. Heavy

R&D expenses, start-up costs, and a leveling out of shipments of the current 8-inch product line (as the new 5¼-inch drives begin to take off) will all contribute to slower revenue growth during fiscal 1984 (the torrid year-over-year increase of almost 200% expected for fiscal 1983 is unsustainable in any case).

Of course, the primary impact of these events will be felt on the bottom line. Therefore, fiscal 1984 operating income (excluding a large amount of interest income) will substantially lag shipment growth; we estimate a gain of 31% on a revenue increase of 63%. To put it another way, we think operating margins, which we estimate this year will be 27.8%, will drop considerably in fiscal 1984 to 22%-23%. By fiscal 1985, however, they should have stabilized around 20%, in line with those of Quantum's peers, and the Company should enjoy a year of strong profit growth.

In fiscal 1985, revenues of about $100-million are readily achievable, provided the new products enter volume shipment without a major hitch, as we expect. Gross margins, which this year are still running better than 40% and will temporarily drop to below 40% in fiscal 1984, should stabilize at approximately 40% again, in line with industry experience. Accordingly, we forecast that Quantum's fiscal 1985 earnings will rise 50% year over year.

Fiscal 1984 is still to come, however, and the Company's earnings progress will not be overly strong, although buoyed by significant interest income earned on the proceeds of the recent equity issue. We show historical and projected income statements for the fiscal years 1982 through 1984 in Table 3.

Quantum's fiscal 1984 quarterly sales and profit profile will reflect the impact of the product transition that is about to begin. (We present our quarterly forecasts for fiscal 1983 and 1984 in Table 4.) The progression of earnings in the first and second fiscal periods of 1983 has been pleasant to behold, and the December and March periods should show earnings of about $0.22 and $0.24 per share, respectively, versus $0.22 in the second fiscal quarter.

Following the first reporting period of fiscal 1984, however, the pattern will probably become irregular; profits are likely to be flat sequentially in the second and third quarters and slightly lower than in the first. Fourth-period profits, however, should be strong, both relatively and absolutely, as the revenue contribution from the new products begins to be felt in earnest.

As the data in Table 3 reveal, beginning with the fourth period of fiscal 1983, Quantum will benefit substantially from interest income (mainly as a result of the recent equity issue) and expects to generate a positive cash flow through the end of fiscal 1984, which will allow it to accumulate a large cash balance (about $35-million).

TABLE 3

QUANTUM

INCOME STATEMENT; 1981-1984E*

($ THOUSANDS EXCEPT PER SHARE DATA)

					% CHANGE		
	1981**	1982	1983E	1984E	82/81	83/82	84/83
SALES	0.00	13.66	40.00	65.00	--	192.88	62.52
COSTS AND EXPENSES							
COST OF SALES	0.00	9.36	21.00	37.18	--	124.43	77.07
RESEARCH, DEVELOPMENT, AND ENGINEERING	1.44	1.42	3.40	5.20	-1.32	139.24	52.96
MARKETING	0.33	1.80	2.60	4.88	446.67	44.11	87.52
GENERAL & ADMINISTRATIVE	0.24	0.85	1.90	3.25	252.48	122.72	71.07
TOTAL	2.01	13.43	28.90	50.51	567.69	115.10	74.78
OPERATING INCOME	-2.01	0.22	11.10	14.50	-111.03	4899.46	30.60
INTEREST EXPENSE	0.00	-0.20	-0.05	0.00	--	-74.49	-100.00
INTEREST INCOME	0.24	0.16	1.45	4.10	-34.16	806.25	182.76
NET INTEREST INCOME	0.24	-0.04	1.40	4.10	-114.81	-3988.89	192.86
PRETAX INCOME	-1.77	0.19	12.50	18.60	-110.51	6619.79	48.78
NET INCOME	-1.77	0.19	6.84	10.17	-110.51	3575.72	48.78
EARNINGS PER SHARE	-1.50	0.03	0.85	1.05	-101.87	2930.22	23.34
AVG. SHARES OUTSTANDING	1.18	6.60	8.00	9.65	461.04	21.30	20.63
EFFECTIVE TAX RATE	0.00	0.00	45.30	45.30	--	--	0.00

% OF SALES			
COST OF SALES	68.51	52.50	57.20
RESEARCH, DEVELOPMENT, AND ENGINEERING	10.41	8.50	8.00
MARKETING	13.21	6.50	7.50
GENERAL & ADMINISTRATIVE	6.25	4.75	5.00
TOTAL OPERATING EXPENSES	98.37	72.25	77.70
OPERATING INCOME	1.63	27.75	22.30
INTEREST EXPENSE	-1.44	-0.13	0.00
INTEREST INCOME	1.17	3.63	6.31
NET INTEREST INCOME	-0.26	3.50	6.31
PRETAX INCOME	1.36	31.25	28.61
NET INCOME	1.36	17.09	15.65
EARNINGS PER SHARE	0.21	2.14	1.62

*FISCAL YEARS END MARCH 31.
**FEBRUARY 20, 1980, THROUGH MARCH 31, 1981.

E = MORGAN STANLEY RESEARCH ESTIMATES

TABLE 4

QUANTUM

QUARTERLY INCOME STATEMENT; 1982-1984E*

	1982	1Q	2Q	3QE	4QE	1983E	1QE	2QE	3QE	4QE	1984E
SALES	13.66	8.66	9.95	10.50	10.90	40.01	12.00	14.00	17.00	22.00	65.00
OPERATING COSTS	13.43	6.40	7.10	7.60	7.85	28.95	8.65	10.70	13.60	17.60	50.55
OPERATING INCOME	0.22	2.26	2.85	2.90	3.05	11.06	3.35	3.30	3.40	4.40	14.45
NET INTEREST	-0.04	0.02	0.11	0.40	0.90	1.43	1.05	1.05	1.00	1.00	4.10
PRETAX INCOME	0.19	2.28	2.96	3.30	3.95	12.48	4.40	4.35	4.40	5.40	18.55
NET INCOME	0.19	1.25	1.62	1.81	2.16	6.83	2.41	2.38	2.41	2.95	10.15
EARNINGS PER SHARE	0.03	0.17	0.22	0.22	0.24	0.85	0.26	0.25	0.25	0.29	1.05
AVG. SHARES OUTSTANDING	6.60	7.50	7.50	8.10	8.90	8.00	9.10	9.40	9.80	10.20	9.63
EFFECTIVE TAX RATE	0.00	45.27	45.27	45.30	45.30	45.29	45.30	45.30	45.30	45.30	45.30
% OF SALES											
OPERATING COSTS	98.37	73.92	71.36	72.38	72.02	72.36	72.08	76.43	80.00	80.00	77.77
OPERATING INCOME	1.63	26.08	28.64	27.62	27.98	27.64	27.92	23.57	20.00	20.00	22.23
NET INTEREST	-0.26	0.23	1.06	3.81	8.26	3.56	8.75	7.50	5.88	4.55	6.31
PRETAX INCOME	1.36	26.31	29.70	31.43	36.24	31.20	36.67	31.07	25.88	24.55	28.54
NET INCOME	1.36	14.40	16.25	17.19	19.82	17.07	20.06	17.00	14.16	13.43	15.61
EARNINGS PER SHARE	0.21	1.92	2.17	2.12	2.23	2.12	2.20	1.81	1.44	1.32	1.62

		1984E/83E				
PERCENTAGE CHANGE	1983E/82	1QE	2QE	3QE	4QE	YR
SALES	192.97	38.60	40.70	61.90	101.83	62.47
OPERATING COSTS	115.50	35.16	50.70	78.95	124.20	74.61
OPERATING INCOME	4881.08	48.36	15.79	17.24	44.26	30.67
NET INTEREST INCOME	--	5150.00	900.00	150.00	11.11	187.72
PRETAX INCOME	6611.29	93.15	47.21	33.33	36.71	48.60
NET INCOME	3571.92	93.05	47.13	33.33	36.71	48.57
EARNINGS PER SHARE	2905.09	59.09	17.38	10.20	19.29	24.22
AVG. SHARES OUTSTANDING	21.30	21.34	25.34	20.99	14.61	20.32
EFFECTIVE TAX RATE	--	0.07	0.07	0.00	0.00	0.03

*FISCAL YEARS END MARCH 31.

E = MORGAN STANLEY RESEARCH ESTIMATES

Management has targeted capital expenditures in fiscal 1984 at $4.0-million, up from the $2.3-million estimated for fiscal 1983.

Historical financial ratios, such as return on equity (the Company has no debt outstanding), are not very meaningful at this stage of Quantum's development. On a pro forma and a fully taxed basis, in fiscal 1983 and 1984, we estimate return on average equity will be 26% and 19%, respectively. Inventories and accounts receivable are under good control having shown virtually no growth between March 31 and October 2, 1982, during which period, sales accelerated about 26% sequentially. Management's goals are an eminently respectable 55 days outstanding on accounts receivable, versus approximately 50 now, and 3.5 times for inventory turns, in line with current performance.

RISKS

Young companies -- Quantum is only three years old -- face many tough decisions, almost by definition. High-technology firms (small or medium-sized) are risky because rapidly changing technological advances can easily swamp an organization trying to get on its feet with, at least initially, a limited product range. On top of that, the OEM-oriented rigid disk market has characteristics (see the industry section of this report) that place great demands on management. Windows of opportunity in this environment are relatively narrow: often, product life cycles average only two years -- they can be longer but no one can be sure of that at the beginning. Price-eroding excess capacity is an ever-present danger.

The dramatic technological progress observed in the evolution of high-capacity 14-inch disk subsystems will be replicated at the low end in the not-too-distant future. Among industry savants, it is accepted that, within the next two or three years, 5¼-inch rigid drives will take over in the 30MB-100MB product segment, while 8-inch rigid drives will move up and supersede the currently popular 14-inch drives in the 100MB- to 300MB-capacity range.

Concurrently, in the higher capacity 8-inch drives, the more costly closed-loop access technology is taking over from open-loop (stepper motor) design. Thin film heads and plated or sputtered media, which will permit much higher recorded densities as well as shorter access times and faster data transfer rates, will require major R&D efforts and concomitant financial resources.

So far, Quantum is making the necessary moves "to keep up with the Joneses" -- i.e., it is developing 5¼-inch rigid drives to take over from its present family of 8-inch drives, which, in turn, are being enhanced to address a higher capacity range. This should ensure that the Company will hold on to its stable of high-growth OEM customers, at least for the time being. Only if Quantum were to falter in bringing the new products to market on time or fail to ride the

ever-advancing technology curve should its earnings fall behind the industry growth rate. Certainly, the Company is amassing the financial resources to stay in line.

In this dynamic industry segment, however, it takes more than cash to succeed, although cash is a necessary ingredient. A successful vendor has only months to bring a new product on-stream and get it into volume production. Competition is keen, and start-ups are too manifold to permit any one firm the luxury of taking a few extra months to debug or reschedule a new product. The large customers that rely on the independent small disk subsystem vendors are not known for loyalty; to wit, Apple's recent decision to give all its 5¼-inch floppy disk business to Alps (Japan) at the expense of its previous alternative supplier (Shugart Associates). Other things being equal, these customers key off cost per unit, cost/performance, reliability, and availability in awarding contracts. Failure or nonperformance on any one of these counts can lead to quick elimination of the vendor. Clearly this is a high risk business and not the stuff of which ultra-high P/Es are made, despite the substantial growth rate forecast.

Ulric Weil
(212) 974-4396
December 16, 1982

Morgan Stanley & Co. Incorporated comanaged the most recent public offering, within the last three years, of the securities of Apple Computer and Hitachi.

Morgan Stanley & Co. Incorporated makes a market in the securities of Apple Computer and Seagate.

Morgan Stanley & Co. Incorporated has a trading position in the securities of Wang and Xerox.

Morgan Stanley & Co. Incorporated holds options in the securities of Wang and Xerox.

Copies of this report delivered until February 10, 1983, are being accompanied by a copy of the Prospectus relating to a recent public offering of the common stock of Quantum Corporation, for which Morgan Stanley & Co. Incorporated acted as comanager.

CUSTOMERS

PROMOTION

PRODUCTS

MAJOR CUSTOMERS

Altos Computers

Arrow Electronics

CompuPro

Convergent Technologies

Data Systems Design

Industrial Micro Systems

Nixdorf Computers

Pixel Computer Inc.

Rolm Corporation

Scientific Micro Systems

Telesis Systems Corporation

TeleVideo

Wang Laboratories

Xerox Office Products Division

QUANTUM

QUANTUM NEWS RELEASE

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(408) 727-1188

FOR IMMEDIATE RELEASE
519-017/4599a

QUANTUM CORPORATION AND ALTOS COMPUTER SYSTEMS SIGN $25 MILLION CONTRACT

MILPITAS, Calif., July 6 -- Quantum Corporation (OTC-QNTM) today announced a major contract with Altos Computer Systems, San Jose, for Quantum to supply several models of its 5-1/4-inch and 8-inch Winchester disk drives for use in Altos systems. The two-year agreement calls for a minimum of 20,000 disk drives, with a value in excess of $25 million.

The contract is believed to be the first significant commitment by a major OEM to higher-capacity 5-1/4-inch Winchester disk drives, incorporating Quantum's 32-megabyte Q530 and 43-megabyte Q540 products. The agreement also represents a renewal of an existing relationship covering Quantum's 8-inch product family, with the addition now of the 85-megabyte Q2080 product.

With this major new commitment, Quantum becomes Altos' primary supplier of higher-capacity small Winchester disk drives. The 8-inch products are used in Altos' ACS8000, ACS8600 and ACS68000 multi-user systems, and the 5-1/4-inch products are slated for use in advanced multi-user systems to be introduced later this year.

(more)

"One of our main reasons for selecting Quantum was the company's proven performance in manufacturing 8-inch Winchester drives in high volume at consistently high-quality levels," said Dave Jackson, Altos' president. "The same product and process technologies are used in the Q500 5-1/4-inch product family as in the Q2000 8-inch family."

Altos, based in San Jose, California, has been a pioneer in the development of inexpensive multi-user, general purpose business computers. Quantum Corporation is a leading, independent manufacturer of small Winchester disk drives for the OEM market.

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1983

QUANTUM NEWS RELEASE

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FOR IMMEDIATE RELEASE
519-019/4704a

QUANTUM CORPORATION TO SUPPLY 5-1/4-, 8-INCH WINCHESTER DRIVES TO IMS INTERNATIONAL

MILPITAS, Calif., July 22 -- Quantum Corporation announced today that it has signed a contract with Industrial Micro Systems International (IMS), Carson City, Nevada, to supply both 5-1/4-inch and 8-inch Winchester disk drives for use in IMS's series 5000 and 8000 microcomputer systems designed for general business applications. This two-year agreement involves a minimum of 5,000 Quantum disk drives and has a potential value of $8 million.

IMS manufactures vertically integrated 8- and 16-bit multiprocessor-based microcomputer systems for multi-user environments. This contract represents the first time that Quantum's Q500 product line, primarily the 43-megabyte Q540, will be used in IMS's 5000SX multi-user table-top computer systems and in IMS's 5000IS integrated desktop systems.

Quantum's 8-inch drives currently serve IMS's 8000SX table-top microcomputer and the 8000S multi-terminal systems. IMS sells its product line to systems OEMs and end users.

(more)

According to Al Fiegehen, vice president of IMS, "Quantum's Q500 product line represents a cost-effective way of incorporating higher capacity into our desktop systems, enabling us to continue to offer a compact, high-performance system at a competitive price."

Quantum Corporation is a leading independent supplier of high-capacity, small Winchester disk drives for micro-based small business systems and personal computers.

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QUANTUM NEWS RELEASE

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FOR IMMEDIATE RELEASE
519-021/4717a

QUANTUM CORPORATION SIGNS $2 MILLION CONTRACT WITH ROLM TO SUPPLY 8-INCH WINCHESTERS FOR DIGITAL TELEPHONE SYSTEM

MILPITAS, Calif., July 26 -- Continuing a series of major contract announcements, Quantum Corporation today said that it will provide ROLM Corporation, Santa Clara, Calif., with 8-inch Winchester disk drives for use in ROLM's computer-controlled business communications systems. The one-year contract has an approximate value of $2 million.

Quantum's 43-megabyte, Q2040 disk drives will be integrated into ROLM's VL/CBX digital telephone system, which provides distributed processing capabilities for simultaneous voice and data transmission. This system will be used in facilities requiring between 1,500 and 4,000 telephone lines.

Quantum Corporation, based in Milpitas, Calif., is a leading independent supplier of high-capacity, 5-1/4- and 8-inch Winchester disk drives for micro-based small business systems and personal computers.

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1983

A second OEM agreement was signed by Telesis Systems Corporation of Chelmsford, Mass. The $3 million contract calls for Quantum's Q2000, Q2080 and Q500 disk drives. Telesis will integrate the 8- and 5-1/4-inch drives into its computer-aided design (CAD) workstations. The company's CAD systems present a distributed processing solution to the design of printed circuit boards and offer high functionality at a fraction of the cost usually associated with traditional multi-terminal systems.

Quantum Corporation (OTC-QNTM) is a leading independent supplier of high-capacity small Winchester disk drives for microcomputer-based small business systems and personal computers.

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1983

QUANTUM NEWS RELEASE

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FOR IMMEDIATE RELEASE
519-036/5075a

QUANTUM RECEIVES $5 MILLION CONTRACT FROM COMPUPRO FOR Q500 WINCHESTER DRIVES

MILPITAS, Calif., Oct. 3 -- Quantum Corporation today announced the receipt of a contract for the company's new Q500 Winchester disk drives from CompuPro, based in Hayward, Calif. The initial 18-month agreement to purchase Quantum's Q540 40-megabyte 5-1/4-inch drives represents a first-time contract between Quantum and CompuPro and is valued at approximately $5 million.

CompuPro has slated the Q540 drives as optional fixed disk mass storage subsystems for its CompuPro 10, a four-user, multiprocessor microcomputer business system announced this month. Les Lee, CompuPro's vice president of operations, said, "Our engineering team continued to evaluate 5-1/4-inch disk drives even after the initial product was developed. There was total agreement that the Quantum drives give us the price and performance we're seeking for the CompuPro 10." Lee added that shared mass storage is a critical requirement of multi-user business systems.

(more)

CompuPro is a privately held manufacturer and supplier of microprocessor-based business and industrial computer systems. The CompuPro 10 is the company's first fully integrated business system and features the ability to concurrently use 8- and 16-bit programs. This contract with Quantum represents CompuPro's first system integration of fixed disk mass storage, allowing users to access and use information from large mainframe databases at the workstation level.

Quantum Corporation is a leading independent supplier of high-capacity, small Winchester disk drives for microcomputer-based small business sytems and personal computers.

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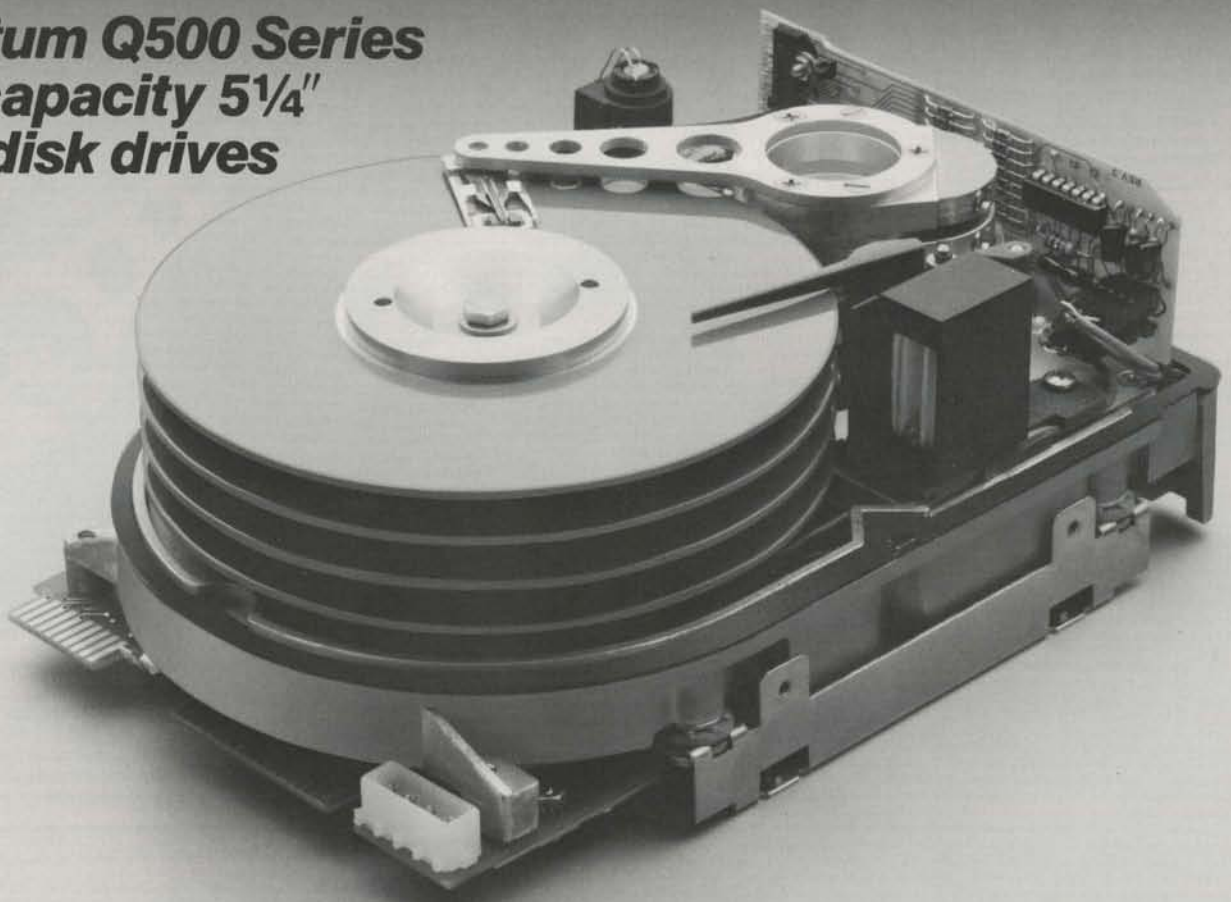
1983

PROMOTION

PRODUCTS

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

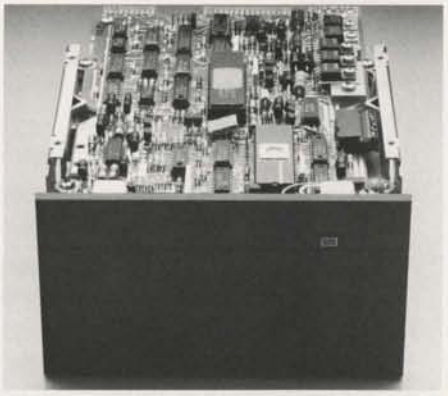
Quantum, the leading high-volume supplier in 8" disk drives, can confidently promise the same high-volume availability for our 5¼" products. As many as you need, when you need them.

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

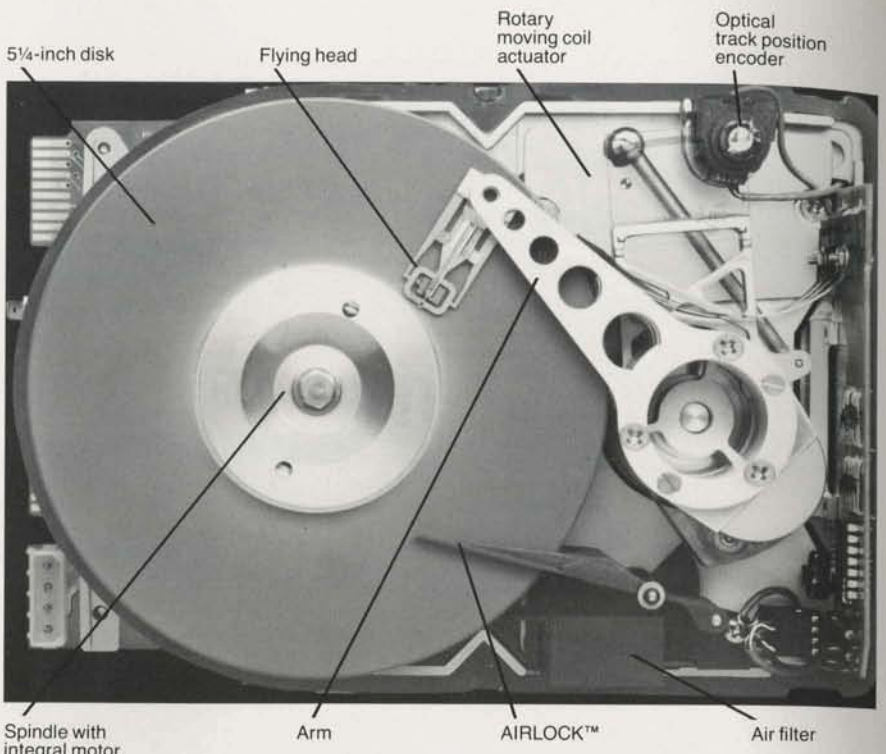
Read/Write Heads
- Monolithic manganese zinc Winchester (IBM 3350) heads
- Low mass/low load force design
- Reliable contact start/stop operation
- Heads automatically return to a landing zone during power-off and shipping

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

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002 5/83 10M

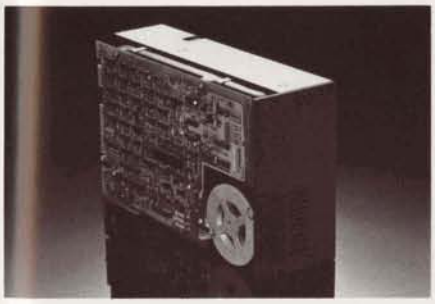
QUANTUM

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.

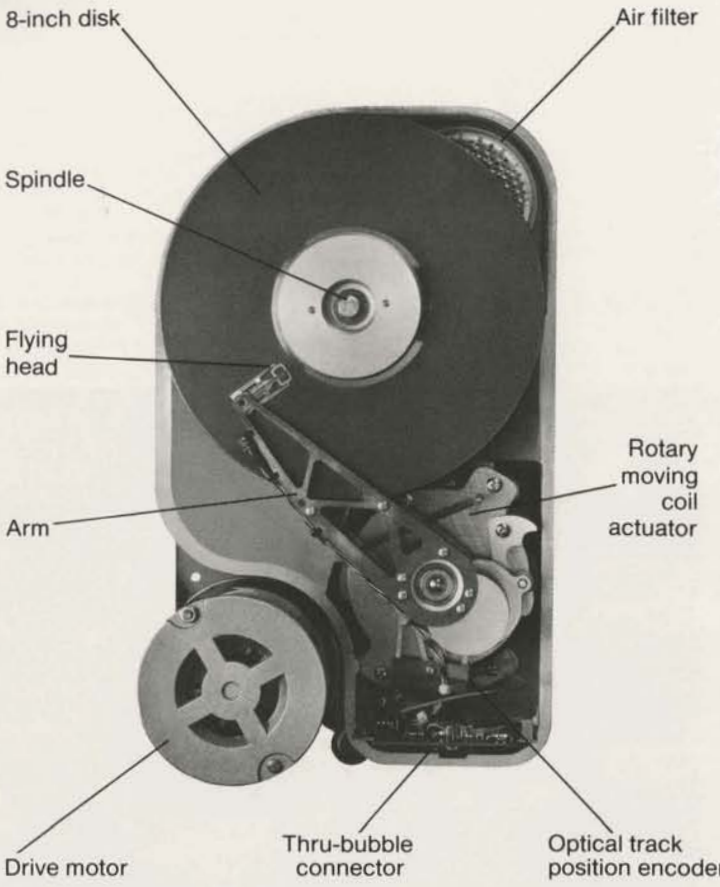
DC voltage requirements are identical to those for standard floppy drives and data cartridge streamers. The same power supply can be used with Quantum 2000 and various back-up drive options.

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 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

QUANTUM

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004 5-82 20M

QUANTUM

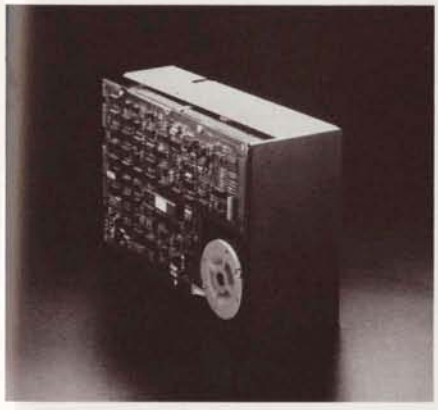
Quantum Q2080™ low-cost, 85 megabyte, fixed disk drive.

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.



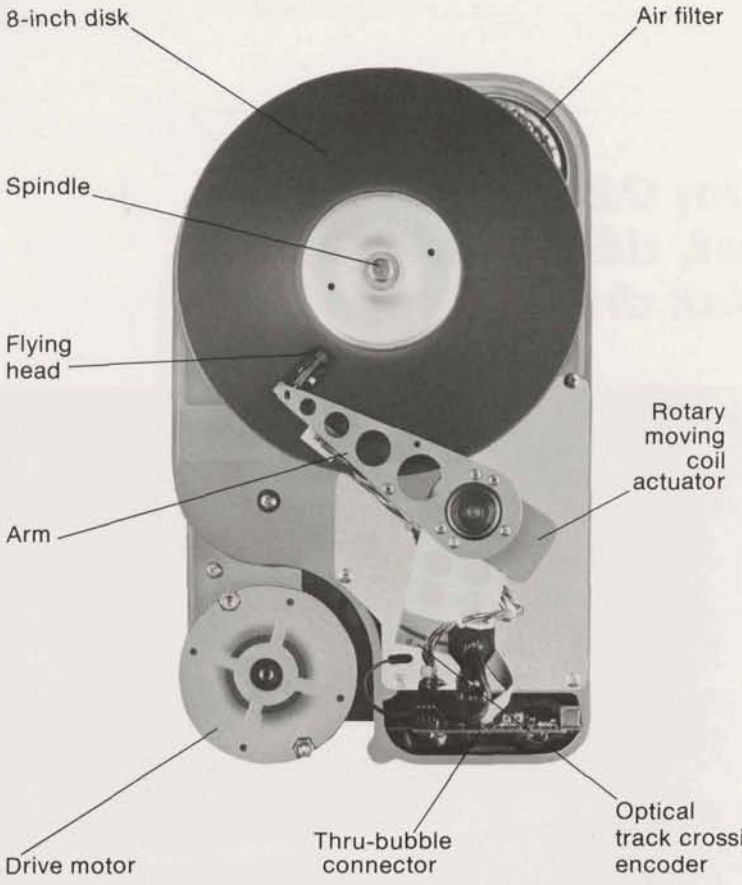
Mounting requirements are fully compatible with industry-standard 8-inch floppy drives. Drive control and data signals use the same pin assignments as compatible floppy drives, allowing daisy-chaining of fixed and floppy drives.

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 1.0 A typical
- 200/230 VAC installations = 180-253V at 0.5 A typical

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

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  - Fort Lauderdale

QUANTUM

Our reputation is on the line.

We're a manufacturing company. Our engineers are manufacturing engineers. And our assemblers know that our reputation, and your system's, are in their hands.

Our strategy is simple. We build reliable disk drives, in volume. We've concentrated on perfecting the medium capacity Winchesters you need, now. 8″ drives, from 10 to 85 megabytes; 5¼″ drives, from 20 to 40 megabytes. By *perfecting*, we mean as perfect in 10,000 of your systems as they were in one demonstration unit.

We start with a cleaner design. Fewer parts. A design that can be assembled smoothly, tested effectively, and produced in volume without compromising quality.

Our production techniques, like our Winchesters, are a highly refined blend of experience and innovation. The "clean tunnel" approach we pioneered, for example, is less costly, more flexible, and yet just as free of contaminants as standard clean rooms. The modular sections can be expanded, duplicated or rearranged around changing production needs.

We'd like an opportunity to show you why we're so confident about putting our reputation, and yours, on the line. Give us a call.

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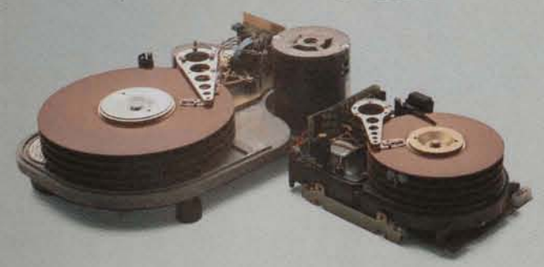

High Volume. Low Anxiety.

The only surprises you'll get with Quantum disk drives are pleasant ones.

Consistently excellent performance.

Quality and reliability you can count on to keep systems up, anxiety down.

Low Cost.

And the best surprise of all: we can deliver all the medium-capacity Winchesters you need. Now. 8″ drives, from 10 to 85 megabytes. 5¼″ drives, from 20 to 40 megabytes.

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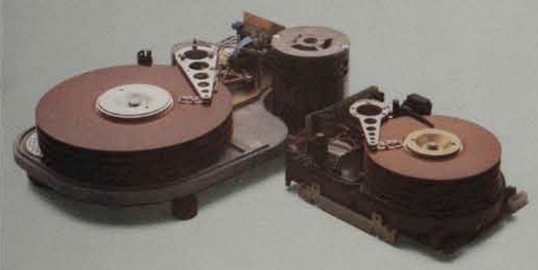
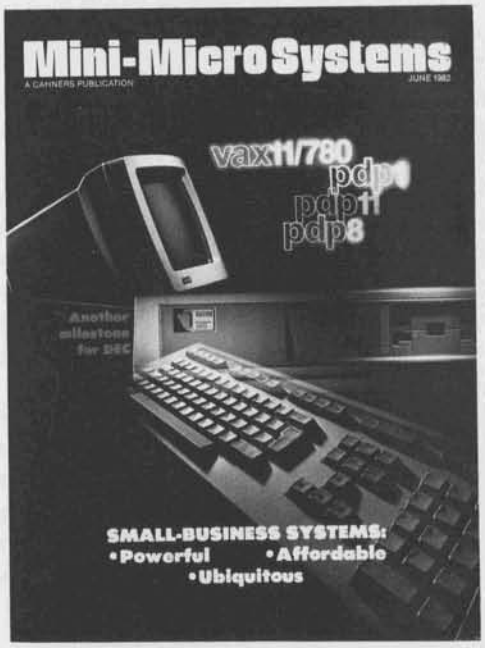


Quantum
Taking the Lead in 8-in. OEM Winchester Shipments



As appeared in June 1982 Edition of Mini-Micro Systems

QUANTUM

Quantum Corporation
1804 McCarthy Blvd.
Milpitas, CA 95035

Mini-Micro World

Quantum taking lead in 8-in. OEM Winchester shipments

Despite the increasing availability of higher capacity (12M- to 25M-byte), 5¼-in. Winchesters and plans by many vendors to offer even higher performance, higher capacity hardware, the demand for low-cost 10M- to 40M-byte, 8-in. Winchesters will continue to accelerate at a strong pace, fueled by the growing demand for μp-based small-business systems and word processors, says an executive at one of the few disk-drive companies founded for the express purpose of building this size drive.

"Systems in these categories are growing at a rate of 40 to 50 percent per year," says Steve Berkley, marketing vice president at Quantum Corp., Milpitas, Calif., "and most of them originally used 8-in. floppy-disk drives for system and file storage." As a result, he says, there continues to be a growing, built-in market for 8-in. fixed-disk hardware. "We're replacing one of the floppies in these systems with a higher capacity Winchester," he explains, "and right now, we're replacing them at a rate of 150 drives per day, six days a week."

That adds up to a lot of hardware, Berkley goes on, noting that Quantum, founded only two years ago by a number of executives from Sunnyvale, Calif., disk-drive rival Shugart Associates and from Sunnyvale-based subsystem builder Systems Industries, Inc. (MMS, May, 1980, p. 47), did $13.8 million in business at the close of its fiscal year last March. Next year, he says, Quantum is looking at $50 million in revenues from the sale of 8-in. Winchesters, and expects to double that figure by the end of fiscal year 1984.

Most of next year's increased revenues will come from the company's existing Q2000 series 10M- to 40M-byte Winchesters, Berkley says, with newer products expected to contribute to 1984's earnings. "Right now, 65 percent of our revenues come from our Q2040 40M-byte drives," he explains, with 30 percent coming from sales of the company's 20M-byte Q2020.

Sales of Quantum's 30M-byte Q2030 drive account for only 2 percent of sales, while its 10M-byte Q2010 accounts for only 3 percent, a figure that reflects the dominant market share held by Shugart's 10M-byte SA1004 8-in. Winchester. "Between the two companies, we're shipping close to 90 percent of all low-cost 8-in. Winchesters," Berkley says. Quantum's Q2040 is priced at $2450 in 100-lot orders; Shugart's 10M-byte SA1004 and Quantum's Q2010 are both priced at $1400.

In terms of numbers, Berkley goes on, Shugart's lower capacity drive is shipping in larger volume in markets where both companies compete. In terms of overall revenues from the sale of 8-in. Winchesters, however, he says, Quantum is posting larger numbers. Moreover, he does not anticipate that Quantum's position of revenue leadership will change. "It's a question of volumes," Berkley explains. "The servo systems and voice-coil actuators proposed by many vendors of higher capacity, higher performance 8-in. drives will remain a production constraint." What it all comes down to, he says, is that no one knows how to build drives using these actuators in large numbers and at low cost.

Shugart's 5M- and 10M-byte SA1000 Winchesters are open-loop drives that use split-band actuators driven by stepper motors—a lower cost, lower performance design derived from the company's floppy-disk drives.

In an effort to get higher performance and higher capacity from an actuator system that could be produced in high volumes, Quantum developed a "hybrid" actuator design. Instead of using stepper motors and split-band actuators to move the read/write heads, the company connected a torque motor directly to a pivot arm onto which the read/write heads are mounted. And, instead of using the incremental steps of a stepper motor to determine head locations, coarse positioning on the Quantum drives is handled by an optical encoder that comprises a scribed glass scale, an LED and a receiver. Fine positioning needed to keep the heads on track is derived from track-location data encoded onto a dedicated sector on the data surfaces of each disk.

While more producible, this type of actuator offers lower performance than the closed-loop servo/voice-coil combination used by other

vendors of high-capacity 8-in. hardware. It does, however, give Quantum's products a performance edge compared to stepper motor-driven drives. Average positioning time on the 10M-byte Q2010, for example, is pegged at 60 msec. compared to 70 msec. for Shugart's SA1000. Use of both coarse- and fine-positioning techniques also gives Quantum hardware an edge on capacities. Shugart's SA1000 provides 256 tracks per data surface at 172 tracks per in.; Quantum's hardware handles 512 tracks at 345 tpi.

Vendors of voice-coil drives also stress higher performance. International Business Machines Corp.'s 3310 Piccolo drive, the only other high-capacity (64M-byte), 8-in. fixed-disk drive to be installed in large volumes, operates at an average access time of 27 msec. This drive provides 359 tracks per surface at a track density of 450 tpi.

Berkley does not see the Piccolo as a direct competitor of Quantum's hardware, however. "There are two reasons," Berkley says. "First, it would be rare for an OEM to be evaluating our drive and a higher performance device such as the Piccolo with the idea of selecting one or the other."

Second, Berkley goes on, IBM and Quantum are pursuing different markets. IBM, he says, is selling 8-in. hardware to system designers that are not constrained by the physical dimensions of the cutouts and depths originally specified for the floppy-disk drives in small-business systems and word processors targeted by Quantum.

Just how much 8-in. hardware with capacities of more than 30M bytes will be shipped over the next few years depends on whom you ask.

Jim Porter, Mountain View, Calif., industry analyst and publisher of *Disk/Trend Report*, remains conservative when estimating the amount of 30M- to 200M-byte, 8-in. hardware to be shipped, regardless of performance level. Porter estimated that 16,000 8-in. drives in the 30M- to 200M-byte range would be shipped by U.S. vendors this year, with that figure climbing to 39,000 next year, and to 85,000 in 1984. He concedes, however, that he may revise his figures upward, based to a certain extent on the amount of hardware that Quantum is shipping.

Newark, Calif., industry analyst Andrew Roman anticipates higher levels of demand, especially for IBM and Quantum hardware. "These two companies control 90 percent of the market for OEM 8-in. drives in the 25M- to 100M-byte range," he says, with Quantum alone accounting for 85 percent of this hardware. Roman predicts that a total of 50,000 OEM Winchesters in this capacity range will be shipped in 1982, bringing Quantum's share of the pie to more than 38,000 drives.

8-in. Winchesters roll off the Quantum assembly line. *Assembly begins at the head of a "clean tunnel" (background) Quantum uses in place of the clean rooms used by Winchester vendors. In a clean-tunnel environment, purified air blows down over the line while assembly personnel work through plastic curtains. Completed drives in the foreground await shipping and testing. Quantum is shipping 8-in. hardware at the rate of 150 drives a day.*

Quantum's own figures are slightly lower. At a ship rate of 150 drives a day, six days a week, Quantum plans to move 46,800 drives, more than 30,000 of which will be 40M-byte devices.

"The real test for OEM Winchester vendors is how quickly production can be ramped up," Berkley says, noting that the company plans to quadruple its manufacturing space and to ship at the rate of 600 units a day by late summer of this year. "The real winners will be those that are geared up to meet high-volume demands."

—*John Trifari*

QUANTUM

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Dave Brown