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Quantum

# **Q** **Quantum**

**February, 1989**

**This book is intended as a reference guide on Quantum Corporation and the hard disk drive market. For further information, contact Joseph T. Rodgers, Jr., Executive Vice President, Finance, or Mark D. Wilson, Vice President, Marketing.**

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# **QUANTUM CORPORATION**

## **Corporate Background**

### **Overview**

Quantum designs, manufactures, and markets rigid disk drives for use by original equipment manufacturers (OEMs) in personal computers and workstations. In addition, Quantum's wholly-owned subsidiary, Plus Development Corporation, designs high-value-added, personal computer enhancement products and markets them through retail channels to end-users.

Quantum was founded in 1980 by a group of experienced managers from the disk-drive and computer manufacturing industries. Early equity financing was provided by Kleiner, Perkins, Caufield and Byers, the Mayfield Fund, and Sutter Hill, leading venture capital firms. The Company made its initial public offering in December 1982 at \$20.50 per share, raising \$32 million.

### **Products**

Quantum currently offers the ProDrive Series™, a broad family of high performance 3 1/2-inch hard disk drives. Plus Development markets three hard disk product lines: the Hardcard™ family of fully integrated disk drives on expansion cards, the Plus Passport™ removable hard disk drive systems for personal computers, and the Plus Impulse™ expandable hard disk drive system for PC LANs.

Announced in February 1988, Quantum's ProDrive Series of high performance 3 1/2-inch hard disk drives provides formatted capacities ranging from 42 to 168 megabytes and a choice of SCSI (Small Computer System Interface) and AT-Bus interfaces. These drives are designed for use in high performance personal computers, workstations, and multi-user systems - applications which require the high performance and reliability provided by ProDrive Series drives.

ProDrive Series disk drives provide several advantages over competing 3 1/2-inch hard disk drives in both performance and reliability. All ProDrive™ products offer lower average seek times and faster data transfer to the host than competing products. The average seek time for all drives in the series is 19 milliseconds or less. ProDrive Series products also feature exceptional reliability, with lower unrecoverable data error rates and a significantly higher specified Mean Time Between Failures (MTBF) - 50,000 hours - than other 3 1/2-inch drives.

The ProDrive Series drives also feature Quantum's proprietary DisCache® buffer management system which decreases disk access time even further - as much as 50% in some applications. These drives feature embedded controllers that release the host computer from the task of managing data storage operations, permitting higher system performance and faster access to disk memory. In addition, the design of these drives allows systematic compensation for errors in disk media, resulting in higher production yields, lower manufacturing costs, and greater data storage integrity.

Quantum is currently phasing out its Q200 Series™ of intelligent, half-height, 5 1/4-inch hard disk drives - the first small disk drives with embedded SCSI controllers. This move

is part of the Company's new OEM business strategy announced in June 1987. Quantum is focussing OEM product development on high performance 3 1/2-inch drives and is transitioning out of its 5 1/4-inch products. Phasing out the Q200 Series is necessary to enable the Company to focus on the tremendous 3 1/2-inch market opportunity.

Quantum's subsidiary, Plus Development, markets mass storage products specifically designed for installation in IBM PC™/XT™/AT® systems and compatibles. Plus' original product offering, the 10-megabyte Hardcard, pioneered a new class of products - the popular hard-disk-on-an-expansion card product lines. The Hardcard products implement a 3 1/2-inch form factor drive on an expansion card and are designed to fit in a single full-length expansion slot in an IBM PC or compatible. In June 1986, Plus introduced the Hardcard 20 which features 21 megabytes of storage capacity, and an average seek time of 40 milliseconds. The Hardcard 40, originally introduced in May 1987, provides 42 megabytes of storage and features PlusCache™ disk caching software. With PlusCache, the Hardcard 40 achieves an effective average seek time of 28 milliseconds. These Hardcard products have established an industry standard for reliability with a 60,000 MTBF rating.

In April 1988, Plus launched a new product line with the Plus Passport products. These removable hard disk systems for personal computers provide 3 1/2-inch format drives in 20- and 40-megabyte capacities. The Plus Passport system offers complete compatibility and data interchange between IBM PC/XT/AT systems and PS/2™ microcomputers with IBM's new Micro Channel™ architecture. Optimized for high speed 286, 386, and PS/2 computers, Plus Passport products feature Hyperwrite™ for faster disk writing and a read-ahead buffer for faster data retrieval. These products provide effective access times of 28 ms, bringing high performance to the removable mass storage market. The MTBF of the Plus Passport hard drives is 60,000 hours, four to five times higher than the MTBF of other removable disk drive products.

In November 1988, Plus announced a third product category with the Plus Impulse hard disk drive systems for PC LANs. These products provide an unequalled combination of performance, expandability, and reliability for LAN environments and disk-intensive applications such as database, accounting, and CAD programs. The Plus Impulse system includes a 3 1/2-inch form factor hard disk drive with 40 or 80 megabytes of formatted capacity, and a 16-bit bus adapter card. It features Plus' proprietary Cluster Disk Interface™ which allows LAN administrators to configure the PC LAN initially with the amount of storage required and to incrementally increase the storage capacity of the LAN as required, up to 32 drives. The Plus Impulse system features exceptionally high LAN throughput rates with an effective access time of 12 milliseconds and a data transfer rate of up to 4 megabytes per second.

All Plus products are designed by Plus for manufacture in Japan by Quantum's manufacturing partner, Matsushita Kotobuki Electronics Industries Ltd. (MKE).

## **Product Development**

Quantum operates in an industry noted for rapid technological changes. Accordingly, the Company is committed to the development of new products and the continuing evaluation of new technologies. Achieving efficient volume production of new products, and maintaining the efficiency of current manufacturing lines, requires a continuous investment of engineering resources in the development of tooling, production processes, and specialized test equipment.

The Company is currently concentrating much of its product development efforts on the higher capacity products (>100 megabytes) in the ProDrive Series of high performance, 3 1/2-inch disk drives. In addition, other 3 1/2-inch disk drive products in a variety of capacities are under development. For the three fiscal years ended March 31, 1988, 1987, and 1986, the Company's research and development expenses were \$12,067,000, \$11,499,000, and \$11,298,000, respectively.

## **Manufacturing**

Quantum is committed to manufacturing excellence and to developing and maintaining a manufacturing strategy which will give the Company a competitive edge in the disk drive industry. Quantum attributes its business success to the ability to quickly achieve high-volume production of reliable, cost-effective products. Rapid transition from product development to volume production reflects the Company's integrated approach to engineering and manufacturing. The approach involves developing product designs concurrently with production processes, applying proven technologies, and using readily available components in innovative ways.

Quantum currently enjoys a manufacturing partnership with Matsushita Kotobuki Electronics Industries, Ltd. (MKE), a Japanese firm renowned for its sophisticated, high volume, electromechanical manufacturing capabilities. MKE has produced all three generations of the Plus Hardcard products and is producing the 42, 84, and 105 megabyte ProDrive Series drives and the new Plus Passport removable hard disk drive systems.

The relationship with MKE has been rewarding, yielding products with consistently high quality and reliability, at competitive costs. To achieve higher production efficiencies, Quantum and MKE have worked together to develop manufacturing techniques, tools, and test equipment which reduce the labor and parts requirements for Quantum's products.

Quantum also operates a manufacturing facility in Milpitas, California. This facility is currently used to produce Quantum Q200 Series drives which are being phased out as the company transitions to the 3 1/2-inch form factor. This manufacturing facility will subsequently be used for pilot production of the higher capacity products in the ProDrive Series. This manufacturing line uses continuous-flow processing and automated work stations to increase output and production yield while reducing labor and work-in-process inventories. A Class 100 clean room controls environmental conditions in the final assembly area.

Two previous generations of Quantum hard disk drives, the Q2000 8-inch drive and the Q500 5 1/4-inch drive, were produced at the Company's manufacturing facility in Ponce, Puerto Rico. These products have been discontinued, and the Puerto Rico plant was closed in December, 1987.

## **Marketing**

During fiscal 1988, Quantum Corporation's largest customers were Apple Computer and Microamerica, which accounted for approximately 39% and 11% of sales, respectively. By the second quarter of fiscal 1989, Apple Computer, Commodore, Memorex, and Tandy had chosen Quantum ProDrive Series drives to be used in a variety of their systems, and a number of other large OEMs have begun placing initial orders for ProDrive Series drives. The Company's OEM and VAR customers typically enter into 12 to 24-month agreements which provide for volume discounts if certain purchase levels are met.

Quantum's OEM products are sold domestically through the Company's own sales force and through independent distributors, such as Arrow Electronics, Inc. and Marshall Industries. Export sales are made to OEMs in Europe through direct sales personnel and through independent foreign distributors.

Plus Development markets its products through more than 2,500 dealers worldwide. In the U.S., Plus sells directly to the largest computer retailers and serves independent retailers and value-added resellers through independent distributors. Outside of the U.S., Plus sells its products through a network of independent distributors in Canada, Europe, Asia, and Latin America.

Quantum maintains OEM sales offices in Santa Clara, California; Salem, New Hampshire; Austell, Georgia; Dallas, Texas; Berkshire, England; Paris, France; and Frankfurt, West Germany. In addition, Plus maintains sales offices in Los Angeles, and Redwood City, California; Burlington, Massachusetts; Danbury, Connecticut; Atlanta, Georgia; Dallas, Texas; Schaumburg, Illinois; St. Louis, Missouri; and Vienna, Virginia.

### **Backlog**

The Company's order backlog at June 12, 1988, was approximately \$23.3 million, compared with approximately \$31.6 million at June 14, 1987. The decrease in the backlog was due primarily to the ramping down of Q200 orders and the Company's transition to the 3 1/2-inch ProDrive product line. Backlog includes only firm orders for which delivery has been specified by the customer for shipment within six months. For this reason, and because of the possibility of customer changes in delivery schedules or cancellations of orders, Quantum's backlog as of any particular date may not be representative of actual sales for any succeeding period.

### **Competition**

Quantum faces competition from several manufactures in each market segment. The main competition for the Company's new 3 1/2-inch disk drives is expected to come from Conner Peripherals, Control Data Corporation, MiniScribe, Rodime, and Seagate. Competition in this market is based primarily on product and vendor reliability, performance, price, and product availability.

Plus has become the dominant supplier of hard disk expansion boards for personal computers and has shipped over 400,000 Hardcard products to date. Plus faces competition from up to 30 other companies. However, no competitor has matched the combination of speed, reliability, capacity, convenience, and compactness offered by the Plus Hardcards. Plus currently holds about 80% of the board-mounted hard disk market.

The Plus Passport faces competition from other removable hard disks as well as from flexible disk cartridge systems. Major competition is expected to come from Iomega's flexible disk cartridge systems and Tandon's removable hard disk. Competition in the removable mass storage market is based primarily on performance, reliability, versatility, and price. Like the Hardcard products, the Plus Passport systems offer an unmatched combination of performance, reliability, and versatility.

The Plus Impulse faces competition from other LAN server disk drive suppliers and from some general purpose PC manufacturers who market manufacturer-installed disk drives in

their PCs. Major competition is expected from Storage Dimensions (a Maxtor subsidiary) in LAN server disk drives and from Compaq Computer Corporation in the manufacturer-installed disk drive category. Competition in the LAN disk drive market is based primarily on performance, scalability of capacity, breadth of compatibility, and price. The Plus Impulse products offer an unmatched combination of performance, expandability of capacity, and compatibility.

## **Patents and Licenses**

Quantum owns 13 and Plus owns 3 United States Registered patents. The first of these patents was reissued by the Patent and Trademark Office of the U.S. Department of Commerce on January 28, 1986. The Company and Plus also have several foreign patents and pending United States and foreign patent applications.

The Company has a cross-licensing agreement with IBM which commenced on March 10, 1986 and runs until the expiration of the last IBM patent. The agreement allows Quantum to use certain patents owned by IBM and IBM to use certain patents owned by Quantum.

## **Patent Litigation**

Quantum Corporation has favorably settled patent litigation in several instances resulting from infringement of one or more of its patents. Two specific patents have been the subjects of this litigation: a Quantum patent, U.S. Reissue Patent Number Re. 32,075; and a Plus Development patent, U.S. Patent Number 4,639,863.

Quantum's patent Re. 32,075 covers a unique wedge-servo disk architecture used in Quantum's disk drives. The patented features give Quantum's products a high degree of data recording and retrieval accuracy and provide storage capacity at a lower cost than traditional servo designs. The patent was originally issued in 1983 under patent number 4,369,959, and was subsequently reissued by the U.S. Patent Office in 1986.

Plus Development's patent 4,639,863, issued in January 1987, covers the hard disk expansion board product category Plus pioneered with its popular Hardcard products. The original Plus Hardcard was the first hard disk drive on a plug-in expansion board for personal computers. The Plus Hardcard products provide personal computer users with an easy-to-install means of upgrading the performance and storage capacity of their computers.

In January 1986, Quantum received \$6,000,000 as a result of settlement of litigation against Computer Memories, Inc., a Chatsworth, California disk drive manufacturer. As part of the settlement, CMI agreed to cease the manufacture and sale of its CM6000 Series 5 1/4-inch rigid disk drives and was permanently enjoined from manufacturing and selling any product within the scope of the technology claimed in Quantum's patent, U.S. Reissue Patent Number Re. 32,075.

In October 1987, Quantum received \$2,975,000 as a result of settlement of litigation against NEC Corporation, NEC Information Systems (NECIS), and Mountain Computer, Inc. The settlement followed a court order that granted Quantum's motion for summary judgment of infringement and ruled that NEC and NECIS infringed Quantum's patent Re. 32,075. In making the determination of infringement, the court ruled that NEC disk drive products, specifically NEC's D5126 (5 1/4-inch) and D3126 (3 1/2-inch) products, used

the wedge-servo architecture covered in Quantum's patent. In addition, as part of the settlement agreement, the defendants agreed to discontinue the manufacture and sale of products that infringed upon Quantum's patent.

In 1988, Quantum favorably settled litigation against Mountain Computer, Inc., concerning the Plus Hardcard patent, U.S. Patent Number 4,639,863. As part of the settlement agreement, Mountain agreed to pay Quantum an undisclosed cash settlement and to discontinue the manufacture and sale of its Drivecard product line.

Quantum currently has two suits pending. A suit pending against Western Digital Corporation, Irvine, California, alleges willful infringement of both Quantum's patent Re. 32,075 and Plus' patent 4,639,863. Filed in May 1988, the suit charges that Western Digital's Filecard, and certain disk drive products Western Digital acquired from Tandon as part of Western Digital's acquisition of Tandon's disk drive business, violate these two patents. In September 1988, Quantum filed suit against Tandon Corporation, Chatsworth, California. This suit alleges that certain products produced and/or sold by Tandon have also violated both the Quantum and Plus patents.

### **Employees**

As of January 1989, the Quantum Corporation employed 551 persons, including 138 in engineering, 246 in manufacturing, 104 in marketing and sales, and 63 in general management and administration.

### **Properties**

The Company's principal executive, administrative, manufacturing, and engineering operations are located in 5 modern buildings totalling approximately 178,000 square feet and located in Milpitas, California. Leases on these facilities expire in 1991. The Company also leases small domestic and international sales offices, typically on a short-term basis.



**ANALYST REPORTS**

**FINANCIAL**

**MANAGEMENT**

**CUSTOMERS**

# QUANTUM CORPORATION

## Management Profiles

**Stephen M. Berkley**                      **Chairman of the Board and  
Chief Executive Officer**

Mr. Berkley joined Quantum in October 1981 as vice president of marketing. In November 1983, he became the founding president of Plus Development Corporation, the Company's then majority-owned subsidiary. Mr. Berkley succeeded James L. Patterson as Chairman of the Board of Quantum and Chief Executive Officer in May 1987 and assumed immediate overall responsibility for managing the Company. Previously, Mr. Berkley served four years as an officer of Qume Corporation, including vice president and general manager of the Memory Product Division.

**David A. Brown**                      **President and  
Chief Operating Officer, Quantum**

Mr. Brown has been with the Company since its inception in February 1980, initially serving as vice president of engineering. In 1983, he became a cofounder and executive vice president of operations at Plus Development Corporation, Quantum's then majority-owned subsidiary. He returned to Quantum in September 1986 to lead the engineering organization and direct the Company's thrust into the 3 1/2-inch disk drive market. Mr. Brown has been active in the disk drive business since 1970, serving in various engineering and management positions at Memorex Corporation and Shugart Associates. He owns several patents relating to disk drive design.

**Joseph T. Rodgers**                      **Executive Vice President, Finance  
Secretary and Treasurer**

Mr. Rodgers joined Quantum in December 1980 as vice president of finance and was elected secretary in May 1981 and treasurer in September 1981. Mr. Rodgers became executive vice president in April 1986. Previously, Mr. Rodgers served as vice president of finance at Braegen Corporation, assistant vice president of finance at Plantronics Corporation, and vice president of finance, secretary, and treasurer at Consolidated Video Systems. In addition, he spent over nine years in management positions at Price Waterhouse.

**Jeffrey Heimbuck**                      **President, Plus Development Corporation**

Mr. Heimbuck joined Plus Development Corporation as president in July 1988. Prior to joining Plus, Mr. Heimbuck was a venture capital partner with Montgomery Securities and sat on the boards of several companies in the PC industry. Previously, Mr. Heimbuck served as president and Chief Executive Officer of Koala Technologies and senior vice president of marketing and engineering at Atari Products. In addition, he held vice president of marketing positions at Joseph E. Seagram & Sons and Paul Masson Vineyards prior to entering technology industries.

**ANALYST REPORTS**

**FINANCIAL**

**PRODUCTS**

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# QUANTUM CORPORATION

## Financial Summary

(\$ Millions Except Per-Share Amounts)

Fiscal Year	Revenue	Net Income (Loss)	Earnings (Losses) Per Share
<b>1986</b>			
1Q	\$ 34.0	\$ 5.7	\$ .60
2Q	29.0	4.4	.45
3Q	30.5	5.2	.54
4Q	27.7	6.9 (a)	.71 (a)
Year End	\$ 121.2	\$ 22.2	\$ 2.30
<b>1987</b>			
1Q	\$ 25.3	\$ 2.5	\$ .25
2Q	29.6	2.7	.30
3Q	34.0	0.7 (b)	.08 (b)
4Q	31.9	2.9	.32
Year End	\$ 120.8	\$ 8.8	\$ .95
<b>1988</b>			
1Q	\$ 40.2	\$ (3.5) (c)	\$ (.38) (c)
2Q	49.5	4.0 (d)	.44 (d)
3Q	56.6	4.7	.51
4Q	42.2	(8.4) (e)	(.86) (e)
Year End	\$ 188.6	\$ (3.2)	\$ (.35)
<b>1989</b>			
1Q	\$ 38.9	\$ 0.6	\$ .06
2Q	\$ 39.8	\$ 2.0	\$ .20
3Q	\$ 51.6	\$ 3.3	\$ .36

(a) Includes \$6 million pretax settlement from patent litigation.

(b) Includes \$3 million pretax charge for plant closing.

(c) Includes \$3.5 million pretax charge for discontinuance of product.

(d) Includes \$2.98 million pretax settlement from patent litigation.

(e) Includes \$13.2 million pretax charge for write-down of excess manufacturing capacity.

**ANALYST REPORTS**

**MARKETS**

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**SUMMARY OF ANALYSTS FORECASTS FOR YEARS ENDING MARCH 31, 1989 AND 1990**

	Revenue (millions)					Earnings Per Share					1990	
	Q1	Q2	Q3	Q4	Year	Q1	Q2	Q3	Q4	Year	Sales	EPS
Harvey Allison Wertheim & Co.	\$39	\$40	\$51	\$48	\$178	\$.06	\$.20	\$.36	\$.30	\$.92		
Dave Claridge Hambrecht & Quist	39	40	51	51	181	.06	.20	.36	.25	.87		
Ron Elijah Robertson, Colman & Stephens	39	40	51	50	180	.06	.20	.36	.38	1.00		
Gerard Hallaren (Consultant)	39	40	51	56	186	.06	.20	.36	.36	.98	\$234	\$1.28
Alexa McGloughan Goldman Sachs	39	40	51	57	187	.06	.20	.36	.40	1.02	245	1.60
Andy Neff Bear Sterns	39	40	51	58	188	.06	.20	.36	.42	1.04	258	1.35
John Rossi Alex Brown	39	40	51	55	185	.06	.20	.36	.41	1.03	250	1.70
Rick Ruvkin Morgan Stanley	39	40	51	60	190	.06	.20	.36	.38	1.00	240	1.50
Adams, Harkness & Hill	39	40	51	54	184	.06	.20	.36	.29	.91	245	1.55
Jim Stone (Consultant)	39	40	51	53	183	.06	.20	.36	.28	.90	226	1.23
Tom Rood Value Line	39	40	51	46	186	.06	.20	.36	.29	.91	220	1.50
Charles Wolf First Boston Research	39	40	51	60	190	.06	.20	.36	.35	.97	216	1.61
<b>AVERAGE</b>	<b>\$39</b>	<b>\$40</b>	<b>\$51</b>	<b>\$54</b>	<b>\$184</b>	<b>\$.06</b>	<b>\$.20</b>	<b>\$.36</b>	<b>\$.34</b>	<b>\$.96</b>	<b>\$237</b>	<b>\$1.48</b>

## MICROCOMPUTERS AND PERIPHERALS

John T. Rossi

Quantum Physics--Out of phase doesn't equal out of sync

The O'Neil chart of Quantum Corporation presents a curious image when viewed against a backdrop of charts of other drive companies. Even though the drive companies have generally traded as a group, the progress of Quantum stock has almost always defied the group trend. In the December quarter of 1984, when the market laid waste to the drive stocks, and Seagate bottomed at \$4 a share, Quantum traded as high as 23--a symbol of strength amid weakness. The drive stocks' glory days of 1986 brought a reversal: as Seagate surged upward from 7 to 21 (on its way to 45 in 1987), Quantum stock slumped, beginning the year at 28 and ending it at 19.

The generally disappointing June 1988 quarter marked a new inflection point for the drive group. Investors, anxious over signs of price competition and overcapacity in the industry and shaken by weak quarterly earnings reports, began to beat a hasty retreat from the drive stocks in July. After hitting highs for the year of 16, 30, 14, and 23, Maxtor, Micropolis, Miniscribe, and Seagate shares traded off to 8 1/8, 12 1/2, 11 3/8, and 10 3/8, respectively, by August 7. Quantum, in keeping with its peculiar tradition, bucked the trend

again, staying in a relatively narrow 10-11 price range through most of early summer.

At this juncture, the immediate future for the drive group appears clouded, uncertain at best. Yet, if the past is of any value as a guide, Quantum's fortunes may begin to look up in this setting.

Quantum's past countercyclical behavior has not come as a mere quirk nor as something mandated by market technicalities; the Company has generally run on a different development schedule than the rest of the industry. In 1983 and 1984, as the rest of the industry pushed forward with research and development programs for half-height 20-megabyte and full-height 85-megabyte 5 1/4-inch drives, Quantum harvested the bounty from established 40-megabyte 8-inch and 5 1/4-inch full-height products. In 1985, as other firms focused on mainstream products, Quantum, through its Plus subsidiary, introduced a patented hard-disk expansion board, Hardcard, for the PC aftermarket. In 1986, instead of sticking with the full-height form factor, ST506 interface, and oxide media for a high-capacity drive, Quantum forced itself into what looked like an ill-timed transition to the half-height form factor, thin-film media, and embedded SCSI interface for the Q200.

Countercyclicity was not only a trait of Quantum's product development, but also of its manufacturing strategy. In 1985 and 1986, as other companies rushed to manufacture offshore, mainly in Singapore, Quantum began winding down its Puerto Rican plant. In 1987, as the rest of the industry undertook a large capacity build-up, Quantum shut down or wrote down nearly all of its manufacturing capacity.

Now it looks as though Quantum's course may end up demonstrating what every commuter knows, that the highway is not always the best way. For instance, the issues of overcapacity and price competition hanging over the rest of the drive industry could have limited impact on Quantum. The Company has already purged its balance sheet and is not a likely candidate for further write-downs; at this point, the Firm has only \$36 million in operating assets (accounts receivable, inventories, and PP&E) to produce annual revenues approaching \$200 million. Moreover, two of the company's products--Hardcard, the hard-disk expansion board for IBM standard compatibles, and Passport, a removable, high-performance hard-disk drive--sell into specialized markets and are protected by patents and patents pending.

Where the Company will compete directly against mainstream drive manufacturers is in the market for new-generation 3 1/2-inch drives--small drives with thin-film media, embedded controllers, more than 40 megabytes' storage capacity, and access times of less than 30 milliseconds. Although generally viewed as a dark horse in the race for 3 1/2-inch drive market share, the Company is remarkably well positioned. From the Hardcard products, Quantum has gotten as much experience with high-density 3 1/2-inch drives as any company. Moreover, from both the Hardcard and Q200 programs, the Firm has developed the skills for designing thin-film-media equipped drives, embedded SCSI interfaces, and compact, surface-mount-device equipped boards.

The culmination of these various efforts is Quantum's Prodrive. With capacities of 40 and 80-megabytes, access time of 19 milliseconds, mean time between failure of 50,000 hours, and data transfer rate of 16 megabits per



second (asynchronous mode), Quantum's Prodrive series has the best performance of any 3 1/2-inch drives currently in volume production. In addition, the Prodrive requires fewer expensive recording components than rival products--only two disks and three heads to achieve storage of 40 megabytes, compared to three disks and six heads for some competing products.

What the Company does not have, by design, is production capacity for the Prodrive. The product will be manufactured by the Company's manufacturing partner of the past three years, Matsushita Kotobuki Electronic. Accordingly, Quantum stands to benefit from the potential explosion of demand for new-generation 3 1/2-inch drives, but has avoided the pitfalls of a "bet the ranch" manufacturing strategy.

With the Q200 winding down, the Hardcard products leveling off, and the brand-new Passport likely serving the needs of a collection of high-data-security niche markets, the Prodrive emerges as the key to Quantum's revenue growth, and therein lies the risk. Currently, the drive is in evaluation programs at 35 personal-computer, workstation, and communications companies. Although Quantum has won Tandy as a customer for the drive, in the main, demand visibility for the Prodrive remains unclear.

Without doubt, the critical account for the Prodrive to win for Quantum is Apple. In Quantum's fiscal 1988 (March), Apple's purchases of the Q200 for the use in the Macintosh II microcomputer accounted for 39 percent of Quantum's sales. Although Quantum has received follow-on orders from Apple for the Q200 that extend through the December 1988 quarter, shortly thereafter Apple will shift completely to 3 1/2-inch drives for the Macintosh II.

Currently, Apple is evaluating 40- and 80-megabyte drives for both the Macintosh SE and the Macintosh II. The list of potential suppliers is long: CDC, Conner Peripherals, Miniscribe, Quantum, Seagate, and others. At this point, we believe that Seagate has already passed qualification tests for its 40-megabyte drive and may begin shipping product to Apple in the September quarter. Quantum began the qualification process after Seagate, and news of Apple's acceptance of the Prodrive might not come until early fall. At this point, however, because of Quantum's strong current relationship with Apple and the superior performance of the Prodrive, Quantum appears likely to emerge as the primary supplier of 80-megabyte 3 1/2-inch drives and one of two suppliers of 40-megabyte drives to Apple.

With so much depending upon the fate of the Prodrive and the fate of the supply relationship with Apple, an investment in Quantum at this point is a calculated gamble. Although a gamble, the downside risk would seem to be limited. At the end of the June quarter, several fundamental measures presented a compelling picture for capital-conservation-minded investors. Book value was \$11.41 per share, tangible book value was \$10.43, and cash per share was \$9.21 (before deduction of items senior to common), with no long-term debt. The fundamental value of the Company should continue to give the stock solid protection against downside risk.

Because of Quantum's strong fundamental valuation, the protected positions of the Company's retail products, and the promise of the Prodrive, we continue to recommend purchase of the stock, despite the woes of the most of the drive industry. We estimate EPS of \$0.80 on sales of \$192 million in fiscal 1989,

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but point out that our sales forecast depends on Quantum's capture of key accounts for the Prodrive. In the December quarter, with strong seasonal sales of the Hardcard and Passport and the capture by the Prodrive of follow-on business with Apple, we envision the stock regaining momentum and moving into the lower end of its historical, pre-crash trading range of 15-35, and perhaps again defying the trend of the rest of the drive group.

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