"The only reason it's a story is the rest of the world isn't doing it."

Quantum

Quantum Corporation was founded in February, 1980, to fill the growing need for large quantities of low-cost, easily integrated mass storage upgrades for OEM customers of 8″ floppy disk drives. By the end of 1982, Quantum was a publicly-owned company in full production with the Q2000™ line of 8″ Winchester disk drives.

By 1983, Quantum was the leading supplier of 8″ OEM rigid disk drives, the Q500™ line of 5¼″ Winchesters was in production, revenues had grown to $42 million, and the company was solidly profitable.

We present this highly compressed history by way of introduction, because we believe it says a lot about our products and the people who make them.

The rest of the story is told through conversations with some of the people who built Quantum. In these conversations, you'll get a look at the framework of our operation. But beyond the statistics and the systems, we hope you'll find an indication of how and why they've worked for us and for our customers so successfully.

Our buildings, manufacturing lines, and engineering facilities look about like what you'd expect, from the outside. So do our products. What we'd like to talk about has little to do with buildings full of state-of-the-art equipment, and everything to do with making more product, better product, at more attractive prices.

For that, you need an inside look.

Welcome to Quantum.

"The concept of mass-producing a precision product at a good price isn't remarkable. The reality is."

Jim Patterson, president:
"Quantum is a manufacturing company. Everything we do stems from a very clear focus on making large quantities of an excellent product. It's a simple thesis, resulting in one vital benefit to the computer manufacturers we serve, and to their customers. Our disk drives work reliably, predictably well.

"From the beginning, we've concentrated on the industry's growing need for widely compatible Winchesters in the medium-capacity range to meet the storage requirements of multi-user and networked computer systems.

"But meeting our customers' needs wasn't a matter of coming up with an impressive demonstration unit in the 10- to 85-megabyte range. It meant we had to come up with multiples of 10,000 units at precisely the right time, as impressive in receiving as they were in evaluation.

"Everything about our organization is geared to getting our customers into volume production of their products, on their schedules. That starts with knowing precisely, from the outset, what our customers want in a disk drive. From there, we take a fast, straight course from design into production.

"As an illustration of our speed in getting products to market, we took both the Q2000 and Q500 products from concept to volume production in twelve months.

"The concept of mass-producing a precision product at a good price isn't remarkable. The reality is. Especially when it's done with the kind of timing we've demonstrated.

"We've done it by taking lots of time up front to put an extraordinary team of people together. Even with all our growth, that's one area where we don't make compromises, and where we will continue to take as much time as we need.

"And we've done it by being uncommonly faithful to some commonly accepted but rarely practiced tenets of productivity."

Joel Harrison, engineering manager: "At Quantum, all engineering resources are part of one organization. Every engineer is a manufacturing engineer.

"When a new project is begun, the design team includes representatives from all the disciplines that are involved during the life of the product. If the manufacturing manager doesn't like the way something looks because an operator might find it difficult to produce, it's negotiated.

"From the beginning, everyone involved understands that a product can't just be thrown over the wall from engineering to manufacturing. Because there's no wall there."

David Brown, vice president, engineering: "There's a certain stress in knowing you can't hand the product off to manufacturing. But this interaction is why our products are simpler than other people's products. Because it's a team effort, we get assembly line solutions that keep product reliability and cost in mind.

"And since the team includes a test engineer, test equipment is being defined and produced as the product is developed. When the product is ready for testing, we're sure it can be tested effectively, and we have the right equipment.

"We also provide Quantum-built component test gear to our vendors so our production paths will converge on time and on specification.

"With the experience gained by the whole team in each product development cycle, we gain competence in every area. Design, testing and manufacturing. That means even better future products, all the way around."

Joel Harrison: "Just as there's no 'manufacturing wall' here, there's no 'marketing wall.' There's no such thing as a 'marketing problem.' There's no filtered information. No manipulation. Because it's not marketing telling us what to do, it's the customer telling us what to do. Without these filters, you get a much stronger commitment from everyone on the team. And team play is our highest priority as a corporation.

"What's unique about Quantum is we don't have a list of what not to say. We bare the facts, sometimes to a fault. But that works well when the facts are credible.

"One of the big problems we face, like a lot of other companies, is finding the kind of people — especially in engineering—who can make this work. We look for people who want to be multi-disciplined. We look for engineers who can communicate, and work with a team. The best engineers, in my experience, have such an open mind that they'll ask anybody and everybody what they think. That has a direct result in better products, and it's essential to the way we do things.

"Of course this is all so sensible, the only reason it's a story at all is that the rest of the world isn't doing it."

"To develop an electro-mechanical product you can make a million of is a much broader challenge, much tougher to do, than making ten prototypes of the 'highest' technology."

"You hear the cliché, 'Quality is everybody's business.' I'll tell you how you can tell whose business it is."

Richard Taylor, vice president, quality and reliability: "A lot of the buzzwords about quality are clichés because everybody says them. Not because everybody does them.

"I'm reluctant to use words like 'quality' and 'reliability,' because everybody uses them so much they stop having any real meaning. Our definition of

quality is a simple one, with some important implications for our customers. Quality is conformance to specifications.

"The first, most important thing in a quality product is design. You design for simplicity. The fewer the components, the less complex the technology you're trying to make work, the more reliable it is.

"Reliability testing begins early in design with mathematical modeling of design alternatives, and continues in a comprehensive program that includes phased tests for Design Verification, Design Maturity, Process Maturity, and Ongoing Reliability Testing.

"We feel it's important to share the results of these tests with our customers, because it tells them how closely our ongoing reliability parallels our predicted reliability.

"The second factor in quality, by our definition, is that as you begin to ramp into production, the manufacturing engineers are the same folks who developed the product. The process and the product are matured at the same time, by the same people.

"The last piece in our quality formula is that as we run the process, we employ statistical techniques to make certain that the process and the product meet the specifications.

"There is nothing mystical about these techniques at all. They were developed here in the U.S. in the twenties, and the Japanese have been using them with great success since the fifties. The only reason they're worth mentioning, like so many other 'motherhood' kinds of things we talk about, is that we're actually *using* them.

"At each station in the process, we use control charts to warn us when we're shifting away from what we've proven we can do on a regular basis. When we start to move away, even though we're still within spec, but out of our normal distribution range, we get the engineers to look at it and get it back where it should be.

"By doing that at every key point in our process, we reduce the variability of the overall process. As a result, we make a product that's more consistent.

"But so much of the effectiveness of control charting is an attitudinal thing, which is why it's been so successful for us. At Quantum, you won't see lots of 'quality' people on the line. Inspection and control measurements are essentially the responsibility of the people on the line, and they care enough to do it right.

"You hear the cliché, 'Quality is everybody's business.' What the heck does that mean? I'll tell you how you can tell whose business quality really is. Ask a corporation what percentage of the corporate budget is the Quality budget. How many Quality people do you have? If it's a big number, you've got a police state where Quality's responsible for quality.

"Much of what you read about American workers is that they're the ones at fault. Sloppy workmanship. Operators get blamed for everything. But I've never met a production person who likes building something wrong and then having to rebuild it. In fact, that's one of the biggest reasons people leave their jobs, because they feel they're working for people who won't let them do the right thing.

"My ultimate goal is to reduce the size of my organization in proportion to the corporation. Our goal is perfect parts from all suppliers, and elimination of receiving inspection as a gate to manufacturing. It should become a place to randomly sample what's coming in, to review the supplier's control charts. Quality should become simply a matter of leadership and vision."

Steve Berkley, vice president, marketing: "From the very first day, we've believed in doing a few things extremely well. By doing just those things, and doing them right, we can provide tremendous value to the marketplace.

"Of all the OEM Winchester disk drives—somewhere in the neighborhood of 200—that have been developed, announced and produced, there are probably fewer than ten that are truly successful products. By successful, I mean *profitable* as well as successful in the marketplace.

"And among all the independent manufacturers of disk drives, only three or four are profitable as companies. These are the producers who are providing a real service to the market. And these are the companies that have focused on doing a few things well.

"Quantum isn't in the part of the marketplace that's served by the lowest-cost-per-box products. We've picked a segment that bites off higher technologies than those, to get the lowest cost-per-megabyte in the medium capacity range.

"The reason you can't buy a lower cost disk drive than ours in the capacities we sell is that we catch our mistakes where they're least expensive.

"We solve problems before they become quality and manufacturing problems—back in the beginning, in engineering. And because we're control charting every part of the process, we can spot potential problems as soon as something goes out of sync, and solve them right there. We get higher yields; our customers get better products at lower costs."

Jim Watson, director of sales: "Because there are so many players in this market now, and they're all repeating the same platitudes—quality, reliability, availability, testing—it's becoming more and more difficult to distinguish companies based on these qualities. Those things that used to be most significant in the decision process are now perceived to be equal among all the players.

"So you have to look closer. Some of the things at Quantum that we're very proud of aren't necessarily impressive at first glance.

"On-time delivery, for example. I can't think of anyone who doesn't say it. We say it, too. But we can go a little further. Defining 'on time' as plus or minus two days from scheduled delivery date, we're exactly *97.0 percent* on time.

"On unscheduled requests to meet customers' unforeseen 'bubble' demands, we meet those demands within five days of the committed date *95.2 percent* of the time.

"Our Customer Service Centers are extremely important in minimizing our customers' spares inventory. Because we have dedicated repair/refurbishing facilities, we can promise turnaround time of two weeks or less. One of the reasons we can do that, obviously, is that so few units need repair.

"Another example, not apparent until we're really working with a customer, is the exceptional quality of our tech support group. They're engineers who can do a lot more than identify a problem as a drive problem—'ours'—or a system problem—'theirs.' Our support people are out to find a solution, regardless of where the problem is."

"Of all the Winchester disk drives... that have been developed, announced and produced, there are probably fewer than ten that are truly successful products."

"We've never had to go through the trauma of changing from 'small company' thinking to 'big company' systems."

Dale Hiatt, vice president, manufacturing: "In a lot of ways, we were overqualified for a small company. All of us on the management team had been through start-ups before, and we all also had 'big' company backgrounds. So from the beginning, we've had systems in place typical of much more mature operations."

Helen Preston, director, human resources: "There would be few start-up companies that wouldn't be fun to work for. It's easier for start-ups to be different, better places to work, because you can invent things as you go along. So I don't know if we've been that different, so far, from other companies where the atmosphere is very positively charged, and everyone feels their contribution is needed and appreciated. Where we're different is in our determination to keep that energy going.

"We realize we're asking employees for the greatest waking chunk of their lives. I think that's something so obvious people don't see it. Our employees work an average of 55 hours a week. Commute time, lunch, and so on. It's all part of work. There are only 112 waking hours in a week. How do you compensate them for that?

"We offer freedom of expression; an atmosphere that truly encourages everyone, at every level, to be frank and communicative. We can offer the training and career path development that builds commitment on both sides.

"Our turnover rate right now is about 5%. The average across the country is about 20%. Here, in Silicon Valley, it's more like 30%. Of course that's not the only way to measure how successful we are at finding outstanding people and keeping them. But it's a good indication that the commitment we talk about has a basis in fact."

Dale Hiatt: "Our willingness to commit has given us an important edge with our suppliers, too. We've worked closely with our critical vendors, including them early in our design process, and committing to them on paper early in the game.

"We've been treating our vendors like they were part of the company, carrying extra inventory when we didn't have to — things like that. When they needed us, we were here. As a consequence, we've established some excellent working relationships. That shows up in the numbers, too. Average incoming acceptance rates for all our vendors has been in excess of 97%.

"Another big factor in this exceptional incoming quality level has been a precision approach to production ramps. For example, once specifications are defined for a new product, we start to firm up hard tools immediately to produce the parts in volume. Working closely with committed vendors, we go from 'hog-outs' to hard tools fairly quickly. That keeps costs down, and lets us deliver higher volumes at the front end. We don't have to go through several iterations of tools and vendors to go up a production ramp.

"Our documentation is done earlier, and we get our line tools up and running a lot faster because we're in the process as a team earlier.

"It's also unique that for a company as young as we are, we use an on-line computer system from the time we first plan production until we ship product out the door. Everything is on the computer, from material planning, through purchasing, receiving inspection and QA. We have a complete shop floor control system following the product all the way through the manufacturing process.

"And because this system, this framework, has been in place from the start, it didn't have to be imposed on a manufacturing structure. Our manufacturing structure and our computer system were designed, from the beginning, to work together. And we've never had to go through the trauma of changing from 'small company' thinking to 'big company' systems."

So that we can meet growing demand with the same flexibility, responsiveness and timely delivery our customers now rely on, we're augmenting our volume manufacturing capabilities with a new plant in Ponce, Puerto Rico.

While new products will continue to be developed and ramped into production at our headquarters in Milpitas, California, this additional manufacturing strength within the United States will help us continue to meet high volume commitments, keep costs down, and maintain the exceptional quality of our products.

We look forward to expanding our product line further, offering even more efficient designs at more attractive prices. But you won't read about them here, or anywhere else, until they're a reality. When you do read about them, they may sound like a lot of other products coming out. The difference—"the only reason this is a story at all"—is that what we say, we do.

QUANTUM

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