INSIGHT

International Disk Drive Equipment and Materials Association

May/June 2001

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INSIGHT Editor, Jeri Burdick

INSIGHT Transitions...

I'm sure we're all keenly aware of the economic uncertainties that have plagued the data storage industry for quite some time now. What you might not be aware of is that, as a nonprofit association, our success is based on the success of the industry, which we measure in part by the frequency of ad insertions, event participation, and DISKCON exhibitor registration. That said, it shouldn't come as much of a surprise to learn that the current downturn affecting the data storage industry has also affected IDEMA, requiring us to rethink some of our standard operating procedures.

At the request of the IDEMA Board of Directors to reduce production and distribution expenses, INSIGHT is transitioning from an association magazine to more of an association/trade journal. Part of this transition includes not publishing staff-contributed articles in the magazine anymore (letters from the chair and/or president, international activity for IDEMA Asia-Pacific and IDEMA Japan, membership updates, standards development, and technical education) since much of this information is already published on our website, or easily can be.

Furthermore, beginning with this issue of INSIGHT, only IDEMA members are eligible to receive the magazine free of charge. However, because we truly value our entire readership, nonmember subscribers will receive one final copy of INSIGHT—the upcoming July/August (DISKCON USA Preview) issue—and will be given the opportunity to continue receiving the magazine, but on a paid basis. Rates listed below are for a one-year subscription of six issues.

Nonmember Subscription Rates:

$ 80	U.S. residents
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New INSIGHT Tag Line!

In the previous two issues of INSIGHT, we asked you to send us your suggestions for a new new tag line for the front cover of the magazine. As added incentive, we also offered a $200 IDEMA coupon (good towards future IDEMA events) for the best suggestion received (the top 15 suggestions are listed below). The new INSIGHT banner and tag line, plus the winner of the $200 IDEMA coupon, will be announced in the July/August (DISKCON USA Preview) issue, along with a special *Thank You* to everyone who contributed suggestions.

1) *INSIGHT to Data Storage [trends, technologies, products]*
2) *INSIGHT Professional Journal of the Data Storage Industry*
3) *INSIGHT for the Data-Storage Professional*
4) *INSIGHT Bits, Bytes and Beyond*
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13) *INSIGHT Advancing the Boundaries of Data Storage*
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Ad space is available for the July/August (DISKCON USA Preview) issue; ad close is May 31, with materials due June 7, 2001. Editorial calendar and advertising rates available online at www.idema.org.

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INSIGHT is an association/trade journal published bimonthly by IDEMA—the Trade Association for the Data Storage Industry. The goal of INSIGHT is to inform IDEMA members and industry professionals worldwide about emerging technologies, industry news, as well as upcoming IDEMA and industry trade events. INSIGHT is an international publication read by more than 15,000 engineers, scientists, and technical managers involved in the selection and purchase of materials, equipment, supplies, and products used in the development and manufacture of data storage devices.

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The Emerging Non-PC Storage Market: Where and When?

William Ress, Data Storage Review—a Publication of the Business Research Team

We have been seeing signs that the desktop PC market has been saturating for several quarters. Several surveys have pegged the saturation point for the United States at around 60 percent. These surveys suggest that 20 percent of the potential U.S. users can't afford to buy a PC, and the other 20 percent can afford to buy one but have no interest in doing so. Analysts have reported around 57 percent penetration starting into 2001. In the enterprise market segment, growth is also showing weakness as the current "economic uncertainties" ripple through corporate America. Whether you agree or disagree with these numbers, trends would indicate "the days of 15 percent compound annual growth (CAG) rate for the PC market are over" and current economic uncertainties will only make the problem worse. This article represents excerpts from our industry report published in May 2001 "The Non-PC Market for Hard Disk Drives—2001," which provides detailed analysis of the identified non-PC markets and their growth potentials.

With the traditional markets for disk drives slowing, the industry must look for new markets that can use its technology. Komag and Read-Rite are looking to the fiber communications markets and the disk drive companies are marketing NAS (network-attached storage) products. These new business initiatives will help, but the biggest market for HDD growth potential is in the non-PC consumer market.

The matrix in Table 1.0 shows our view of the non-PC consumer applications employing storage. We first look at the application and then identify the category of storage used, giving a comparative estimate of the volume potential. Clearly, the matrix indicates that the non-PC market covers a wide breadth of applications. If all these markets were to "take off" tomorrow, the disk drive industry would be overwhelmed—it's easy to predict that the HDD volumes could exceed the PC market in short order. Unfortunately, that's not a reality, so the task is to view this matrix and then determine

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Statistical Summary Selected Data Storage Stocks

Industry Sector	Company	Shares Out. (MM)	Stock Price 4/02/00	Calendar Year Earnings Per Share 1999A	2000A	2001E	Price/Earnings Ratio 2000	2001	Market Cap ($M)	Cal 2000 Revs. ($M)	Market Cap/ 00 Revs
Disk Drives	Maxtor	116.2	$ 7.38	(0.82)	0.32	0.50	23.0x	14.8x	857	2,705	0.3
	Quantum	79.2	$ 10.56	(1.06)	0.18	0.23	58.7x	45.9x	837	3,298	0.3
	Western Digital	171.3	$ 4.80	(3.46)	(0.71)	(0.25)	NM	NM	822	2,050	0.4
Components	Hutchinson Tech.	24.9	$ 14.94	0.02	(0.82)	(0.56)	NM	NM	371	455	0.8
	Komag	111.7	$ 0.78	(1.95)	(0.81)	(1.19)	NM	NM	87	358	0.2
	Read-Rite	117.9	$ 7.28	(4.11)	(1.69)	0.50	NM	14.6x	858	800	1.1
Capital Equipment	Intevac	11.9	$ 5.25	(1.02)	(0.83)	(0.28)	NM	NM	63	36	1.7
	Veeco Instruments **	24.7	$ 37.19	1.45	0.91	2.32	40.9x	16.0x	918	381	2.4
Removable	Iomega **	270.2	$ 3.60	0.12	0.24	0.36	15.0x	10.0x	973	1,300	0.7
						Average:	34.4x	20.3x			0.9

***No official H&Q coverage; First-call estimates. When referenced, "A"= actual; "E"= estimate.*

from "where and when" the best opportunities for our industry are going to emerge.

While our report analyzes them all in depth, we will focus only on the high-volume applications that we believe will be the first to happen: video game machines, set-top-boxes (STBs), and "jukebox" digital audio recorder/players.

Video Game Machines

The worldwide video game market in 2000 was estimated to be at over 40 million units. That figure includes the handhelds like the Gameboy by Nintendo and the Play Station 2 console by Sony. None currently use hard disk drive storage, but the video game machine that will propel disk drives into the high-volume video game market will be the Xbox by Microsoft. Their competitor, Sony, is planning to ship 9 million Play Station 2 consoles in 2001 and rumors persist about a Play Station 3 console (which includes a hard disk drive) that's already in development.

Using sophisticated processing and graphics capabilities the Microsoft Xbox will see definite performance benefits from the use of a hard disk drive. Third-party program developers tell us that, for them, the porting of existing games and the creation of new games for the Xbox is going to be easier than on previous platforms because the Xbox functions exactly like their familiar PC. Microsoft also sees additional functionality for the Xbox. By using its power, an internal modem, and a hard disk drive, Microsoft is positioning the Xbox to become an Internet portal device with uses other than gaming.

Assuming Microsoft and their game-development partners stay on schedule, the Xbox is planned to ship in October 2001. The initial production build will be for a minimum of 1.5 million units and could easily be increased to 2.5 million should the product rollout go well. This product will represent the largest incremental non-PC disk drive ramp for our industry. Figure 1 shows our prediction that 4 million disk drives will be sold into the video game console market in 2002, increasing to 14 million units sold in 2005. The current beneficiaries for market growth in this area are Seagate and Western Digital.

Table 1. Non-PC Consumer Applications Employing Storage

APPLICATION	STORAGE CATEGORY					VOLUME POTENTIAL
	Low-Capacity HDD [1]	Medium-Capacity HDD [2]	High-Capacity HDD [3]	Flash	Optical	
Set-Top Boxes (STBs) with PVR			X			High
Digital Video Recorder (VCR Replacement)			X		X	High
Digital Audio Player/Recorders: Mini-Portable (MP3)				X		High
Jukebox (Portable, Automotive, Home)		X				Medium–High
Personal Digital Assistants (PDAs) (Pilot, Windows CE)	X			X		High
Digital Video Cameras, Still: Consumer	X			X	X	High
Professional		X			X	Low
Digital Video Cameras, Motion: Consumer		X			X	High
Professional			X		X	Low
Network-Attached Storage (NAS)			X			Medium–High
Home Networks			X			Medium–High
High-Capacity Removable (Tape Media Replacement)			X			Medium–High
Video Game Machines (Xbox, PlayStation2)		X			X	Medium–High
eMail Appliances: Cell Phone-Based				X		Medium–High
Handheld	X					Medium
Global Positioning Systems (GPS): Portable				X		Low
Automotive	X	X		X		Low
Personal Video Recorders (PVRs), Standalone			X			Low
Laser Printers		X	X			Low
Video-on-Demand (Hotels, Motels)			X			Low
eBooks	X			X	X	Low
Home Appliances (Sewing Machine, Refrigerators, etc,)				X		Low
(Inter)Net.TV (WebTV)		X				Low

Notes:
[1] Low-Capacity HDD: < 2GB, [2] Medium-Capacity HDD: > 2GB to < 40GB, [3] Medium-Capacity HDD: > 40GB

The Set-Top Box

The set-top box (STB) represents another high-volume market developing on the horizon. To analyze this market segment we must first understand the STB market, currently represented by three distinct categories: analog, digital, and digital with personal video recording (PVR) capability.

All cable and satellite TV subscribers require a set-top box. The vast majority of cable TV STBs are analog, while satellite TV STBs are first-generation digital. Most of the talk about STBs today revolves around the new, second-generation digital devices that include interactive capabilities and function in both cable and satellite TV markets. These

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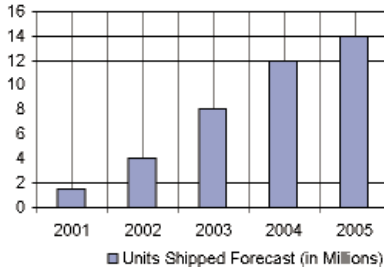

Figure 1. HDDs in Video Game Consoles

new devices incorporating interactive menus and two-way capabilities are the devices that began rolling out in 2000. Now enters the personal video recording feature.

While we predict that standalone PVR devices (a.k.a. TiVo and ReplayTV) will soon drift into obscurity, the highly desirable function of PVR will live on in set-top boxes currently being readied for deployment in both cable and satellite TV markets. It is this application that will soon take very large volumes of high-capacity disk drives.

The production ramps for STBs with PVR capability are just now beginning, with Microsoft's UltimateTV box for DirecTV available now in retail outlets. Other major players in the STB market to watch for include EchoStar, Humax, Motorola, Pace, Pioneer, Samsung, Scientific Atlanta, and Sony/Philips/TiVo.

The global market for set-top boxes is currently quite large. Worldwide cable TV subscribers number 256 million (with 70 million located in the U.S.) and worldwide satellite TV subscribers number 23 million (with 17 million located in the U.S.). While the market is growing, cable and direct-broadcast analysts are now cautiously predicting a "soft year" for STB sales in all categories. Taking the "sluggish economy" into consideration (as shown in Figure 2), we are predicting that 400,000 HDDs will be sold into the STB with PVR segment in 2001, increasing to 4 million units sold in 2005.

"Jukebox" Digital Audio Recorder/Players

Creative Labs was the "market front-runner" last year in the new "jukebox" category of digital audio recorder/players, which use the MPEG-1 Audio Layer-3 (MP3) format. It is the high MP3 file capacity jukebox devices that use the hard disk drive, mainly 2.5-inch devices. Creative Lab's portable NOMAD Jukebox, which uses a 6-gigabyte disk drive, sold 175,000 units last year. The beneficiary here has been Fujitsu who indicates that the market trend is going towards higher capacity HDDs. While this market has been slow unfolding this year, we are seeing increased deployment into the home and automotive segments as SonicBlue (Rio) and Lydstrom refine their marketing efforts and PhatNoise teams with automotive component maker Visteon to get designed into vehicles.

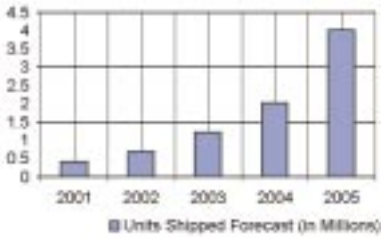

Figure 2. HDDs in Set-Top Boxes with PVR

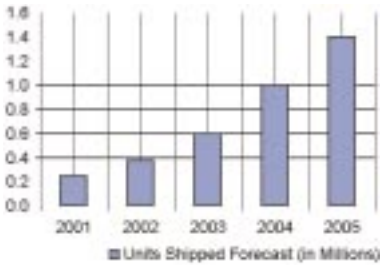

Figure 3. HDDs in Digital Audio Player/Recorders

This market has large volume potential but will confuse consumers inundated with a dazzling number of digital audio choices: handheld MP3 players, MP3 players with FM receivers, CD MP3 players, and jukeboxes for portable, home and automotive use. Figure 3 shows our projections for this market segment, with 250,000 HDDs in digital audio recorder/players sold in 2001, increasing to 1.4 million units sold in 2005.

While we are predicting that close to 3.2 million HDDs will be sold into the worldwide non-PC market this year (representing approximately 1.5 percent of total 2001 HDD shipments), the non-PC markets will represent a very real and exciting potential for volume growth for the disk drive industry. Unfortunately, market acceptance (by fickle and unpredictable consumers) of many of these products will be agonizingly slow, and so the industry must be patient. The industry must also be willing to adjust build plans that will see volume declines before these non-PC markets kick in with sufficient volume, putting us on what inevitably will become a new and more exciting growth curve. ●

William "Bill" Ress is Editor/Publisher of Data Storage Review, a weekly publication analyzing the magnetic, optical and solid-state storage devices industry, and the component and manufacturing/test equipment industries supporting that industry. The publication has been published by Ress for the past three years and for 11 years prior, the publication was known as Rumor and Raw Data. Prior to that time, Ress served for over 20 years in various engineering, management and consulting positions within the disk drive and telecommunications industries with Highgain Development Inc., Radian Technology and the Business Research Team. Mr. Ress received a BSEL in 1968 from California State Polytechnic College in San Luis Obispo, California.

The Hard Disk Spindle Technology: Limitations, New Trends, and Unexplored Paths

Iwona Bida, FAMA Corporation and Roman Bida, Consultant

For years, the technological progress in the area of hard disk-spindle systems was focused on cost, rather than performance. Recent introduction of hard disks operating with 10,000 rpm and 15,000 rpm brings the data storage industry to the point where spindle performance substantially influences characteristics of data storage devices. This article will deal with the spindle system of the hard disk and will discuss the limitations of spindle technology, new industry trends in this area, and potential directions of further development.

Figure 1 presents a block diagram of a permanent-magnet motor, variable-speed drive system, the spindle system typically employed in data storage devices. The system contains five distinct elements: the load (platters), motor, modulator, power converter (inverter), and controller. The motor is supplied by the inverter, which consists of a set of power semiconductor devices switching the current according to a specific modulation algorithm. The modulator translates the motor shaft position and linear signal from the controller into the ON and OFF pulses controlling the inverter. The controller gathers information on the current state of the system and makes decisions influencing the system behavior (start-up sequence, breaking) and performance (closed-loop speed control, motor current/torque control).

The motor of choice in the data storage industry is the permanent-magnet synchronous motor (PMSM). Such a motor is often referred to as a "brushless DC" motor, or electronically commutated motor (ECM). Unlike other motors, the PMSM characteristics substantially depend on the employed power converter topology and control concept. The PMSM is a synchronous motor—the mechanical movements of the shaft exactly follow the position of the rotating magnetic field generated by the current in the motor's winding. Generally, depending on the field distribution in the air gap, motors are divided into two groups: trapezoidal and sinusoidal.

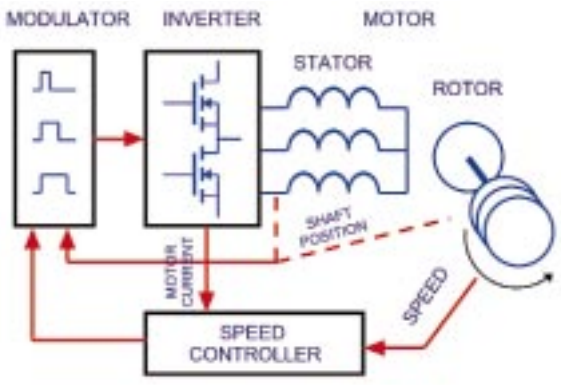

Figure 1. Block Diagram of a Permanent-Magnet Motor, Variable-Speed Drive System, the Spindle System Typically Employed in Data Storage Devices.

The power-section (inverter) transistors are turned ON and OFF according to the modulation algorithm. In the typical case of the voltage-source inverters, the voltage is the modulated parameter. The motor current is a result of the pulse-width-modulated (PWM) voltage applied to the windings. A review of the PWM techniques employed in the motor drives supplying induction motors can be found in Pulsewidth modulation—a survey[1].

The energy consumed by the spindle system can be divided into three groups: motor losses, inverter losses, and energy supplied to the load. The motor losses can be divided into: winding losses (power lost in the resistance of the motor's windings, due to the eddy currents in the winding and to the skin effect) and iron losses, due to the characteristics of the magnetic materials (hysteresis and eddy-current losses in iron). The losses in the inverter can be attributed to the switching losses of the switching devices and diodes, and conduction losses of the switching devices and anti-parallel diodes. More details on this subject may be found in the following publications: *Power Electronics, Converters, Applications and Design*[2], *The Field Orientation Principle in Control of Induction Motors*[3], and *Control of Electrical Devices*[4].

Servomotor drives typically require shaft position and current sensors for both control and protection. The simple six-step commutation commonly used on small brushless DC motors, employs Hall effect sensors activated by the rotor magnet. Other alternatives are high-resolution encoders or resolver feedback, as used in precision brushless servo systems. In data storage applications, the motor drive operating conditions are well predetermined. This greatly simplified set of requirements, combined with certain switching/modulation techniques, allows implementation of the sensorless detection of the shaft position. The shaft-position information is typically derived from the zero crossing of the back-EMF voltage of the undriven phase, with respect to the center point.

For voltage-source inverters there are three basic motor/drive configurations characterized in terms of the phase voltage applied to the motor: six-step (square wave),

trapezoidal, and sinusoidal. Further references to six-step (square wave), trapezoidal, and sinusoidal drives assume voltage-source inverters.

The **Six-Step** *(Square-Wave) Drive System*

The **six-step** (square-wave) drive system sequentially changes the voltage applied to the motor windings and generates the synchronous field required for motor operation. The switching sequence is coupled with the shaft (rotor-field) position. To improve six-step system performance, the motor voltage is added as another degree of freedom. The voltage control is achieved by either control of the inverter supplying DC voltage (double conversion), or by superimposing the PWM pattern on the six-step waveform. The pure six-step requires very low switching frequency and, in effect, inverter efficiency is high. The drawback of this method is that the motor is treated with substantially distorted currents that lead to increased power losses. The current harmonics are also responsible for the high level of motor-generated noise. The hardware implementation of the six-step drive is relatively simple; it also permits an easy introduction of the sensorless commutation.

The **Trapezoidal** *Drive System*

The **trapezoidal** drive system, although similar in principle to the six-step drive, generates trapezoidal instead of square-wave waveform. The change of shape is achieved by applying a PWM-modulated-voltage transition instead of the simple switching from one polarity to another. The average voltage value (not instantaneous) forms a trapezoid. The trapezoidal drive system provides a balanced solution, striking a good compromise between performance and system complexity. It performs better than six-step in terms of efficiency and torque pulsations, but does not require sophisticated and costly engineering solutions required by the sinusoidal approach. Lower losses and noise, combined with simplicity of implementation and easy implementation of the sensorless commutation, are the benefits of the trapezoidal approach. For the full optimization of the trapezoidal solution, the motor requires special design.

The **Sinusoidal** *Drive System*

The **sinusoidal** drive system generates PWM-modulated, sinusoidal voltages. The drive controls the voltage amplitude and frequency. This is the most sophisticated drive system, bringing typically high motor efficiency and low noise, but at the expense of inverter efficiency and substantial system complexity. Implementation of the sensorless sinusoidal drive system is not trivial. In this case, the motor design requires special attention, as well.

A comparison of the most important characteristics of the three basic spindle motor/drive configurations is presented in Table 1.

Table 1. Comparison of the Most Important Characteristics of the Three Basic Spindle Motor/Drive Configurations.

	SIX-STEP DRIVE SYSTEM	TRAPEZOIDAL DRIVE SYSTEM	SINUSOIDAL DRIVE SYSTEM
Suitability for particular market segment	Consumer market – low rpm	Consumer to enterprise	High rpm, enterprise class
Level of parasitic torque components	Very high	High to Medium	Low to very low
Probability of spindle excited mechanical resonances	High	Medium	Low
Impact on performance of other subsystems	High	Medium	Low
Spindle generated noise	High	Medium	Low
Suitability for advanced bearing solutions (hydrodynamic, magnetic, air bearings)	Low	Low to Medium	High
Required level of motor-drive integration	Low	Medium	High
Power consumption of the spindle system	High	Medium	Medium
Inverter efficiency	High	Medium	Low
Motor efficiency	Low	Medium	High
Ease of hardware implementation	Simple	Simple	Difficult
Ease of implementing of sensorless commutation	Easy	Easy	Difficult
Control algorithm complexity	Low	Low - Medium	High
Availability of fully integrated solutions	Yes	Yes	Limited
Spindle system cost (excluding motor)	Low	Low	Medium to High
Motor cost	Low	Medium	Medium
Reliability – mechanical components	Low	Medium to High	Medium to High
Reliability – electrical components	High	High	High

Although seldom associated with drive performance, spindle technology influences (and often limits) performance of the data storage device in direct and indirect ways. The higher rotational speed results in a shorter latency time, improving the access time. Let us examine the implications of increasing the rotational speed from the motor and drive perspective.

Assuming an unchanged supply voltage, to reach the maximum allowable back-EMF value, the number of turns should be reduced in the higher-speed motor. The smaller number of turns reduces the winding inductance. The smaller winding inductance then results in an increase of the current harmonics associated with the switching operation of the inverter and amplifies other harmonics caused by interactions between the inverter and the motor. The harmonics cause parasitic losses, torque ripple, noise, and other undesirable effects. A simple method of reducing the current harmonics is to increase the switching frequency of the inverter. However, it also means an increase of the switching losses, and for finite switching times, distortion of the generated voltage and, in effect, more current harmonics.

The smaller winding inductance and lower number of pole-pairs of high-speed motors, in connection with simple extrapolation of the operating parameters and

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storage news

Featured in this issue:

Edgar M. Williams

Brandon Die Cutting

FEI Company

GMW Associates

KLA-Tencor Corporation

Maxtor Corporation

Nikko Materials

ppb, Inc.

Process Integration, LLC

Unaxis Management, Ltd.

Book Review: Design and Analysis of Magnetoresistive Recording Heads

Finn Jorgensen, author of The Complete Handbook of Magnetic Recording, wrote a review for this new book written by Edgar M. Williams, stating that "a first glance through this book will impress the reader with an abundance of facts on MR and GMR heads, formulas, graphs and analytical data, backed up by more than 255 references." The eight chapters span across advanced quantum physics to down-to-earth results for the practicing engineer. "This book is unusual because all of the design equations for MR heads are written in closed-form mathematical language," added Jorgensen, "and it is easy to convert these equations for use on a personal computer." The book was written between October1998 and January 2000, while the author was a "Read-Rite Fellow" at Read-Rite Corporation. According to Jorgensen, the material is so well integrated that the reader quickly can find an answer to most questions. For more information about the book, send author Ed Williams an e-mail at EWilliams340@home.com.

Brandon Die Cutting opens first Asian facility

Brandon International of Baldwin Park announced the opening of its first Asian facility. The new operation located at 69 UBI Cresent-03, CES Building, in Singapore provides Class 100 rotary die cutting and packaging to customers in East Asia. According to president Steve Gasparrelli, "In order to best serve our customers we have to be close to them. This new facility is our way of demonstrating our commitment to our Asian customers. We will be doing plant qualification and begin pre-production runs in March 2001." Brandon Die Cutting is a $12 million sales subsidiary of Brandon International and is a leader in the field of precision die cutting and manufactures precise gaskets, seals, dampers and assembly aids for a variety of industries. Some of the major industries it works with include medical equipment, disk drive, automotive and cellular phone manufacturers. For more information, visit Brandon Die Cutting online at www.brandondiecutting.com.

FEI Company reports $6 million order for thin-film head trimming systems

A leading Japanese producer of GMR (giant magneto resistive) thin-film data storage heads has placed an order in excess of $6 million for multiple AutoTrim™ 600eX systems. These FEI systems deliver advanced critical dimension control and head trimming capabilities down to 0.1 micron economically by using Focused Ion Beam (FIB) technology. "This order underscores the continuing need for FEI's thin-film head trimming solutions in the data storage industry," commented Jack Doherty, FEI's vice president of sales for Asia-Pacific. "FIB technology for data storage applications allows manufacturers to stay ahead of the lithography curve as dimensions shrink and storage capacities grow, without making hugh investments in new generations of lithography systems." Because of their flexibility, critical dimension control FIB techniques have been adopted by manufacturers as the sizes of GMR heads continue to shrink in response to demands for increased performance and storage capacities. The order was executed by Tokyo Electron Ltd., FEI's distribution partner for microelectronics products in Japan. The systems are scheduled to ship in the first half of this year. For more information, visit FEI online at www.feicompany.com.

GMW Associates announces the release of Model 867-400 Current Transducer manufactured by Danfysik A/S

The new device uses the principle of maintaining zero magnetic flux in a toroidal core which results in a precise 2000:1 ratio with an output of ±200mA for a ±400A primary current. The new model is an addition to the family of Current Transducers produced by Danfysik. Applications for the 867-400 include current control of particle accelerator corrector and focussing electromagnet power supplies, magnetic resonance imaging (MRI) gradient amplifiers, servo motor amplifiers and current measurement for precision power metering. Compared to resistive shunts or Hall-effect transducers, the 867-400 provides greatly improved stability, lower common mode noise, much better linearity, reduced hysteresis, and enhanced frequency response. The 867-400 ULTRASTAB Current

Transducer is manufactured by Danfysik A/S and is distributed by GMW Associates. Further details are available on the GMW website at www.gmw.com.

KLA-Tencor expands its presence in emerging data storage markets with planned acquisition of Phase Metrics

KLA-Tencor Corp. announces another step in its strategic growth plan by signing a definitive agreement to purchase Phase Metrics—the leading supplier of inspection/certification technologies to the data storage industry. The acquisition, for an undisclosed sum, will be accounted for as a purchase and will be finalized no later than April 30, 2001. Company officials report that Phase Metrics' tools and technologies will be combined with KLA-Tencor's existing data storage inspection and metrology solutions to create a new corporate division focused exclusively on advanced data storage technologies. Whereas KLA-Tencor's demonstrated technology and expertise focuses on front-end data storage metrology and inspection, Phase Metrics' efforts are focused on data storage back-end inspection and test. By leveraging the naturally synergistic products and services from both companies, in tandem with their joint sales, marketing and customer-support channels, the newly combined entity is expected to create the single largest yield management force in the data storage industry. According to KLA-Tencor president and chief executive officer Ken Schroeder, the acquisition marks the latest move in the company's plan to leverage its core competencies and leadership position in the global semiconductor industry to create similar industry-leading positions in other advanced technology markets. "We are targeting growing high-tech market segments where sophisticated yield management and process-control strategies are critical to manufacturing success. The data storage industry is an excellent example. Combining Phase Metrics' business opportunities with KLA-Tencor''s existing data storage business, as well as with our financial and distribution strengths, should create another growth engine for the company." KLA-Tencor's new data storage division will be located in Phase Metrics' existing facilities in San Diego, Fremont and Hayward, California. Frank Brienzo, who currently serves as vice president of business operations and chief manufacturing officer at KLA-Tencor, will head the new division as general manager. For additional information, visit KLA-Tencor online at www.kla-tencor.com.

Maxtor Corporation becomes world's largest hard disk drive company with the completion of Quantum HDD merger

The product range of the merged company includes HDDs for an array of applications including desktop PCs and advanced servers, to NAS solutions and consumer electronics products. Additionally, Maxtor's financial strength, excellent ability to execute, and intellectual property portfolio will allow the company to not only maintain a leadership position in HDDs, but also enable Maxtor to expand rapidly into new and growing storage segments. "This merger is a historic moment for Maxtor, and we are very excited about the opportunities it offers to our customers, shareholders, and employees," said Mike Cannon, president and CEO. "We now have a very broad line of products, an even stronger customer base, and the financial resources to capitalize on the growth opportunities in storage." "Storage is at an incredible intersection point. One where technology advancement, the emergence of networked computing architecture, and the delivery of rich media are all converging," said Crawford Del Prete, senior vice president of IDC's Hardware Research. "Storage has something to offer all of these areas, making it an immense opportunity for years to come. Maxtor is strategically equipped to not only capture value in its traditional HDD business, but also from its NAS and consumer electronics storage initiatives, placing them in a very strong competitive market position." For more information, visit Maxtor online at www.maxtor.com.

NIMTEC Inc. changes name to Nikko Materials

As part of an international name unification of operations under its parent company Japan Energy Corporation, NIMTEC Inc. has changed its name to Nikko Materials. This decision signals a move to uniformity of the names of similar operating companies within Japan Energy Corporation. In addition to NIMTEC, Japan Energy Corporation subsidiaries NIMTEC GmbH in Europe, Japan Energy Pte. Ltd. in Singapore, and Japan Energy (Taiwan) Co. are united under the Nikko Materials name. "Changing our name to Nikko Materials harmonizes all of the names of our fellow subsidiary companies worldwide," said Robert H. Combs, president and chief executive officer of Nikko Materials. "With today's burgeoning electronic materials market, customers need only remember one name—Nikko Materials—for all their sputtering target, anode and compound semiconductor wafer needs." The word "Nikko" is a contraction of the Japanese words "Nippon" (meaning Japan) and the word "ko" (meaning mining). For more information, visit their website at www.nikkomaterials.com.

ppb, Inc. relocates to San Diego, California, where they have also set up an R&D center

ppb, Inc. has been serving the ultrasonic cleaning market since 1996. Since then, their customers for the Ultrasonic Energy Meter (0 to 500 kHz) have included Branson Ultrasonics, Seagate Technology, H-P, Samsung, Quantum, GE, and others. The industries typically fall in the electronic (including disk drive), pharmaceutical, aerospace, automotive, and machine parts cleaning and manufacturing markets. With the addition of the Megasonic Energy Meter

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no fundamental changes in the spindle technology, causes the quick deterioration of the high-speed spindle efficiency. To minimize the impact of the deteriorating spindle performance and still reach the high rotational speed, it has become common practice to reduce the load by decreasing the diameter of the platters. This also reduces the maximum storage capacity, but recent increases of the maximum data density help to compensate for the loss of capacity due to spindle-induced limitations. Platter diameter reduction forced by the spindle performance is one of the most evident limitations imposed by the spindle system on the data storage device. Paradoxically, the smaller platter diameter reduces the load inertia and magnifies the impact of the parasitic torque components.

Are there other spindle-induced limitations? One can certainly draw a connection between parasitic torque components and the maximum data density or the maximum bandwidth of the voice-coil actuator. In both cases, it is quite difficult to precisely define the correlation, especially having no ideal spindle motor for establishing the reference point.

The parasitic torque components with their wide frequency spectrum are often responsible for exciting mechanical resonances. Those resonances occur at frequencies assumed to be outside the range of frequencies exciting the mechanical system; they are very difficult to model, predict, and eliminate in the design stage. A portion of the losses in the spindle motor is transformed in acoustic energy. The motor-generated noise is in direct proportion to the level of current and current harmonics in the motor windings. The loosely wound motor windings often act as the electro-dynamical transformers of the electrical energy into acoustic energy. The parasitic torque components increase the noise level generated by the high-speed motor.

The high-speed spindle design for data storage devices rotating with 20,000 rpm or more will require high-efficiency, smooth-torque solutions. The fully sinusoidal drive seems to be the most promising. Recently, a number of purely sinusoidal solutions were introduced; however, the majority of them, having their roots in the induction motor drives or servo drives, do not offer benefits clearly outweighing the drawbacks. Unfortunately, for developers involved in spindle systems for data storage applications, not only technology, but also the means of implementing the technology (such as modulators, microcontrollers, or DSP chips) are developed with relatively slow induction-motor drives or servo drives in mind.

Preliminary work by the authors would indicate that by applying a sinusoidal drive system specifically designed for the high-speed spindle motor the power losses can be significantly reduced. Mainly due to the reduction of the parasitic torque components, the efficiency of a 10,000-rpm enterprise-class spindle system employing a four-pole-pair motor with trapezoidal back-EMF was improved by 17 percent (see Figure 2).

It is important to point out that a substantial portion of the eliminated power was originally transformed in the energy exciting other electromechanical components and subsystems of the data storage device, causing other performance limitations. The reduction of the spindle power losses is often perceived only as a relatively small change of one of the components in the thermal budget. However, this view does not reflect the true meaning of this change. The efficiency improvement of the spindle system should rather be viewed as a reduction of the parasitic energy that excites the mechanical components of the hard drive in an uncontrolled way.

Establishing hard data presenting correlation between the spindle efficiency (parasitic torque components) and the hard disk performance has yet to be done; the probability of such dependencies appears to be quite high.

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(500 kHz to 5 MHz) and the Ultrasonic/Megasonic Energy Meter (0 to 5 MHz), ppb's customer base is expanding to include the high-end semiconductor processing and wafer cleaning industries. Additional information may be found on their website, located at www.megasonics.com.

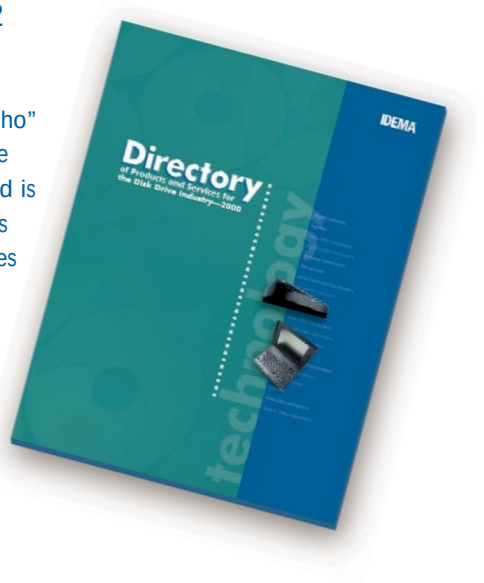
Process Integration, LLC purchases the assets of Mantis Robotics Corporation

By order of the Maricopa County Superior Court as of March 23, 2001, the dissolution of Mantis Robotics Corporation resulted in a purchase of all their assets, products, designs, trademarks, patents, and intellectual property by Process Integration, LLC (Pi). Pi is a recognized semiconductor equipment manufacturer specializing in sputter and etch tools. The Mantis line of products includes flux dispensers, after reflow wafer cleaners, and polyimide coating equipment used in the fast-growing flip chip and advanced packaging technologies. This will allow Pi to enter the back-end assembly and packaging with a new line of products. Plans include a new system for processing 300 mm wafers to be delivered by August of 2001. For more information regarding this purchase, visit Process Integration online at www.processintegrationllc.com.

Unaxis acquires SPTec Signal Processing Technologies SA

Unaxis Management Ltd. of Zurich, Switzerland acquired SPTec Signal Processing Technologies SA on February 28, 2001. As a new legal entity, the company has been renamed Unaxis SPTec SA. Unaxis SPTec will be fully integrated into the compound semiconductors Strategic Business Unit (SBU) of Unaxis Semiconductors. The main goal of the acquisition is to enlarge Unaxis Semiconductors' capabilities to offer integrated solutions for the manufacturing of telecommunication-related components. Unaxis SPTec will engineer integrated solutions with hardware from Unaxis Semiconductors and other strategic partners. Unaxis Semiconductors is one of the key divisions in the Unaxis Group and is a global leader in production systems for the telecommunications industry, targeting advanced packaging and other selected segments of the semiconductor market. The Unaxis Group is focused on high-tech domains in information technology (IT), surface treatment, components, and special systems. IT is used as a term to describe any form of technology necessary to process, transmit, store, and visualize data. Unaxis provides production solutions and services for the semiconductors, data storage, displays and optical components market. With a multi-cultural global team of over 8,000 employees, Unaxis builds on its core competencies which have evolved over the past 50 years. For more information, visit Unaxis online at www.unaxis.com.

Place your ad insertion order NOW for the 2002 IDEMA Member Directory



The IDEMA Member Directory is the only international publication that lists the "Who's Who" in the data storage industry. The directory, hailed as one of the industry's leading resource tools, is the preferred source of information on companies in the data storage industry and is an ideal publication to communicate your company's corporate and product messages. As an annual publication, the directory is devoted exclusively to IDEMA members and features member company addresses, phone/fax numbers, e-mail/website addresses, company information, and key contact names. Also included are listings and key contact names of university, association, and individual IDEMA members. The directory is used by storage professionals worldwide on a year-round basis to identify potential customers, determine product suppliers, as well as to search for corporate contact information. A searchable database of IDEMA members is also available on the IDEMA Website at www.idema.org.

The directory lists more than 700 storage equipment and drive manufacturers worldwide and features a data storage glossary of terms, a geographic listing of corporate members, as well as a product index and matrix. This popular IDEMA publication is used as a desk reference by executives, buyers, sales executives, engineers, and other data storage professionals involved in the purchase of materials, equipment, supplies, products, and services used in the manufacture of data storage devices. This valuable publication is FREE to all corporate and employee members and is also distributed freely during DISKCON® tradeshows, technical symposia, and quarterly dinner meetings—non-IDEMA members may purchase copies for $25 each.Contact the IDEMA office (phone 408-330-8100 to request an IDEMA Member Directory Insertion Order form. Last day to reserve ad space in the 2002 IDEMA Member Directory is June 15, 2001.

Technical Week in Minnesota

IDEMA is planning a full week of data storage-related events in Bloomington, Minnesota. Plan to attend the Advanced Head Interface Technology Symposium, as well as the five technical education classes being offered. Afterwards, meet your colleagues "out on the green" for a round of championship golf on 3M's 18-hole golf course located in Lake Elmo. Please check www.idema.org for complete event details and to register online.

Advanced Head Interface Technology Symposium

June 13, 2001, 8 a.m. to 5 p.m.

Radisson Hotel South & Plaza Tower—Bloomington, MN

member: $160 nonmember: $190

If your drive is making funny noises and your data retention is getting shaky, maybe you need to have your head examined! The advanced head and disk technology presented at this symposium will show you how to reduce your headaches. New suspension technologies, such as microactuators as well as drive mechanical improvements, will help keep your head from wandering. Advanced head sensor and disk technology can really boost your memory (good thing). And, in case you can't remember where you saved your data last, take a closer look at your disk; leading tribologists suggest that improving the head and medium interface can help you avoid crashing.

Speaker Line-up (as of 4/17/2001):

Dr. Ronald J.A. van den Oetelaar, Senior Scientist—Royal Phillips Electronics: "*Slider-based removable optical storage*"

Speaker to be announced—Tektronix: "*Guzik oscilloscope-based solutions*"

Aman Khan—Magenecomp Corporation: "*Microactuator technology*"

Speaker & topic to be announced—Hutchinson Technology, Inc.

Speaker & topic to be announced—3M Corporation

Golf Tournament

June 14, 2001

10:45 a.m. to Noon

Tartan Park Golf Course

Lake Elmo, MN

member: $95

nonmember: $140

Join IDEMA and other data storage professionals at an exclusive golf tournament sponsored in part by 3M. Enjoy a round of championship golf (scramble format) on 3M's beautiful 18-hole golf course and test your skill by entering one or more of the golf challenges (such as the longest drive and putt, or the closest to the pin). Afterwards, relax with colleagues at the awards banquet, where prizes and trophies for the top teams

REGISTRATION DISCOUNT

Register five people to attend the symposium and/or any combination of technical education classes and one goes FREE! Certain restrictions apply, contact IDEMA Event Registration at 408.330.8100 for full details.

Hotel Rooms

IDEMA has reserved a block of rooms at the Radisson Hotel South & Plaza Tower (1.952.893.8456) located at 7800 Normandale Blvd. in Bloomington, MN at the rate of $115/room. Discount on room rates only available if reservations are made by May 14; be sure to mention that you are attending an IDEMA event at the time you make your reservation.

Keep Pace with current technologies by attending an IDEMA Technical Education Class

In conjunction with the Advanced Head Interface Technology Symposium, IDEMA is also offering three days of technical education classes on June 11, 12 and 14. Classes will include KnowledgeTek's *Data Storage: The Cutting Edge*, which focuses on current and future challenges to the data storage industry. KnowledgeTek's specialized experts continually update this course to include the latest technologies and market trends. This class sold out quickly last time, so register early to reserve your space. For detailed class descriptions and to register online, visit the IDEMA Website at www.idema.org. Unless otherwise noted, registration cost is $195 (members) and $230 (nonmembers). Space is limited—early registration will ensure that you have a place!

Disk Drive Basics

June 11, 8 a.m. to Noon

This class is a must for industry newcomers and non-technical professionals who need a general understanding of magnetic storage. Students will learn about the key components of a disk drive, such as the head and disk, as well as the read/write, servo writing, and data storage functions. No prerequisites required.

Introduction to Disk Drive Interfaces

June 11, 1 p.m. to 5 p.m.

Non-technical professionals are introduced to the interfaces used to connect disk drives to computers in this basic class. Students will learn what the drive looks like to the computer (as in files, directories, blocks, etc.), and will be provided with an overview of the key points of popular interfaces such as: ATA/IDE, SCSI, Fibre Channel, and 1394. Participants in this half-day class should already have a basic understanding of how a disk drive functions before enrolling. Disk Drive Basics is an excellent preparation course.

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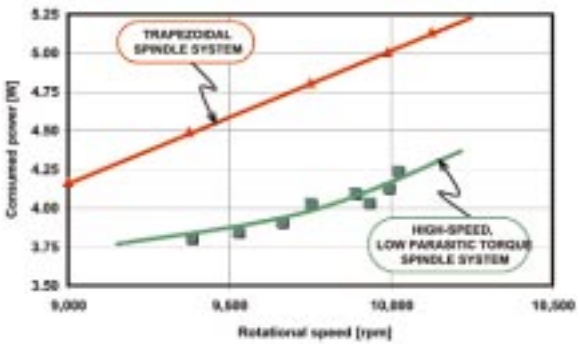

Figure 2. Comparison of the Power Consumption of a 10,000-rpm Spindle System Employing Trapezoidal and High-Speed, Low Parasitic Torque Spindle Systems.

Parasitic torque components may play an even greater role in the case of spindle motors employing low stiffness bearings, such as hydrodynamic, air, or magnetic bearings. Time-variable torque components are created as a result of the employed modulation technique and interaction between the inverter and the motor. They may occur on almost any point of the frequency spectrum, from sub-harmonics up to the 40th harmonics of the fundamental frequency of the motor current. Excitation of mechanical systems employing low stiffness bearing, with so wide a spectrum of time-variable torque components, may lead to more severe mechanical resonances and oscillations than in the case of ball bearings. Ball bearings play an important role in "torque budget" of the spindle motor. A number of motor-design techniques rely on the cancellation of certain torque components, which actually occur in the bearings. Application of the low-stiffness bearings may amplify the need for spindle systems capable of reduction or elimination of the parasitic torque components.

The ultimate solution, offering an unlimited spindle lifetime, is a fully integrated spindle motor and magnetic bearing system. The integrated motor/magnetic bearing system would offer a practically unlimited lifetime of the spindle system. Although there is substantial progress in magnetic bearing technology, fluid bearings may offer an immediate solution to certain drawbacks of ball bearings.

Summary

Although seldom associated with drive performance, spindle technology influences (and often limits) performance of the data storage device in direct and indirect ways. Platter diameter reduction forced by the thermal budget limitation is one of the most obvious.

Interactions between the inverter and motor increase the level of parasitic torque components, resulting in increased power losses and increased noise level. The parasitic torque components are often responsible for exciting resonances that are difficult to predict and avoid during the design stage.

Reduction of spindle power consumption should be viewed as a reduction of the parasitic energy that excites the mechanical components of the hard drive in an uncontrolled way, rather than a small efficiency improvement.

Reduction of parasitic torque components is especially important in the case of spindle motors employing low-stiffness bearings, such as hydrodynamic, air, or magnetic bearings.

The specialized, sinusoidal high-speed spindle controller has been developed. Mainly due to reduction of parasitic torque components, the efficiency of a 10,000-rpm enterprise-class spindle system was improved by 17 percent.

The dedicated sinusoidal-based drive and fully integrated motor and magnetic-bearing system are two of the most promising directions in which the high-speed spindle for data storage devices may evolve in the future. ●

References

[1] *J. Holtz, Pulsewidth modulation—a survey. IEEE Transactions on Industrial Electronics, Vol. 39, 1992, pg. 410.*

[2] *N. Mohan, T. Underland and W. Robbins, Power Electronics, Converters, Applications and Design published by John Wiley and Sons, Inc. in 1995.*

[3] *Andrzej M. Trzynadlowski, The Field Orientation Principle in Control of Induction Motors published in 1994 by Kluwer Academic Publishers.*

[4] *Werner Leonhard, Control of Electrical Drives published by Springer-Verlag in 1996.*

Iwona Bida is president of FAMA Corporation. Since its inception in 1999, the company has been engaged in technology development and consulting services in the areas of power conversion, high-speed motor drives, and high-performance actuators. FAMA Corporation is presently in the process of introducing a family of specialized integrated circuits for efficient and cost-effective control of high-speed motors. The integrated circuits, based on proprietary technology, generate cost-savings and improved motor efficiency and overall performance of hard disks and other storage devices employing rotating media. Mrs. Bida holds a master's degree in engineering from the Technical University of Wroclaw, Poland. She may be reached by e-mail at Iwona_Bida@email.msn.com.

Roman Bida is a consultant engaged primarily in the areas of high-speed motor drives, integrated motor-drive systems, and efficient power-modulation strategies. For over fifteen years he has been involved in R&D activities with companies such as Siemens, ABB (Asea Brown Boveri), and Eaton. Mr. Bida has recently applied for a number of patents in the areas of permanent-magnet and high-speed motor drives. He holds a master's degree in electronics engineering and control systems from the Technical University of Wroclaw, Poland.

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Storage Networks (SAN) Basics

June 12, 8 a.m. to Noon

Get a glimpse into how disk drives are arrayed together to provide enterprise and server storage system solutions. Learn the difference between SAN (storage area network) and NAS (network-attached storage)—it's more than just the order of the letters! This class will introduce students to the basics of storage systems: what they are, how they work, and what the important issues are. Participants in this half-day class should already have a basic understanding of how a disk drive functions before enrolling. *Disk Drive Basics* is an excellent preparation course.

Head-Disk Interface

June 12, 1 p.m. to 5 p.m.

This half-day introductory course examines a key technology in the quest for increasing density: the head-disk interface. The amount of space between the head and disk is only about a hundred atoms and shrinking, as bit sizes decrease. This space squeeze makes the head-disk interface increasingly important. This class discusses some of the key issues involved, such as: stiction, wear, lubricants and additives, bonded versus non-bonded lubes, fly stiction, and load/unload tribology issues. Students who have a basic understanding of disk drive technology will get the most from this class.

Data Storage: The Cutting Edge

June 14, 8 a.m. to 5 p.m.

member: $395 nonmember: $465

This full-day course focuses on the current and future challenges to the data storage industry. The course is continuously updated to include the latest challenges, technologies, and market trends. Topics presented will cover: superparamagnetism and the physical limits to magnetic recording, high TPI and dual-stage actuators, and the impact of video on the disk drive industry. This course assumes a solid understanding of the technologies used in today's disk drives. KnowledgeTek's *Disk Drive Technology* class or previous industry experience is strongly recommended.

To register, contact the IDEMA office at 408.330.8100 or visit the IDEMA Website at www.idema.org and navigate to the technical education section.

REGISTRATION DISCOUNT

Register five people to attend the symposium and/or any combination of technical education classes and one goes FREE! Certain restrictions apply, contact IDEMA Event registration at 408.330.8100 for full details.

Promote your company all year with the IDEMA 2002 Disk Drive World Map Calendar

Promote your company by including your corporate logo and headquarters on the popular IDEMA Disk Drive World Map Calendar, a colorful poster illustrating the data storage industry. This promotional opportunity is exclusively offered to IDEMA corporate members, and provides worldwide exposure to your company's corporate image.

The IDEMA Disk Drive World Map Calendar can help you promote your company and foster goodwill with your customers and employees. Give the IDEMA calendar to your customers, include it in your direct-mail campaigns, frame it and decorate your reception area, or use it as an employee incentive.

The IDEMA Disk Drive World Map Calendar is the most cost-effective marketing tool available to data storage companies today. For only $595, less than $2 a day, you get your company logo and an artist's rendition of your facility printed on the calendar, and you receive 30 FREE copies. The calendar also includes a foil-stamped border featuring the "Who's Who" of the worldwide data storage industry—IDEMA corporate members.

The calendar is targeted for release in September and will be distributed (one copy each) to the IDEMA worldwide corporate and individual members. And, to maximize exposure for participating companies, the IDEMA Disk Drive World Map Calendar will be available for purchase at the IDEMA Gift Shop during DISKCON USA 2001, as well as on the IDEMA Website yearlong, at www.idema.org.

Space is limited, so reserve your space now! If you have any questions or would like to learn how you can incorporate the IDEMA Disk Drive World Map Calendar into your marketing program, contact the IDEMA office at 408.330.8100.

calendar

May/June 2001

Event information listed is taken from the IDEMA online calendar—available to the general public for adding calendar events. Visit www.idema.org and click on Industry Events in the navigation bar. You can add as many events as you wish, along with a brief description and referencing URL. Contact Chris Carrig (ccarrig@idema.org) for additional information.

May 23

IDEMA Analysts' Assessment New Storage Markets and Technologies

The Westin Hotel
Santa Clara, CA

Analyst Program:
1 p.m. to 5 p.m.

No-Host Reception:
5 p.m. to 6 p.m.

Meet the industry's top market analysts face to face, for an open and thought-provoking discussion on the challenges facing storage manufacturers today and in the future. See page 21 for details.

Contact: IDEMA Event Registration
408.330.8100.

May 23 & 24

IDC StorageVision Forum

The Fairmont Hotel
San Jose, CA

The IDC StorageVision Forum will explore the critical issues facing the storage industry. Comprehensive data will be presented on CD-RW, HDD, network-attached storage, storage area networks, SSPs, and more. Visit their website at www.idc.com/events/svf01 for additional information.

May 24

IDEMA Quarterly Dinner Meeting—Tough Questions for a Tough Panel

The Westin Hotel
Santa Clara, CA
No-Host Cocktails: 6 p.m.
Dinner: 7 p.m.

Interactive panel of industry experts focusing on "Tough Questions for a Tough Panel"

Featured Panelists:

Alan Lowe, President & CEO—Read-Rite Corporation

Bill Watkins, President & COO—Seagate Technology

Michael Russak, President & CTO—Komag, Inc.

Edward Braun, Chairman & CEO—Veeco Instruments, Inc.

See page 25 for details or visit the IDEMA Website at www.idema.org to register online.

May 31

Deadline for updating company information online for the 2002 IDEMA Member Directory

Contact the IDEMA office at 408.330.8100 for details.

May 31

Last day to reserve ad space in the July/August (DISKCON USA Preview) issue of INSIGHT

Contact: Jeri Burdick

jburdick@idema.org

408.330.8107

June 7

Deadline for INSIGHT ad materials—July/August (DISKCON USA Preview) issue

Contact: Jeri Burdick
jburdick@idema.org
408.330.8107

June 11

IDEMA Technical Education Class—Disk Drive Basics

Radisson Hotel South
& Plaza Tower
Bloomington, MN
8 a.m. to Noon

See page 16 for details.

Contact: Dr. Sally Bryant
sbryant@idema.org
408.330.8106

June 11

IDEMA Technical Education Class—Introduction to Disk Drive Interfaces

Radisson Hotel South
& Plaza Tower
Bloomington, MN
1 p.m. to 5 p.m.

See page 16 for details.

Contact: Dr. Sally Bryant
sbryant@idema.org
408.330.8106

June 12

IDEMA Technical Education Class—Storage Networks (SAN) Basics

Radisson Hotel South
& Plaza Tower
Bloomington, MN
8 a.m. to Noon

See page 18 for details.

Contact: Dr. Sally Bryant
sbryant@idema.org
408.330.8106

June 12

IDEMA Technical Education Class—Head-Disk Interface

Radisson Hotel South
& Plaza Tower
Bloomington, MN
1 p.m. to 5 p.m.

See page 18 for details.

Contact: Dr. Sally Bryant
sbryant@idema.org
408.330.8106

calendar

June/July 2001 Events

June 13

IDEMA Symposium: Advanced Head Interface Technology

Radisson Hotel South
& Plaza Tower
Bloomington, MN
8 a.m. to 5 p.m.

Subjects covered: heads, suspensions (flex and wireless), microactuation, and disk interface technologies.

See page 16 for details or visit the IDEMA Website at www.idema.org to register online.

Contact: Kristen Montan
kmontan@idema.org
408.330.8109

June 14

IDEMA Technical Education Class—Data Storage: The Cutting Edge

Radisson Hotel South
& Plaza Tower
Bloomington, MN
8 a.m. to 5 p.m.

See page 18 for details.

Contact: Dr. Sally Bryant
sbryant@idema.org
408.330.8106

June 14

IDEMA Golf Tournament

Tartan Park Golf Course
Lake Elmo, MN
10:45 a.m. to Noon

Join IDEMA and other data storage professionals at an exclusive golf tournament held in conjunction with the Advanced Head Interface Technology Symposium and sponsored in part by 3M. See page 16 for details or visit the IDEMA Website at www.idema.org to register online.

June 15

Last day to reserve ad space in the 2002 IDEMA Member Directory

The IDEMA Member Directory is the only international publication that lists the "Who's Who" in the data storage industry. The directory, hailed as one of the industry's leading resource tools, is the preferred source of information on companies in the data storage industry and is an ideal publication to communicate your company's corporate and product messages. As an annual publication, the directory is devoted exclusively to IDEMA members and features member company addresses, phone/fax numbers, e-mail and website addresses, company information, and key contact names. Also included are listings and key contact names of university, association, and individual IDEMA members. The directory is used by storage professionals worldwide on a year-round basis to identify potential customers, determine product suppliers, as well as to search for corporate contact information. A searchable database of IDEMA members is also available on the IDEMA Website at www.idema.org.

Contact the IDEMA office at 408.330.8100 to request an ad insertion order form. See page 15 for details.

June 27–29

ASME Symposium: 12th Annual Symposium on Information Storage and Processing Systems

Santa Clara, CA

Conference will focus on recent research results on disk drives, tape drives, optical drives, printers, and camera technology.

Contact: Mike Suk
suk@us.ibm.com
408.256.6435

July 13

Last day to reserve ad space in the DISKCON USA Show Guide

Only exhibiting companies are eligible to advertise in the 2001 DISKCON USA Show Guide, which will be distributed at the show as attendees arrive. This valuable show publication also provides post-show marketing value as a great desk reference book. The Show Guide contains: an alpha listing of all exhibitors, product descriptions, conference information, floorplan, and a product finder index. Distribution: 8,000+ copies.

Promote your company and enhance your product listing by reserving your ad space today! Visit the DISKCON USA section on the IDEMA Website at www.idema.org to submit your ad insertion order online or contact the IDEMA show group at 408.492.1436.

July 19

IDEMA Quarterly Dinner Meeting

The Westin Hotel
Santa Clara, CA
No-Host Cocktails: 6 p.m.
Dinner: 7 p.m.

Featured speaker and topic to be announced.

For updated information or to register online, visit the IDEMA Website at www.idema.org.

Analysts' Assessment

New Storage Markets and Technologies

May 23, 2001
The Westin Hotel—Santa Clara, CA
Analyst Program: 1 p.m. to 5 p.m.
No-Host Reception: 5 p.m. to 6 p.m.
member: $195 nonmember: $265

Meet the industry's top market analysts face to face, for an open and thought-provoking discussion on the opportunities for storage companies today and in the future. Limited to 150 attendees, this exclusive event offers executives and marketing managers an opportunity to learn the analysts' perspectives about the global storage market and industry trends, focusing on new storage markets and technologies.

This half-day event also features an extended Q&A session, where attendees will have an opportunity to ask key questions about growth opportunities and near-term applications for new storage markets and technologies. The day will conclude with an hors d'oeuvre reception.

Nowhere else will you have an opportunity to meet and interact with leading industry analysts, than at this exclusive event. Hear market perspectives first-hand, and get the answers to your most critical storage questions. Register online at www.idema.org to attend.

Visit www.idema.org for full event details and to register online.

Speaker Line-Up (as of 4/17/2001):

John Dean, *Director Equity Research—Salomon Smith Barney*
New Storage Architecture

John Donovan, *Vice President—TREND*FOCUS, *Inc.*
Silver Lining, the Pending Form-Factor Shift
The theme of the presentation is that areal density growth has occurred so quickly that perhaps we are at the forefront of HDD form-factor transition to smaller footprints....perhaps!

John Monroe, *Chief Analyst, Rigid Disk Drives Worldwide*
Team Leader, Dataquest Storage Cluster—Gartner Dataquest
The Thicket of Life: Changing Competitive Dynamics in the Rigid Disk Drive Industry
Kevin Kelly writes in his fine book, OUT OF CONTROL: "Routine symbiosis on a large scale could drive many of the complexities in nature that seem to require multiple simultaneous innovations...Evolution, with symbiosis included, may resemble a briar patch more than a tree—the THICKET OF LIFE. If the Thicket of Life is sufficiently tangled, it may require a rethinking of our past and future." The RDD industry is certainly a candidate for "complexities" that "seem to require multiple simultaneous innovations," and the thicket of competitive dynamics in this industry has been more than "sufficiently tangled."

Dave Reinsel, *Senior Analyst—IDC*
Emerging from the Malaise: How Technology Heals the HDD Industry
As the smoke dissipates from recent years of strong HDD demand and torrid areal density growth, new challenges are emerging. How can technology advancements help the HDD industry negotiate the effects of potential PC saturation, aggressive ASP erosion, and elongated capacity points? Mr. Reinsel will explore various technologies available to the HDD industry and how HDD vendors can leverage these technologies to emerge healthy, wealthy (well, profitable, anyway), and wise.

William Ress, *Editor/Publisher—Data Storage Review*
Life After the PC for Disk Drives—Where and When
As the PC marketplace starts saturating, the HDD industry is looking to the non-PC markets to pick up the shortfall. We'll look at what we can expect in these new and emerging markets.

DISKCON USA—the world's largest tradeshow and technical conference dedicated to the data storage industry—is an international event that takes months of strategic development and tactical execution under the guidance of seasoned professionals. To give our DISKCON USA exhibitors a better understanding of the in-depth planning process involved in coordinating and presenting this world-class event, we conducted a recent interview with the IDEMA Tradeshow Manager, Barbara Alvarez.

Q: What was the first tradeshow you worked on?

A: My first show was one of my father's *New Cars for Dealers* events at the San Francisco Cow Palace. The sole purpose of the show was to sell the dealers on the new models introduced that year, so that they, in turn, could sell their customers on the new looks and features. If the dealers didn't go wild over the models on display, the cars wouldn't fly off the dealers' showroom floor. My "job" was to stand next to one of the new cars (while we spun around on a revolving pedestal) and to promote the new safety features while demonstrating the fact that even a child like myself couldn't get her hand caught in the doors. I got paid in the currency of "a new party dress and *maryjane* shoes made of patent leather," so even at a young age I knew that tradeshows were where the action was at!

Q: What's so special about participating at tradeshows?

A: They provide a great opportunity to learn about competitors and to meet with customers in a unique environment. Some of the best information about competitors comes from customers—every prospect has information you need, even if they don't want or need your products. What are they interested in? Who do they buy from? Why? How much do they buy? When? At what price? The answers don't necessarily have to result in a sale in order to be of value. You can scout out new suppliers, scope out new and existing competitors, or find new allies to partner with—all from simply listening to what your visitors tell you.

With good pre-show promotion and media coverage, along with a well-planned booth design, company reps are able to talk directly with a lot more people and at a much lower cost per person than costs associated with making field calls.

Q: What do you think is the biggest mistake most exhibitors make?

A: One obvious mistake is not promoting the fact that their company is going to be at the show. I know that most attendees have an agenda for navigating the show floor, planning to stop by pre-selected company booths. How awful to lose potentially great leads simply because you haven't promoted your presence at the show in advance. Visitors to the show floor are looking for solutions and hoping to talk with specific companies. Why not send a targeted pre-show mailer to your prospects telling them about your company, your products, and the people who can help them at your booth?

Another mistake and perhaps the biggest one, in my opinion, is ***not following up on show leads***. The tradeshow industry (CEIR and IAEM) estimates that 50 percent of all leads generated from shows are never followed up! Post-show follow-up is equally essential to getting the most from your initial investment and so should definitely be added to your must-do list.

Q: What's so special about the shows presented by IDEMA?

A: IDEMA produces three shows each year under the DISKCON banner: DISKCON Asia-Pacific, DISKCON Japan, and the largest of them all, DISKCON USA held in San Jose, California.

Besides the main reason (demonstrating company products to existing and potential new customers at a low cost per person), I would have to say the international locations are another reason why the shows are special—considered premier events within their regions. DISKCON USA is the largest tradeshow and technical conference dedicated to the data storage industry, drawing attendance from over twenty countries worldwide. These are must-attend events, to participate in and to be seen at. Participating in DISKCON says you're a key player within the industry and gives you the edge you'll need to stay there.

Q: How long does it take to plan and execute DISKCON?

A: The simple answer is about 12 months. In reality, the professional staff at IDEMA is working on various aspects of the annual events about 20 months in advance of the actual show dates, with contracts and dates secured years in advance to guarantee the right venue.

Q: What's the toughest pre-show task associated with planning DISKCON?

A: Number One is finding new exhibitors! While we have the ongoing challenge to retain our previous exhibitors, searching for new companies and products that will meet the show's criteria is very time-consuming. IDEMA has many products and member services that not everyone in the industry is aware of, so to increase our visibility we started participating at other industry shows and events last year with a booth of our own. We need to identify potential new exhibitors and qualified attendees for DISKCON, and in so doing, to find new members for the association and increase attendance at other IDEMA programs and classes.

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IDEMA is celebrating... and as active participants in the data storage industry, you should too. 2001 marks a significant milestone—the 15th anniversary of both IDEMA and the DISKCON tradeshow. Our success is your success, and as the association for the data storage industry, we enthusiastically invite you to join us in the celebration.

Success is achieved by evaluating the marketplace and then developing razor-sharp strategies that will ensure that your products are developed with cutting-edge technology. By attending DISKCON USA—the world's largest tradeshow and technical conference dedicated to the data storage industry—you will learn of breaking developments, trends and technology challenges facing the industry. Our programs are specifically designed to give you an opportunity to hear from, as well as interact with leading experts in the data storage field.

Visit the IDEMA Website at www.idema.org for full event information and to register online (available in June).

DISKCON® USA

San Jose
Convention Center
San Jose, CA

Education Classes, Sept. 17-21

Charity Golf Tournament, Sept. 17

Standards Workshops, Sept. 17-18

Keynote Dinner, Sept. 18

Technical Conference, Sept. 18-20

Exhibition, Sept. 19-20

Welcome Reception, Sept. 19

15 years

IDEMA®
3255 Scott Blvd. Suite 2-102
Santa Clara, CA 95054-
tel 408.492.1436
fax 408.492.9749

continued from page 22

Q: What are your biggest frustrations in planning this event?

A: I don't know that I have any big frustrations, but as anyone exposed to the underbelly of event planning will tell you: "*no one in the business of creating and managing a tradeshow can afford to ignore the details, the budget constraints, nor the challenges of meeting deadlines.*" My colleagues would say we're all obsessed with producing the best show environment (coming in under budget) to the delight of everyone in attendance, including the exhibitors, members, and visitors. I would say we're just obsessed with quality.

Q: Are there any special challenges this year?

A: One challenge exists every year: how to design the show floor so it is different from past years—fresher and more dynamic. We start with an empty barn and try to create a new look with graphics and show colors. This year we have adopted the ***IDEMA/DISKCON 15th Anniversary*** theme. Then the exhibitors add in their custom-builds and portables, equipment and graphics. That's when the show really starts to sparkle. I walk the show floor many times during set-up and the actual show, averaging between 12–18 miles daily. I am always impressed with the care, creativity, resources and extensive planning by our exhibitors in order to create their corporate space—it's really their hard work that makes me shine in all my efforts.

Q: What's new on the show floor this year, any surprises?

A: We're executing a design now that will allow for some new pavilions and I'm very excited about these new offerings. Currently, we have companies from Japan, Korea, Thailand, and Singapore planning to exhibit. Other new areas will be the Advertising Contest and New Product Announcement pavilions, plus the addition of two theaters that will be available to companies needing a larger setting with A/V equipment to offer 45-minute product demonstrations. We are also discussing having a 15th Anniversary IDEMA Member Lounge where members can drop in for a complimentary beverage on the show floor.

Q: What do you like most about planning the week of DISKCON?

A: I take great pride in watching the details and deadlines come together in order to produce this event. The IDEMA staff, while not very large, is a very impressive group of talented professionals, all dedicated at working together to produce the features and events that comprise the week of DISKCON (charity golf tournament, education classes, expanded technical conference sessions, standards workshops, keynote dinner, customer meetings, exhibitor show floor, registration, and the IDEMA booth, to name a few) and to have fun in the process. I'm sure that if you asked me different questions like, "*what about those hotel contracts?*" or "*when can I see the emergency plans?*" I might not say it's quite as much fun as the rest, but it is always challenging and very rewarding to be able to provide a quick and appropriate response, regardless of the situation. Though some things remain the same from year to year, every show is quite unique and requires strategic planning, close attention to detail, a lot of coordination efforts, and dedicated teamwork to ensure it's overall success.

Of course, it never hurts to include a new dress and a pair of *maryjane* shoes made of patent leather to the list!

Barbara Alvarez is the manager of the IDEMA show group. Barbara serves as a member of the Board of Directors of NCC IAEM and has been in the tradeshow business for more years than she cares to admit.

For detailed information regarding booth sales, promotional opportunities and general information or questions concerning DISKCON USA, call the IDEMA show group at 408.492.1436 to speak directly with Barbara or with tradeshow coordinator Beth McCullough, the other half of this very dynamic duo.

May 24, 2001

The Westin Hotel—Santa Clara, CA

no-host cocktails: 6 p.m.
dinner: 7 p.m.

individual: member $60 nonmember $70
table of 10: member $550 nonmember $700

TOUGH QUESTIONS FOR A TOUGH PANEL

Interactive Format!

IDEMA has assembled a panel of data storage executives that will, in a Q&A format, examine the challenges that face the HDD industry. The audience will interact directly with the panelists, submitting questions for them to address. You may submit your questions when you register in advance for the dinner, or upon your arrival the evening of the event. The moderator (Mark Geenen, *TREND*FOCUS, Inc.) will organize all of the questions submitted and present them to the panel for discussion and debate. This interactive format will create an exciting and interesting forum wherein the tough questions get tackled "live," and in real time by this distinguished and tough panel.

FEATURED PANELISTS

Alan Lowe, President & CEO—Read-Rite Corporation
Bill Watkins, President & COO—Seagate Technology
Michael Russak, President & CTO—Komag, Inc.
Edward Braun, Chairman & CEO—Veeco Instruments, Inc.

July 19, 2001

The Westin Hotel—Santa Clara, CA

no-host cocktails: 6 p.m.
dinner: 7 p.m.

individual: member $60 nonmember $70
table of 10: member $550 nonmember $700

Featured speaker and topic to be announced. For updated information or to register online, visit the IDEMA Website.

Register online at www.idema.org

IDEMA has reserved a block of rooms at The Westin Hotel (1.800.WESTIN.1) in Santa Clara, CA at the rate of $229/room. Discount on room rates only available if reservations are made at least 30 days prior to the event; be sure to mention that you are attending an IDEMA event at the time you make your reservation.

Quarterly Dinner Meeting Summary

State of the Industry Address

"The 2000 Disk Drive Industry: A Wall Street Perspective"

Nationally recognized technology analyst William A. Lewis, Ph.D., Senior Analyst with J.P. Morgan H&Q (formerly Chase H&Q) presented his state of the industry address "The 2000 Disk Drive Industry: A Wall Street Perspective" at the Quarterly Dinner Meeting held February 15, 2001 in Santa Clara, California. Below is a summary of his presentation—to download a PDF file of his slide presentation, visit IDEMA online at www.idema.org and navigate to the Quarterly Dinner Summaries section of the website.

It is a great honor and pleasure for me to be here today. I hope to provide some perspectives on how Wall Street views the disk drive industry, which has not been very favorable in recent years. Things are going to get better from this point forward, hopefully, although the past three years have been very brutal. I should also mention our name change, which has evolved from Hambrecht & Quist, to Chase H&Q when Chase bought us, and now is J.P. Morgan H&Q.

Before we discuss outlooks for the disk drive industry, I'll talk briefly about the broader markets and about how 2000 was an awful year for technology stocks. The NASDAQ reported its worst year ever (and the worst performance by an index since 1931). It wasn't quite as bad for the Dow or the S&P, and the Russell 2000 (a metric of small companies) did relatively quite well. We saw many smaller companies actually succeed, in spite of the estimate in the late 1990s that it would be the big-cap names that would perform the best. With the exception of biotechnology, which somehow managed to have a great year, 2000 was just a bad year in general for technology stocks, although we have begun to see some signs of recovery, beginning in January.

The disk drive industry in 2000 and beyond

A lot happened during the first quarter of 2000 and so we were all very optimistic. We'd just come off the Y2K rocket and had all this pent-up PC demand that was still carrying forward. People were still producing disk drives and even making money at it during the first quarter. Then we hit a slowdown in Q2, which always seems to catch up with us this time every year. Inventories built up. People over-produced, getting their build plans way ahead of actual demand. As a result (heading in to Q3), people had to start slashing prices on product just to make room for the new introductions coming online that fall.

During Q3, much activity took place: Seagate went private (finally), which wasn't unexpected, Maxtor announced it was acquiring Quantum, and PC inventories began to work their way down. But by the end of the quarter there weren't enough drives, so companies began to build up ahead of the fall demand, raiding channel inventories to get as many drives as they could. Going in to Q4, PC demands begin to dramatically weaken, component shortages severely limited builds, and drives on allocation began to push prices up 4 to 8 percent, sequentially. It was an awful quarter, with PCs falling off the map. Nobody wanted to buy one to save their life, no matter what any of the PC vendors did. There's no logical explanation other than the fact that everyone's already got a PC and probably don't need another one. Regardless the low demand (and lower than expected sales), prices for drives was up, with drive companies and their component suppliers actually doing well in Q4. Despite the events and turbulence of 2000, the line-up really hasn't changed much—no one has gone away. The big price wars started in 1999 haven't driven anybody out of business.

Moreover, guess what? Prices are still going down, which shouldn't be much of a surprise. Of interest, while prices are still going down, there's been a significant change in the slope of the decline. I do think it's an indication that we are moderating the price declines (even though disk drive capacities are astronomically high), and that this improved pricing climate will ultimately show up in the gross margins of companies. For a while we were getting declining gross margins—the peaks were getting smaller and the valleys were getting lower. During 2000, for the first time in a long while, we actually saw gross margins begin to expand again, thanks to the disk drive companies.

It should be noted that near-term growth appears to have slowed (in 1999 it was 20 percent and in 2000 only 15 percent, which is still good). For those of you doing the build plans, the outlook for 2001 is 10 percent (if we get some upside to that, consider it gravy), so obviously the long-term growth is quite healthy and holds great opportunity.

"It should be noted that near-term growth appears to have slowed (in 1999 it was 20 percent and in 2000 only 15 percent, which is still good). For those of you doing the build plans, the outlook for 2001 is 10 percent (if we get some upside to that, consider it gravy), so obviously the long-term growth is quite healthy and holds great opportunity."

Opportunities outside the PC industry

While the PC industry, in many respects, is still the "bread-and-butter industry," we do need to look for other growth drivers as well or at least re-set our expectations to a lower rate of growth. The first opportunity I want to discuss is the consumer electronics market, which I feel has tremendous growth potential, although we saw very little realized in 2000. I think 2001 could be the year we start to see a growth spurt in this sector, probably towards the latter part of the year, during the holiday buying season (when the economy is better again). Most likely, 2002 will be the first year we see substantial growth opportunities start to materialize for this area.

Last year we saw a mad rush to network-attached storage (NAS). There were many acquisitions, such as CDS and XIOtech acquired by Seagate, and other companies I can't recall offhand. This year "Photonics" is the industry of choice, which I think is a good decision, especially since there's already a lot of process and high-volume manufacturing expertise that the HDD industry would bring to the table. The communications market is going optical, that's a reality, and it's not going to slow down.

I want to talk about "disruptive technology." We see SCSI and fibre channel people often asking, "Are we going to see Ethernet drives?" or "Are we going to see Infiniband drives?" which mostly have to do with enterprise storage. I think the most interesting interface currently, outside of the SCSI and fibre channel, is ATA. It was always thought that ATA was too unreliable, or it was a PC, or it was too slow, and the data rates were too slow. Many of those challenges have now been overcome.

In the future, it will be serial ATA, with higher data rates. Everyone talks about how data is doubling every year. Well people's pocketbooks are being squeezed too, and they need a more cost-efficient way for storing all of this information we're generating, which makes ATA arrays an interesting opportunity and an opportunity the HDD industry should go after. I think companies with network-attached businesses are already doing so. They're using ATA drives in many solutions (now typically low-end solutions and a few drives), significantly cheaper than some solutions available from Network Appliance, EMC, IBM, Sun, etc.

The drive business should be a very profitable industry

The drive business should be a very profitable industry and it's still growing. I have to talk about pricing, which is really what drives all this. It never ceases to amaze me—whether back in 1999 when Western Digital had the recall and people raised prices, or in 2000 when we had supply constraints and people raised prices—how every dollar makes such a dramatic difference in the financial performance of the HDD companies. That trickles down to the component suppliers.

The reason I'm more optimistic about some of the pricing rationality long-term is thanks to the structural change in the industry. We've talked about the need for structural change and have seen quite a bit at the component level; now we're

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perspective business

Michael D. Regan, Everest Consulting Group

The Kaizen Revolution (Part 1)

What are "kaizen events," and how can you use them to improve quality, cost, delivery, and morale on the shop floor and in the office?

Kaizen events are an innovative and unusually effective method for making process improvements quickly. It will be difficult for you to keep up with your competitors if you do not learn to use them successfully in your organization.

An auto parts manufacturer used a *kaizen event* to improve productivity in one plant by 102 percent, freeing up 65 employees to staff a new plant.

A sheet-metal fabricator used a *kaizen event* in the office area to cut exceptions (special cases requiring extra work) by 50 percent, and get parts through receiving and inspection 65 percent faster.

A large plastics-molding company used a *kaizen event* in their warehouse to improve morale by 78 percent (as measured by internal surveys).

"Your processes are more or less defined and documented, and whether or not you designed them on purpose, they are perfectly designed to get you the results you are getting."

Kaizen (rhymes with "pie-pen") is a Japanese word meaning "improvement." During a *"kaizen event,"* a cross-functional group of employees focuses full-time for three to five days on dramatically improving one specific process within their organization.

Team members achieve results largely by implementing one or more "lean operating concepts." These include:

- *5S (workplace organization and cleanliness).*
- *standard work (development and documentation of a consistent way to get the work done).*
- *work cells (collocating all people and equipment necessary to complete a job).*
- *one-piece flow (finishing one piece of work before starting another).*
- *setup reduction, and preventive maintenance. Most of these techniques work just as well in the office as on the shop floor.*
- *The keys to a successful kaizen event are thorough preparation before the event and great leadership during the event. The most important parts of preparation include:*
- *defining an "achievable breakthrough" goal for the event.*
- *developing training materials to teach the team how to make the improvement.*
- *choosing the team leader and team members. The leader must be able to alternatively drive people forward, deal with conflict, and inspire the team members, in addition to being a terrific trainer and a master of the lean operating concepts discussed above.*

Why should you consider doing *kaizen events*? Your organization is a collection of processes, including hiring, production, strategic planning, accounting, product development, and more. Your processes are more or less defined and documented, and whether or not you designed them on purpose, they are perfectly designed to give you the results you are getting.

If you keep doing what you've always done, you'll keep getting what you've always gotten. If you don't like the results you are getting, then you have to change the processes that produce those results—if you want better results quickly, you need to change your processes quickly. *Kaizen events* enable you to change your processes quickly.

Thinking about getting started? Good. Here are my top seven tips for doing it right:

7. Make sure that 70 percent of the people on your kaizen event teams are hourly employees, the people who do the work. They will be executing the redesigned process and in the end, they will make it succeed or fail. Furthermore, employees' brains are underutilized in most companies and giving them a chance to use their creative abilities will give you better results and do wonders for morale. Allowing managers and engineers to dominate an event is a great way to fail.

6. Give your kaizen event teams freedom to try ideas with which you don't agree. Trust their common sense, and that they

have the best interests of your organization in mind. They probably see problems and solutions that you don't see. Even if their solution fails, they will have a greater respect for you afterward, because you showed your respect for their intellectual and creative abilities. Your people will repay your trust in them the next time, even if they have to break through brick walls to do it.

5. Teach lean operating concepts to participants at the beginning of an event, but do it in less than four hours and stick to concepts they'll be able to use during that week. If they don't use what they learn, they'll forget it, and you'll have wasted your time and money on excess training.

4. Plan your first kaizen event carefully. Include your most opinionated employees on the team because they will enjoy it and talk it up afterwards. Pick a process that is visible, so the results will be obvious. Limit the scope to ensure success.

3. Don't ignore product development, marketing and sales, customer service, or accounting. Kaizen events work just as well in the laboratory or the office as they do on the manufacturing floor, and may give you even better payback.

2. You may eventually develop internal kaizen event leaders, but get help for at least your first five events. There are a lot of ways to do a kaizen event wrong, and you do not want to give this powerful approach a bad reputation in your organization by failing the first few times. There is no reason to invent your own kaizen event process from scratch. You can hire people who will teach you a proven kaizen event process and train your leaders. Don't be cheap and cost yourself (literally) millions of dollars in time and lost improvements.

1. Start now. Learn by doing. One week out on the shop floor will do you more good than five years of sitting around and thinking.

This ends Part 1 of 2 for "The Kaizen Revolution," by Michael D. Regan—Everest Consulting Group. Look for Part 2, scheduled for the July/August (DISKCON USA Preview) issue of INSIGHT.

Michael D. Regan is president of Everest Consulting Group, and is the author of the books "The Kaizen Revolution" and "The Journey to Teams." His firm provides kaizen events and leadership training to improve client profits. You may contact ECG at 888.910.8326, or visit their website at www.everestcg.com.

standards

History-making standard activity at IDEMA

In the fall of 2000, Ed Grochowski of IBM Almaden Research Center brought together a group of industry experts to discuss the possibility and feasibility of increasing the data block standard from 512 bytes to 4K. This discussion and possible standard will be history making in both its scope and influence. This is a chance for the data storage industry to become the leader for determining how data will be stored and formatted, as well as how it will be used in the future. After initial discussions on the technical implications and ramifications of this radical change, the committee concluded that the advantages of adapting a longer block size, such as a 4K block, warrants them pursuing this concept further as an industry standard. The committee further determined that the next phase of activities will be to contact directly (through IDEMA) the major PC producers (such as Compaq and Dell) to discuss what impact an introduction of a 4K standard for drives would have on the PC industry. This phase would be accomplished with the HDD members on the committee present in a united effort.

Advertiser Index

Correction to the March/April Index:

Incorrect:Read-Write Corporation—www.readwrite.com
Correct:Read-Rite Corporation—www.readrite.com

We apologize for our error.

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seeing it at the drive level. Seventy percent of the share is now controlled by four suppliers, and I have reason to believe that these four suppliers are going to be much more rational about pricing than historically.

Seagate is now a private company I believe so we'll see what happens with them, but there's no incentive for them to wage another price war since they no longer have the balance sheet they once had. They are a private company with investors focused on getting a return on the equity in the company. Ultimately, I imagine they'll want to IPO this company and you cannot do so with a disk drive company at the present, so I assume that Seagate will become a much more benign competitor than in previous years.

Maxtor is acquiring Quantum so that supply is being consolidated and historically, Maxtor has never demonstrated an appetite for being a price leader. Western Digital, of late, has followed suit, but I don't think they're in a position to really wage a price war to begin with. IBM and Fujitsu have traditionally been the same, so I think it's a very different competitive landscape than it once was—a reason to be slightly optimistic.

The question is, do we need price leaders? I think the current answer is no. What troubles me I guess, is the current rate of innovation, which needs to slow. When I worked in the drive industry, the superparamagnetic limit used to be 10 gigabits per square inch. We blew right through that, so I'm not going to say there's any limit, but there are resistance points. There's really no advantage to driving the technology curve just for the sake of it. All you do is drive the number of components out of the drive to give you the same capacity. There's very little cost savings or what savings there are gets counterbalanced by tight supplies.

From a Wall Street perspective, investors have essentially ignored the HDD industry at the institutional level. For one reason, Seagate went private, and this was the one company that investors traditionally knew to invest in. At the same time, many of the people who previously invested in the industry have recently lost money. This has made them reluctant to continue investing in it, which is why the past three years have been so brutal. I think it's time for a change. How can the HDD industry become a sustainable and profitable industry that will gain the attention of Wall Street? Gross margins. In 1999, it was all about revenue growth (price-to-revenue, price-to-market, and price-to-whatever). People are again focused on earnings. I think industries such as the HDD industry (that isn't driving a lot of top-line growth, but could be very profitable) will again have an opportunity to attract the attention of investors, and we'll see some reasonable price-to-earnings multiples.

Top-line expansion seems to be largely over, at least in the short term. There's not going to be a lot of revenue growth by many companies in the industry so we have to focus on how to drive the bottom line.

It's a competitive business. Many people aren't adding a lot of technology value, but are adding a lot of manufacturing prowess. This industry gets the attention of investors because of its profitability.

Conclusion

In conclusion, we already looked at some of the predictions Todd made last year. I suppose I should make a few of my own, but I'm going to keep them brief. I think the most important one is "don't believe everything you read." The second prediction is "don't believe what anybody tells you." The last prediction is going to be the same as last years, because I truly believe it, "disk drive stocks in 2001 have an awesome opportunity."

I think 2001 is likely to be a challenging year, at least until we can sort out whether the economy is crashing, or just slowing. That being said, I think there is reason to be slightly optimistic about the drive industry. I'd love to see this prediction come true and to be able to talk with investors about the exciting things happening in data storage. When you get right down to it, everything is stored on a disk drive, or at the mass-storage level. That's not going to change any time soon—we might as well capture some value from it.

William Lewis initially joined Hambrecht & Quist (now J.P. Morgan H&Q) in March 1999 where he focused on sub-industries that included enterprise storage systems, storage networking, and disk drives. Prior to joining H&Q, Bill worked at Intevac, Inc. (a capital equipment supplier for the disk drive industry), and has held technical positions in the field for over ten years. Bill was also a researcher at the Rand Corporation (a nonprofit "think tank"), where he assisted federal agencies in targeting R&D investments in science and technology. He also worked on implementing processes for logistics and improved supply chain management for the U.S. Army. Bill received a BS degree from the University of California at Berkeley and MS and Ph.D. degrees from Stanford University.

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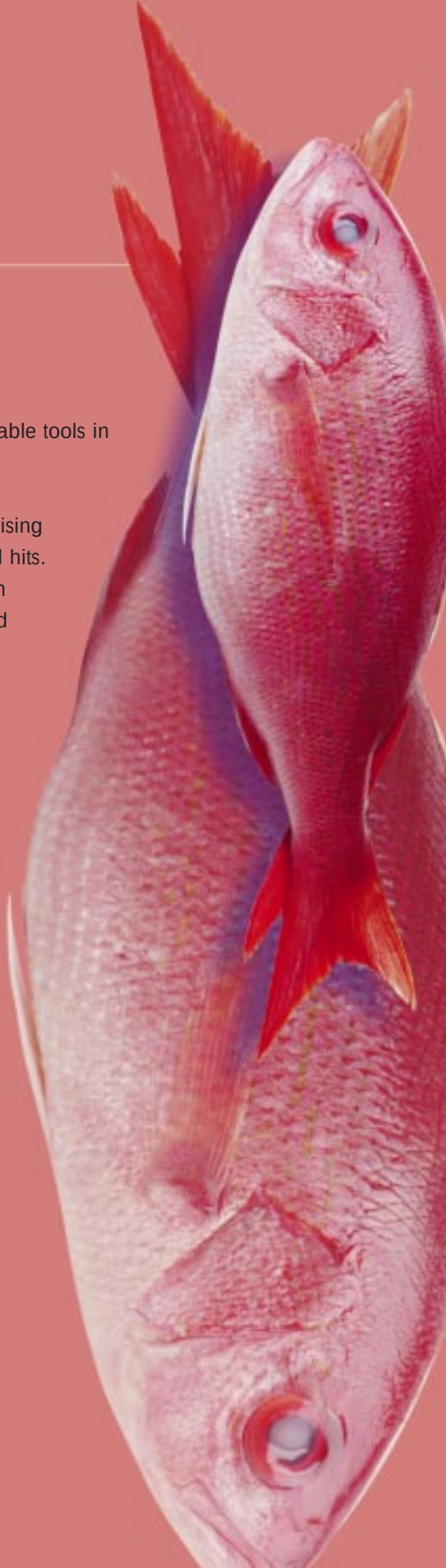

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