



FTR THE FINAL TEST REPORT

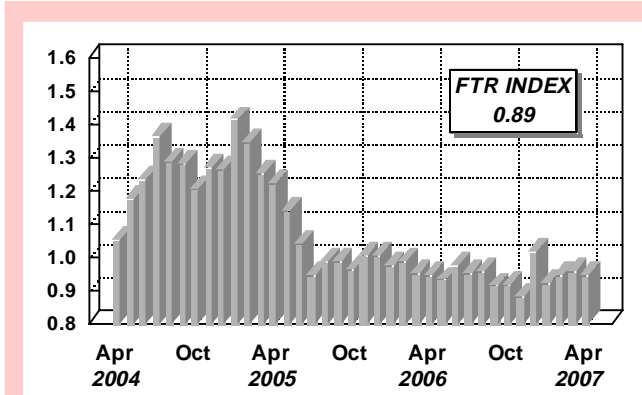
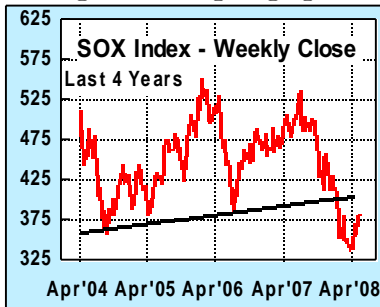


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Memories vs. SoCs Distort Chip/Equipment Revenues

FTR pleads guilty to having breached the Cardinal Rule of investing, *Don't try to catch a falling knife!* The cover story of our December '07 issue asked "Have Chip and Chip Equipment Reached the Trough of This Cycle?" We pointed out that during the last week of November - when that story was written - U.S. stock indexes had put together their best two-day performance in five years, and the SOX index had shown signs of a bottom and appeared to be ready to begin a recovery phase. That led us to be express some excessive optimism. As the graph of the four-year performance of the SOX that we published in that story (extended through the end of last month) shows, we were, at least, a bit premature. That index actually did not hit its recent, and we expect its cycle, low, until March 28, at 339.28.



FTR's index of ATE, chipmakers, and PC makers vs. the Dow-30 fell slightly last month as investors again began to worry about technology stocks.

FTR would still argue that for most of the semiconductor industry, business has bottomed. But, to paraphrase the words of a recent U.S. President, "It's about memory chips stupid!" This was confirmed by SIA CEO, George Scalise in last month's SIA Chip Billings Report.

Scalise said: "Continued price attrition in DRAMs masked underlying strength in global chip sales in February. Excluding memory products, worldwide semiconductor sales grew by nearly 10 percent and total unit shipments for all semiconductor products increased by 11.6 percent YoY." However, DRAM revenues declined by more than 40 percent YoY despite a 43 percent increase in unit shipments. The problem was that average selling prices (ASPs) for DRAMs in February declined by nearly 60 percent YoY."

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He added: "While total chip revenues had fallen for a third straight months, they were still up 1.5 percent YoY. He added that, "Despite a slowing U.S. economy, markets outside the U.S. continued to show robust growth in demand for electronic products that drive semiconductor sales. The Asia-Pacific region, which includes China, has overtaken the United States as the largest market for PCs. Unit sales in the rest of the world equaled sales in the United States in 2007 and are poised to surpass the U.S. market in unit sales this year."

While the accelerating depreciation of the U.S. dollar (See Opinion, p.3) continues to distort – probably to the high side – the SIA's chip revenue numbers when they are presented in dollars – they are certainly not at disaster levels except for memory chips – particularly DRAMs.

Nevertheless, even the DRAM market is finally showing some signs of improvement, prompting industry forecasters such as iSuppli to upgrade its rating of near-term conditions for DRAM suppliers to 'neutral', up from its 'negative' rating in November 2007.

It noted that the average DRAM selling price dropped by 17 percent in first quarter 2008, following a 31 percent decline in the fourth quarter of 2007, and the slower rate of decrease suggests the market now is bottoming out. As a result of reductions in channel inventories, and lower levels of expected capital spending among memory manufacturers, the supply/demand balance is coming into better alignment.

"Although DRAM suppliers themselves are still carrying more inventory than normal, stockpiles in the channel have been reduced significantly," said Nam Hyung Kim, chief analyst at iSuppli. "Furthermore, OEMs including PC makers are now at optimal DRAM inventory levels, meaning their orders will increase during the critical third-quarter holiday build season."

DRAM suppliers early this year said they plan to cut their capital spending on production capacity by about 40 percent in 2008 compared to 2007. But due to a lack of profitability and rapidly diminishing cash reserves over the past several months, many DRAM suppliers will not be able to afford any new spending this year, even at such a reduced level, and may slash their capital outlays by an even greater margin this year, iSuppli noted. This should cause capital spending for this sector of the chip industry to decline by more than 50 percent in 2008 compared to 2007, iSuppli added.

One exception to this trend is the leading DRAM supplier Samsung Electronics, which is expected to actually increase its CAPEX and rate of megabyte production in 2008 by 87 percent compared to by 86 percent in 2007. "Amid the gloomy situation in the global chip market, our company plans to maintain the dominance by killing its rivals with cash," a high ranking official of Samsung Electronics told *The Korea Times* on April 28.

The also troubled NAND market recently received some slightly positive news as prices rallied in the spot memory market. However, the fundamental underlying market conditions have not changed significantly and iSuppli predicts the current spot market price rally will be short lived. Supporting its prediction, China's SMIC said it had stopped manufacturing DRAM chips last month "due to market bearishness." SMIC has been making DRAM chips for Elpida and Qimonda. In fourth quarter of last year DRAMs accounted for 23.6 percent of its US\$93 million in revenue. However SMIC said it is switching to NAND FLASH memory production and has informed its chip equipment suppliers of its new direction.

As a result of the turmoil in the memory markets, SEMI's total equipment book-to-bill – through March – for North American chip equipment makers has not been at or above unity since January 2007.

Japan's chip equipment makers book-to-bill has been below unity since July 2007.

The divergence of memory vs. other semiconductors was reflected in the first quarter financial reports from Advantest and Teradyne late last month. Advantest, which is dependent on memory tester sales to a major extent, reported an operating loss of \$27.5 million for the quarter on sales of \$312 million, while Teradyne, which gets most of its sales from SoC testers, reported an operating profit of \$1.4 million on revenues of \$297 million

Interestingly, Teradyne said it expects its revenues to grow this quarter to \$310 million to \$330 million and operating earnings of between \$0.14 and \$0.19/share, Advantest, however, did not make any forecasts for this quarter or fiscal year.

It commented only that: "With respect to Advantest's future operating environment, amid increased concerns over a slowdown in the global economy, as a result of the escalation in the price of crude oil, rapid exchange rate fluctuations, and further worsening of the sub-prime loan crisis in the U.S., Advantest expects that the future of the economy will remain uncertain. In the semiconductor related market, despite expectations of demand for test systems for semiconductors as a result of an expected expansion in demand for digital consumer electronics for the Beijing Olympics, and the commencement of commercial production of next generation MPUs and next generation high-speed DRAMs, because of concerns over the risk of a decline in prices due to excess supply of semiconductors and increasing competition, Advantest expects that semiconductor manufacturers will continue to be cautious in their approach to capital expenditure."

In comparison, K&S, that supplies bonding equipment for all types of chips, reported an operating loss of \$10.6 million, on sales of \$176 million, – after reporting strong results for the previous two quarters.

IN FTR'S OPINION

Cheap is good! – Weak is bad!

Americans generally like 'Cheap' (as in shopping at Walmart) but they don't like the word 'Weak' attached to anything they do. So, how do they deal with a U.S. dollar that is both Cheap' (to most of the rest of the industrialized world), and 'Weak' when it comes to using them to buy imports – most obviously, oil?



How weak is the dollar? Take a look at the *US Dollar Index* (USDIX), an index of the U.S. dollar relative to a basket of foreign currencies. It is a weighted geometric mean of the dollar's value compared to the euro (EUR), Japanese yen (JPY), Pound sterling (GBP), Canadian dollar (CAD), Swedish krona (SEK) and Swiss franc (CHF). It was started in March 1973, soon after the dismantling of the Bretton Woods system. At that time, the value of the Dollar Index was 100.000 and has since traded as high as the mid-160's and as low as the mid-70's.

As of November 2007, the Dollar Index was trading at the 76-78 level. On March 6, 2008, the index touched 72.89, the lowest since its inception in 1973. This was broken on the 13th of March, 2008 when the index reached 71.578, and again on the 16th of March when it reached 70.698. Some currency traders are speculating that the index could breach the 70 barrier in the very near future.

The euro, for now at least, appears to be the leading contender to usurp the dollar's long reign as the world's reserve currency. Across the globe, everyone from central banks to street vendors happily accepts euros. The euro now dominates the 35-year-old USDIX, accounting for about 57.6 percent of this index's entire weight today! The Japanese yen is a distant second at just 13.6 percent.

U.S. Dollar Exchange Rate				
Month Average				
		Mar'07	Mar'08	YoY
Swiss	frank	1.22	1.01	-16.7%
Israel	shekkel	4.21	3.52	-16.2%
EU	euro	0.76	0.65	-14.5%
Canada	Cdlr	1.17	1.00	-14.5%
Japan	yen	117.40	100.98	-14.0%
Malaysia	ringgit	3.51	3.19	-9.1%
India	rupee	44.00	40.32	-8.4%
Singapore	dollar	1.53	1.39	-9.1%
China	yuen	7.75	7.09	-8.5%
Taiwan	ntdlr	33.07	30.62	-7.4%
UK	pound	0.51	0.50	-2.7%
Korea	won	958.39	981.35	2.4%

Oil in euros is up 276 percent since its lows in early 2002, but in dollars it's up 577 percent. So, about half of oil's total gains are driven by demand and speculation while the other half are dollar-weakness driven.

The second alternate currency is the world's oldest and best, gold. Gold maintains its intrinsic value over centuries regardless of what central banks are doing to debase their own currencies. And, as anyone connected to the semiconductor industry knows, has surged in value recently. Gold is also highly sought-after by the major oil-exporting countries, so they almost certainly monitor oil priced in gold to see what kind of real value they are getting. In gold terms, oil is only up 107 percent since January 2001 – just under one-fifth of USD oil's 577 percent gain.

So, how does this situation affect our (TAP) industry. Not an easy question to answer. The general rule is that a weak dollar – against foreign currencies – means the goods and services that we export go for more dollars while what we import cost more dollars. A decade ago, this would have been a great situation for U.S. TAP companies as almost all of them manufactured their products in the U.S. and had begun to export more and more of those products to Asia and Europe.

However, now almost all of the TAP companies are having their products manufactured (and drop-shipped) from Asia and mainly from China. (Arguably, Flextronics China is rapidly becoming the major worldwide supplier of ATE systems!)

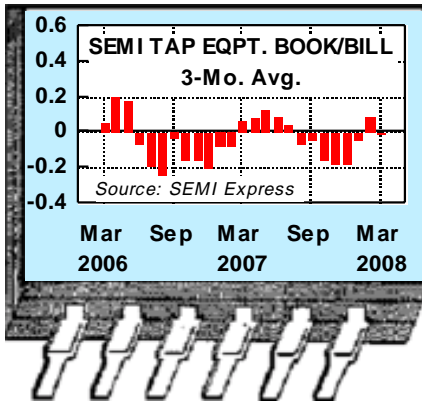
While, there is still some gain to be had by manufacturing in China and its neighboring countries – it does not offer the savings expected when the big move began a few years ago. As the chart at right shows, the Chinese yuan has risen at only about half the rate of the euro against the dol-

lar. Nevertheless, it is up about 8.5 percent YoY – due to its value being controlled by the Chinese government. But in addition, China's inflation rate stayed close to an 11-year high of 8.3 percent last month.

While it's hard to measure the effect all of this on the gains resulting from moving manufacturing offshore – this writer found a comment by Greg Beecher, Teradyne's VP/CFO, during its analyst's call on April 23 interesting. He was asked how the completion of the move of the *UltraFLEX* tester [to Flextronics, China] would affect its gross margin. He responded, "That will get us a little less than one point in gross margin." Beecher, in that same call also commented: "We have no plans to move the [Nextest] *Magnum* offshore. Over some period of time, we'll look to see if that makes sense."

What all this means for the future advantage of TAP manufacturing in China and other Asian countries is anyone's guess. Most TAP companies are now so committed to manufacturing there that it's unlikely to change – unless Flextronics and its competitors decide to relocate their facilities to a 'lower-cost area such as the U.S.'

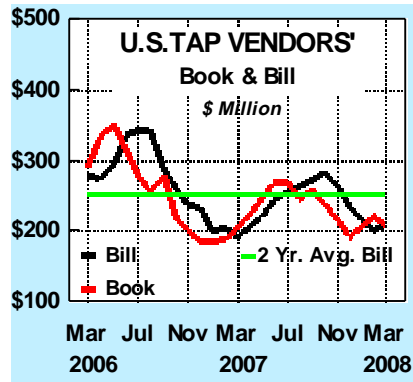
A bit cynical, that's just my opinion.



Mar. TAP B/B at Unity

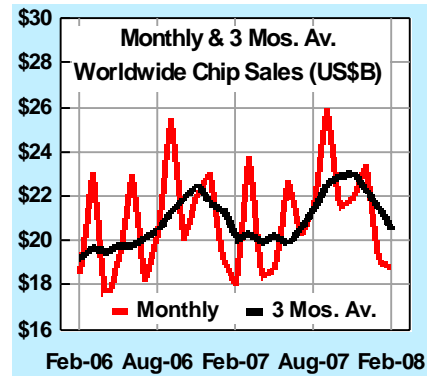
SEMI said No. American chip equipment suppliers reported \$1,157.4 million in (3-month average) bookings for March, down 4.0% MoM and down 18.5% YoY. Total equipment billings were \$1,293.7 million, down 1.3% MoM and down 10 percent YoY. The resulting book-to-bill ratio for all equipment was 0.89.

Front-end equipment net bookings were \$949.0 million in March, down 3.6% MoM and down 21.7% YoY. Front-end equipment billings were \$1,109.1 million, down 2.2% MoM and down 12.8% YoY, resulting in a front-end equipment B/B of 0.88.



TAP (Test, Assembly and Packaging) equipment bookings were \$208.4 million in March down 5.8% from the \$221.3 million reported in February and about flat YoY. TAP equipment March billings were \$201.7 million, down 6 percent MoM but up 4.2 percent from billings of \$193.6 million in March of 2007. The March'08 TAP equipment book-to-bill ratio was about unity (1.00).

U.S. \$Million			
	Feb'08	Mar'08	Mar'07
Book	\$221.3	\$208.4	\$208.0
Bill	\$201.7	\$209.4	\$193.6
B/B	1.10	1.00	1.07



W/O Memory Feb. IC Sales up 10.5% YoY

The SIA reported that actual (not 3-month average) chip sales in February were US\$18.73B up 3.9 percent YoY, but down 2.2 percent MoM. Considering that the floating Chinese New Year holiday took out two weeks of February sales, they were better than many had expected.

If we take memory out of the mix, total IC sales (total semi sales less discretives, optoelectronics and sensors) registered an impressive YoY gain of 13.9 percent, bringing the YTD gain for ICs less memory to 10.5 percent. DRAM unit volume was up nearly 40 percent while DRAM revenues were down over 40 percent YTD due to much lower ASPs.

February 2008 WW Chip Sales

The SIA said February '08 chip sales were \$20.44 billion, down 4.9 percent MoM but up 1.5 percent from February 2007 sales of \$20.14 billion. The sequential decline was "in line with normal seasonal patterns," said the SIA. "Continued price attrition in DRAMs masked underlying strength in global chip sales in February," said SIA president George Scalise. "Excluding memory products, worldwide semiconductor sales grew by nearly 10 percent YoY. DRAM revenues declined by more than 40 percent YoY despite a 43 percent increase in unit shipments. ASPs for DRAMs declined by nearly 60 percent YoY. Total unit shipments for all semiconductor products increased by 11.6 percent YoY, indicating strength in the end markets that drive demand for microchips. "Despite a slowing U.S. economy, markets outside the U.S. continued to show robust growth in demand for electronic products that drive semiconductor sales," Scalise added.

Market	MoM			YoY	
	Jan'08	Feb'08	Change	Feb'07	Change
Americas	\$3.45	\$3.29	-4.6%	\$3.41	-3.5%
Europe	\$3.44	\$3.34	-3.1%	\$3.34	-0.1%
Japan	\$4.10	\$3.99	-2.8%	\$3.68	8.2%
Asia-Pacific	\$10.49	\$9.82	-6.4%	\$9.70	1.2%
World Total	\$21.48	\$20.44	-4.9%	\$20.14	1.5%

	Revenue	Units	ASP
Logic	16.1%	11.1%	4.5%
Analog	2.8%	3.2%	-0.4%
MPU	27.7%	27.2%	0.4%
DRAM	-36.9%	34.1%	-53.0%
MCU	13.7%	16.9%	-2.7%
NAND	27.2%	26.7%	0.4%
DSP	-4.4%	-4.4%	0.0%
NOR	-13.1%	12.8%	-23.0%
SRAM	-13.0%	-4.0%	-9.4%
Total	3.5%	9.2%	-5.3%

Market	Sales	MoM	YoY
Americas	\$2.96	-5.1%	-0.4%
Europe	\$3.21	4.2%	2.8%
Japan	\$3.87	4.8%	9.0%
ROA	\$8.69	-6.1%	3.6%
TOTAL	\$18.73	-2.2%	3.9%

ATE STOCKS

Ticker	Close	Change	52 Week	
	04/30	Month	High	Low
AEHR	\$8.50	0.6%	\$9.50	\$5.41
ATRM	\$3.10	-21.3%	\$6.24	\$3.03
ATE	\$27.49	4.4%	\$45.47	\$19.31
CSCD	\$7.46	-6.5%	\$13.28	\$7.07
COHU	\$17.37	6.9%	\$23.70	\$13.27
CMOS	\$1.04	-38.8%	\$3.99	\$1.04
EGLS	\$1.78	22.8%	\$2.75	\$1.12
EGLT	\$12.07	15.0%	\$17.64	\$9.31
ESIO	\$16.41	-0.4%	\$25.64	\$15.42
FORM	\$19.27	0.9%	\$48.48	\$16.17
INTT	\$1.98	-5.7%	\$4.86	\$1.60
KLIC	\$6.59	37.9%	\$12.46	\$4.55
LTXX	\$2.90	-7.6%	\$6.38	\$2.25
PHTN	\$11.07	4.4%	\$12.46	\$7.71
TER	\$13.29	7.0%	\$18.53	\$8.75
VRGY	\$21.37	13.4%	\$30.25	\$17.04
Av. Change		2.1%		

ATE Sales**LTX**

Said that **DA-Test** has expanded its deployment of LTX's X-Series test platform at its Ottawa, Canada facility. The new tester adds high performance mixed signal and analog test to DA-Test's existing capabilities.

MJC Probe

Said it shipped 41 LED testers in March, and 123 units in the full first quarter. The company projects it claims a 60-70% share in the driver IC market.

Teradyne

Said **Cambridge Silicon Radio** (CSR) of Cambridge, England accepted the 350th shipment of its Gen4 for its installed base of **FLEX** test systems.

Said that **Bosch** will equip their automotive test facilities with its **FLEX** Test Platform for future projects spanning multiple years.

Verigy

Said **ZMD AG** has standardized on the **V93000** Series for wafer sort and final test of its high-end signal conditioning devices and has added incremental V93000 capacity.

Feb. WW Chip Eqpt. Sales up 5.5% YoY

SEMI and the SEAJ reported that global sales of chipmaking equipment grew 5.5% YoY to \$2,817.17 million dollars in February -- rising for the first time in five months. But they added that the growth should be taken as temporary since the downtrend remains intact.

Total chip equipment sales during February were very strong in Korea and No. America, but weaker in Japan and So. Korea compared to the same month last year;

Global Chip Eqpt. Feb. Sales

US\$ Million

Region	Sales	YoY
Taiwan	\$605.55	39.0%
No. America	\$546.2	23.9%
Europe	\$217.12	2.4%
China	\$143.96	7.7%
Japan	\$611.74	-3.9%
So. Korea	523.11	-14.1%
Total	\$2817.17	5.5%

FINANCIAL REPORTS**Advantest Corporation**

FQ4 Ending March 31 : \$000

	2008	2007
Sales	\$311.80	\$576.10
Ops. Pft.	(27.50)	139.80
Net	(31.30)	65.30
Orders	\$339.60	\$584.40
FYr. Ending March 31 : \$000		
	2008	2007
Sales	\$1,598.6	\$2,009.22
Ops. Pft.	198.50	485.63
Net	145.20	304.38
Orders	\$1418.70	\$2,076.76
Aetrium, Inc.		
Q1 Ending June 30 : \$000		
	2008	2007
Sales	\$5,635	\$5,105
Ops. Pft.	298	448
Net	263	544
Per shr.	0.02	0.05

Cascade Microtech, inc.

FQ1 Ending Mar. 30 : \$000

	2008	2007
Sales	\$20,759	\$22,471
Ops. Pft.	(650)	853
Net	\$(16)	\$1,048
Per shr.	0.00	0.09

Cohu, Inc.

FQ1 Ending Mar. 30 : \$000

	2008	2007
Sales	\$58,409	\$53,368
Ops. Pft.	1,952	1,716
Net	1,952	1,691
Per shr.	0.08	0.07

Eagle Test Systems

FQ2 Ending Mar. 30 : \$000

	2008	2007
Sales	\$33,134	\$21,308
Ops. Pft.	8,034	2,012
Net	5,994	1,839
Per shr.	0.26	0.08

FormFactor

FQ1 Ending Mar. 30 : \$000

	2008	2007
Sales	\$65,703	\$102,271
Ops. Pft.	(31,794)	17,253
Net	(17,961)	15,211
Per shr.	(0.37)	0.31

Kulicke & Soffa Industries

FQ1 Ending Mar. 31 : \$000

	2008	2007
Sales	\$176,340	\$142,714
Ops. Pft.	(10,638)	(2,755)
Net	(6,134)	(2,214)
Per shr.	(0.11)	(0.04)

Teradyne, Inc.

FQ1 Ending Mar. 30 : \$000

	2008	2007
Sales	\$297,315	\$253,693
Ops. Pft.	1,385	(18,670)
Net	2,367	(7,636)
Per shr.	0.01	(0.04)
Orders	\$321,055	\$245,975

Q2'08 Financial Repts.

TAP equipment suppliers reported somewhat mixed results for the first calendar quarter of 2008.

Teradyne

Managed to eke out a GAAP profit of \$2.37 million, or \$0.01/share for the quarter, compared to a loss in the previous quarter of \$7.64 million or \$0.04/share. On an operating basis it had non-GAAP income from continuing operations of \$21.8 million or \$0.12/share, up from the previous year's \$9.2 million or \$0.05 /share.

Sales were \$297 million, up 14 percent sequentially, and included \$21 million from Nextest. In the quarter, semiconductor test sales were 83 percent of the total, and the system test group was 17 percent. On a geographic basis, first quarter sales were: Asia, 57 percent, U.S., 20 percent, Japan, 10 percent, Europe, 8 percent, rest of the world, 5 percent. Its B/B for the quarter was 1.06 for semiconductor test, and 0.96 for its system test group. At the end of the quarter, its backlog stood at \$374 million, of which 82 percent is scheduled to ship within the next 6 months.

Bookings for the quarter were \$321 million, up from \$245.98 million in the previous year and included a full quarter of Nextest bookings of \$33 million. While total bookings were up 9 percent sequentially, SoC system orders were up 14 percent QoQ. On a geographic basis, its bookings for the quarter were: Asia, 61 percent; U.S., 18 percent; Europe, 11; Japan, 9; and ROW, 1.

It said orders were led by wireless applications, coupled with strong microcontroller and power management buying. It posted FLEX orders in excess of 120 units and expects to cross the 2,000 unit FLEX system mark and also break through 3,000 units on the J 750 during this year. The company said it had seen strong ordering for its existing wireless solutions on the FLEX and now has over 350 GEN 4 RF systems installed worldwide, and saw added demand for that product in the quarter.

These were driven by cellular transceiver and blue tooth applications. It also said that its new fifth generation offering, the Ultra Wave 12 gigahertz subsystem saw some orders for ultra wide band, higher frequency and higher port count applications.

It reported about a 60/40 split in Specifier (IDMs and Fabless) to OSAT business from a 70/30 split in the previous quarter. OSAT orders were the third highest in the last eight quarters. It also reported strong demand for its (Nextest) Magnum NAND test product from its major Asian customers. It expects to grow the Magnum business by 35 percent plus this year, even though it recognizes that demand in the memory sector is very unpredictable at this juncture. It is counting on about \$25 million a quarter from FLASH memory test by year end, up from about \$18 million a quarter Nextest averaged in 2007.

It expects this growth to largely be accomplished with a new higher-speed version of Magnum - which will open a larger addressable market. Teradyne said this higher-speed version is currently in qualification at several customers, and should start to contribute revenue in the second half of 2008. While about 95 percent of Magnums are now in final test, it expects to extend it to wafer test during this year and into 2009.

It expects sales for the present quarter to be between \$310 million and \$330 million. Earnings/share for the second quarter on a non-GAAP basis are expected to be between \$0.14 and \$0.19 and on a GAAP basis between \$0.07 and \$0.12.

COHU

Reported sales of \$58.4 million for the quarter up from \$57.1 million in the previous quarter and \$53.4 million for the same quarter last year. Test handling equipment accounted for 76.5 percent of the quarter's sales. Net was \$2.0 million, or \$0.08/share compared to \$2.0 million or \$0.09 in the fourth quarter of 2007 and \$1.7 million in the 2007 quarter.

Orders for the first quarter were \$54.6 million compared to \$50.6 million in the previous quarter. Orders for semiconductor equipment increased from \$40.7 million in the fourth quarter of 2007 to \$44.1 million in the first quarter of 2008. Cohu reported a Backlog was \$55.7 million at March 29, 2008 compared to \$59.5 million at December 29, 2007. Cohu expects June quarter sales to be approximately \$50 million.

Cohu announced that it had won a contract 'from a major microprocessor company to develop a new thermal handler provides higher level of parallelism for 'small form-factor' chips for mobile devices [Intel Atom]. It also said it had received the first order for its new *Matrix* handler that provides 32-in-parallel capability for SoC and general purpose logic.

James A. Donahue, president /CEO said, "We were encouraged that orders for our semiconductor equipment increased 8 percent from the fourth quarter of 2007. However, business conditions in the back-end equipment industry remain challenging and we do not expect this to change in the near term."

FormFactor

Was a victim of both the DRAM problems, and its missed execution of its *Harmony* probe cards in the latter part of 2007 resulting in lost market share and a drop in buying by its memory customers. Its DRAM probe card revenues tumbled by 59 percent to just \$38.9 million. Its total revenues for the quarter were \$65.7 million, down 45.5 percent sequentially and 35.8 percent YoY. Its loss for the quarter was \$18.0 million or \$0.37/share compared to net for the same quarter of 2007 of \$14.4 million or \$0.29/share and \$15.2 million or \$0.31/share for the same quarter last year. The company expects its revenues for the present quarter to fall sequentially to between \$40-\$55 million. Dr. Igor Khandros, its chairman/CEO said he expected the DRAM probe card market "will be down 50 percent YoY in 2008."

Adaptive Test Delivers More Than TTR

By John Bearden, Business Development, Optimal Test - Special to FTR.

Until now, many have viewed adaptive testing exclusively in terms of reducing test time. However, the new generation of adaptive testing can deliver much more. Besides reducing test time (TTR), it can significantly enhance quality, reliability and yield learning. Modern testing is not just about assuring coverage to guarantee the chip will perform across the application. Product and process engineers also have test objectives

While test programs can be developed to cover all these requirements, the cost of test becomes a significant percentage of device costs. With traditional testing all chips see the same test program. With adaptive testing each chip sees only what is needed, reducing overall test cost while augmenting reliability and guaranteeing quality. The key: leveraging the data that exists across the enterprise.

Clearly adaptive testing has progressed to using more data, with more automation. The theoretical applications of adaptive testing have grown considerably in recent years with ideas coming from industry and academia. The ability to implement these ideas really comes down to technology. To unleash the power of adaptive testing requires leveraging advances in software tools and networking hardware. It's now feasible to move large volumes of data with high data integrity. Modern data-base management techniques can make accessing this data easier for multiple diverse users. Data-mining techniques turn piles of raw data into valuable information. Enterprise-wide solutions are feasible even for a diverse geographical and business supply chain with near real-time access.

This new enterprise-wide capability has opened the door to the next generation of adaptive testing. Everything that is known about the device, wafer, lot and batch is available to customize the test program.

Data can now be captured anywhere in the design-fab-test world, overlaid and mined for its value content to drive adaptive testing. The key is data feed forward (DFF) and data fed backward (DFB). Data from design models, lithography, defect inspections, in-line/end-of-line tests, historical test results, prior test insertions and ECID database is fed forward. Data can be leveraged wafer to wafer, lot to lot, fab to sort, sort to final test and so on. The goal is to optimize the test content and provide valuable leverage for yield and reliability learning. Automatic changes to the test content may be the number of tests executed, test sequences and/or the test limits on a per die basis and can be executed with little or no modification to the test program, even in high-parallel configurations. DFF can also enable faster measurement searches as well as increase the effectiveness of outlier detection. DFF from prior process steps takes the guess work out of this decision and also allows adaptive data collection, identifying what needs to be collected from which devices.

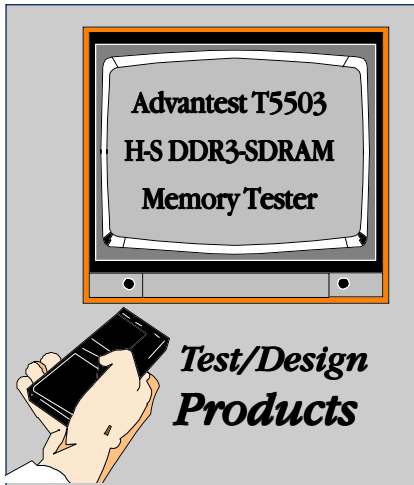
DFF can start with data from the design models along with in-line measurement such as number of via opens, metal/poly shorts and transistor Leff/VT. This provides visibility to the types of failures likely to be seen for a given set of tests, which can be used to modify the test sequence or test content. It may mean that tests are added for some devices, but with the result of improved yield and reliability learning. For instance the data may indicate that additional reliability screens are needed. Test time impact can be minimized by use of adaptive test limits.

Extensive use of adaptive testing requires control and discipline be built into the solution via two important elements: test rules and reference die/units. The rule set contains the criteria for making the dynamic changes to the test program, pre-determined by test engineers, and done with a test rule generator that simplifies the creation of the rules.

And, as well performs simulation of the rules' impact using historical test data. This shows the potential test time reduction, potential impact on yield and reliability, and points to a high level of confidence that the correct modified version of the test program will be automatically executed when the pre-determined criteria is met. A state-of-the-art test management solution incorporates auto-learning and auto-execution. For example, after testing a few lots, an automated test management solution can independently offer either TTR and/or reliability augmentation to be executed based on the test results and other DFF.

Reference die and units are selected as control monitors on every wafer/lot based on their location relative to litho stepping patterns, probe card patterns, etc. and are tested first with the full test program. This maintains the quality assurance of that insertion, provides the opportunity to run additional reliability screens and monitors the health of the test cell. Test results from these reference units can also be used as part of the input for adaptive testing. Exhaustive testing on the reference units is possible to maintain a baseline of test results. This data — critical for yield learning and design modeling — is not compromised by TTR.

The software tools and hardware infrastructure to support adaptive testing are available now and are viable and mature. They are flexible enough to meet the demands of IDMs and Fabless alike and be implemented as modular building blocks to accommodate companies according to where they are on the adaptive testing curve. The key is not to limit enterprise-wide integration with a test management solution that is not extendable across the enterprise. The enabler to possible expansion is the ability to feed data forward and backward, which translates into the most significant gains in test time reduction and accelerating yield and reliability learning — crucial to profitability in a deep sub-micron world.



Advantest announced its new T5503 memory test system targeted at production test of next-generation high-speed DDR3-SDRAM memory. The company claims the T5503 has the highest parallel test capability in the industry of up to 128 devices.

Advantest noted that, "As computers become more and more sophisticated DRAM, used largely as the main memory storage in computers, is continually being replaced with new generations of products that have ever increasing capabilities. The race to achieve higher device speeds and multiple functionality is rapidly advancing in high-performance PCs as the demand for lifelike graphics with audiovisual equipment, including digital TVs and game consoles, continues to escalate.

Consequently, these and other machines are driving a shift toward increased employment of very high-speed memory devices, such as DDR3-SDRAM."

Next-generation DDR3-SDRAM boasts low power consumption through a reduced operating voltage of 1.5V, compared to the DDR2-SDRAM's 1.8V, as well as higher speed and higher volume data processing.

The T5503 enables package test of up to 128 DDR3-SDRAM devices simultaneously. This is double that of the company's previous models, enabling a major reduction in test costs for high volume production lines.

Furthermore, with maximum test speeds of 3.2Gbps and data transmission speeds of over 1Gbps, it is the fastest in the industry, making it an ideal solution for high-volume production testing of DDR3-SDRAM, as well as for GDDR3 and GDDR4.

The tester's semiconductor circuitry makes full use of the latest CMOS technology to achieve greater packaging density, reducing the footprint by approximately 40% over the previous model, and leading to space savings in high-volume production lines. Power consumption has also been reduced by approximately 45 percent compared to the system's predecessor, enabling environmentally friendly operation.

It also features Advantest's proprietary multi-strobe capabilities, introduced in the company's previous model, T5501 and further enhanced in the T5503. Supporting source-synchronous test with the use of multi-strobe technology that measures the phase difference between data output from the device and the reference clock signal at each clock cycle, the system provides high-speed, high-precision test.

Key Specifications

Targeted Devices:
DDR3-SDRAM, GDDR3, GDDR
Parallel Test Capacity:
Up to 128 units
Maximum Test Speed:
3.2Gbps

Delivery:
The T5501 will begin shipping in August 2008.



Advantest T5503 DDR3 Tester

Teradyne's D750Ex LCD Driver Tester

Teradyne announced its *D750Ex* LCD Driver Test System designed for testing high-definition LCD driver devices. The D750Ex system provides a true high density resource per pin architecture that supports over 97 percent parallel test efficiency of the



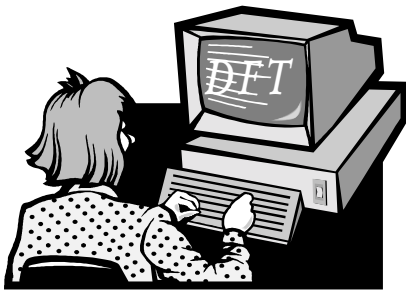
overall program, resulting in faster test time than current solutions by 20 to 60 percent according to the company.

D750EX LCD Driver Tester The D750Ex features both an embedded DSP and central DSP architecture to improve processing throughput. Its zero footprint design takes up 50-85 percent less floor space than competitive systems that use large mainframe cabinets and a test head, Teradyne said.

The D750Ex has a *Universal Slot* architecture, which enables multiple instrument types to be placed in a system depending on the device test needs. A Memory Test Option (MTO) is also available with the D750Ex, requiring no additional slots and can be leveraged to test mobile driver devices in a single pass. On competitive systems, mobile devices must be tested on two platforms, one for LCD and the other for memory. The D750Ex 'any pin' architecture for all channels simplifies probe card design and allows for a more flexible multi-site test development environment.

D750Ex Key Attributes

- Parallelism with up to 32 sites
- True Resource/pin Architecture
- Dual DSPs for Grayscale algorithms
- Compatible with J750 instrumentation
- Zero footprint for Probe
- 50% test floor savings at Final Test
- IG-XL Pure Parallel Software



Syntest Patent on At-Speed Capture for Scan ATPG

Editor's Comment: We found the following interesting, but we are not sure how it impacts the DFT design industry, if at all. If you have an opinion, please forward it to us at: ft@ikonix.com.

SynTest Technologies (Sunnyvale, CA), a supplier of DFT tools, has been granted United States Patent Number 7,260,756 for its invention of *At-Speed capture for testing of delay faults in an integrated circuit containing multiple clock domains in the scan ATPG environment*.

The patent, "covers specific methods and apparatus for providing ordered capture clocks, each running at its intended speed, to detect or locate faults within each clock domain and faults across clock domains in an IC in scan ATPG test mode, where each domain has scan chains.

Dubbed *staggered launch-on-capture* or *staggered double-capture*, the scheme allows designs containing synchronous and asynchronous clock domains to perform at-speed scan ATPG test. A slow Scan-Enable control signal, commonly used for slow-speed test, is also used for at-speed scan testing using this patented invention. Use of this patented invention results in improved productivity and time-to-market (TTM). Since without it, only "one-hot" clock method can be used for at-speed scan testing resulting in significant increase in test time on ATE (proportional to number of clock domains in the design) and subsequent significant increase in overall test cost.

Dr. L. T. Wang, founder, president, CEO of SynTest said, "SynTest's proprietary technology in this patent has been used to our Scan ATPG products offering (*TurboScan* and *VirtualScan*) for many years. Use of this patented invention results in improved productivity and time-to-market (TTM). Since without it, only "one-hot" clock method can be used for at-speed scan testing resulting in significant increase in test application time on ATE (proportional to number of clock domains in the design) and subsequent significant increase in overall test cost."

Wang added, "This patented approach allows our customers improve quality of the devices they produce today in sub-micron technologies containing multiple clock domains each running at very high frequency or At-Speed. ATPG patterns, created using this patented invention, are most compact patterns which results in significant saving in the test application time on ATE.

Application for this patent was made in February 2001, this patent grant after more than 6 years should give DFT community a sense of how fundamental this patent is," he added.

Indian Design Industry to See 22% Growth

According to the *Indian Semiconductor and Embedded Design Service* 2007-08 industry report, the Indian semiconductor design services industry is projected to grow at a compounded annual growth rate (CAGR) of 21.7 percent, to reach \$10.96 billion by 2010, from the present level of \$6 billion. The projections were compiled by the *India Semiconductor Association* (ISA) and International Data Corporation (IDC).

The total chip design services market in India is said to have grown at 21 percent YoY, last year compared to a global growth of 6 percent.

According to Kapil Dev Singh, Country Manager, IDC the impending recession in US and sheer volume of work from US will put pressure on man-month rates and they will increase marginally. Currently there are close to 200 EDA companies active in India.

Last year, the ISA chairman anticipated a 25-35-percent growth in the semiconductor industry since there had been an increasing trend of a brand value for semiconductors within India. This is especially because MNCs are looking at semiconductor-related outsourcing from India. The industry is expected to grow 25-35 percent in 2008.

"Due to the growing expertise and capabilities in complex end-to-end design, strong IP development, and talent, India stands out as a preferential destination for semiconductor and embedded designs," according to the report.

ISA president Poornima Shenoy says that the Indian semicon design industry with over 200 companies is on a strong growth trajectory. India's growth is nearly 22 percent, which is three times the global growth rate of around 7 percent. They are looking eastward for business and collaboration, ushering in a new era in the future of the sector.

However, the Indian design industry has recently begun to feel the heat of US recession and dollar depreciation and the tightening of IT spending by US-based firms. A recent IDC report indicates the Indian design service industry is facing challenges due a depreciating dollar putting pressure on export margins and are requiring very hard bargaining to sustain billing rates.

EDA STOCKS

COMPANY	Ticker	Close 04/30	Change Month	52 Week High	52 Week Low
Cadence	CDNS	\$11.13	4.2%	\$24.90	\$9.89
LogicVision	LGVN	\$1.20	-24.5%	\$3.00	\$1.16
Mentor	MENT	\$10.07	14.0%	\$16.50	\$7.51
Synopsys	SNPS	\$23.11	1.8%	\$29.11	\$21.13
Avg. Change			-1.1%		



Japan Eqpt. March 2008 B/B at 0.73

The SEAJ said Japan-based chip equipment makers posted ¥113,471 million (US\$1,076.36 million) in orders in March 2008 (three-month average). The bookings figure was up 0.9 percent from the final February 2008 level of ¥112,493 million and down 38.2 percent down from the ¥183,640 million in orders posted in March 2007.

The SEAJ' three-month average of worldwide billings in March 2008 were ¥154,842 million (US\$1,468.79 million). The billings figure was up 17.0 percent up from the final February 2008 level of ¥132,322 million, but down 13.2 percent down from the March 2007 billings level of ¥178,292 million.

The SEAJ three-month average book-to-bill ratio for March was 0.73.

In comparison SEMI reported March (three-month average) North American total chip equipment bookings were US\$1,157.4 million and billings were US \$1,293.7 million.

SEMI's three-month average book-to-bill was 0.89.

JAPANESE ATE STOCKS

INDEX	TICKER	Close Change	
		04/30	Month
NIKKEI 225	N225	13,950	11.4%
Advantest	6857	2,855	10.4%
JEM	6855	875	2.2%
MJC	6871	3,750	17.6%
TEL	8035	6,750	11.4%
TSK	7729	2,080	13.7%
Yokogawa	6841	1,131	13.3%
Average Change in April.			11.4%

Difficult Q4 & Fiscal Year for Advantest

Advantest reported QoQ and YoY declines in sales and profits for the periods ended March 31, 2008, as weak chip prices prompted chip-makers to hold back spending on new equipment. In its FQ4 it swung to a loss of ¥3.3 billion (US\$31.3 million) compared with a year-earlier profit of ¥7.8 billion (US\$65.3 million) as its sales tumbled 52 percent YoY to ¥32.9 billion (US\$311.8 million) from ¥68.8 billion in the same quarter last year. Orders for FQ4 were ¥35.8 billion (US\$339.6 million.)

For its full fiscal '07 year it had a net of ¥16.6 billion (\$145.2 million), down 53.4 percent from ¥35.6 billion (US\$304.4 million) a year earlier. Its full year sales tumbled 22 percent to ¥182.77 billion (US\$1,599 million) from ¥235.01 billion (US\$2,009 million) in its previous fiscal year. Orders fell by 33.2 percent from the previous fiscal year to ¥162.2 billion (US\$1,418 million) and its operating income decreased by 60.0 percent from the previous fiscal year to ¥22.7 billion (US\$198.5 million.)

The ratio of its sales in to overseas customers to domestic sales however remained about flat at was 69.3 percent. (See chart below.)

FYr Sales by Region			
Region	US\$M)	YoY.	% Sales
Japan	\$490.1	-23.1%	30.7%
America	\$84.1	-5.3%	5.3%
Europe	\$77.5	-21.2%	4.8%
Korea	\$314.6	-29.7%	19.7%
Taiwan	\$490.9	-11.1%	30.7%
ROA	\$141.4	-39.0%	8.8%
Total	\$1,598.6	-22.2%	100.0%

In the memory test systems segment, it noted that "due to excess supply there was a very substantial decline in the price of both DRAM chip and NAND FLASH chips and chipmakers restrained their capital expenditure for test systems." As a result its sales of memory testers fell by 22.2 percent YoY to ¥92.9 billion (US\$812.5 million).

In the non-memory chip tester market, it said, "Demand for test systems for digital consumer electronic ICs remained strong in the first half of the fiscal year, but was 'restrained in the latter half of the fiscal year. It also said "that although efforts were made to expand sales of its *T2000 Open Architecture Test System*, by attracting new customers in Japan an expected improvement in demand for that system toward the end of the fiscal year failed to materialize, and results remained weak throughout the fiscal year. In addition, test systems for LCD driver ICs were restrained. As a result its sales of non-memory testers fell by 33.6 percent YoY to ¥38.7 billion (US\$336 million.)

Total new orders for test systems were ¥115.7 billion, down 33.9 percent YoY. (Advantest did not break out orders by tester application.)

Due to weaker demand for test systems for memory and non memory testers, sales of its test handlers and interface products were ¥30.3 billion (US\$264.6 million) a decline of 44.9 percent YoY.

Sales of services and support were 19.3 billion (US\$169.2 million) up 5.6 percent YoY, while, orders for this sector were ¥19.3 billion (US\$169.1 million) up 7.3 percent YoY.

Advantest, in an unusual move, did not provide any financial forecasts for future time periods - including the present quarter - as part of its latest report.

Advantest Corporation		
FQ4 Ending March 31 : ¥Billion		
	2008	2007
Sales	¥32.867	¥68.812
Ops. Pft.	(2.900)	16.700
Net	(3.300)	7.800
Orders	¥35.800	¥69.800
FYr. Ending March 31 : ¥Billion		
	2008	2007
Sales	¥182.767	¥235.012
Ops. Pft.	22.700	56.800
Net	16.600	35.600
Orders	¥162.200	¥242.900

Note: See p.5 for this chart in US\$



Many multiple-input multiple-output (MIMO) wireless devices will ramp into high-volume production this year. However, for MIMO technology to become widely accepted by consumers, it will have to cost about the same as present-day wireless technology.

In an article in the April issue of *Test & Measurement World* magazine, Keith Schaub, a product engineer at Advantest America, outlines the need for test-system makers to rein in test costs by developing ATE that can handle MIMO devices in high-volume production.

Today, non-MIMO devices such as multibanded cellphones, with anywhere from two to 10 radios, already ship in volume on ATE. You might ask then, what's so different and challenging about MIMO, when the ATE industry has been testing multiple-radio systems successfully for several years? The answer lies in the fact that MIMO systems use the radios simultaneously to take advantage of the multipath effect, meaning at any given time they all are 'on', either transmitting or receiving, whereas a multi-banded phone has only one radio "on" at any given time.

Therefore, to adequately test MIMO devices, ATE systems need an architecture similar to the MIMO systems themselves. Currently, the industry expects to see up to 4x4 MIMO, which will require the ATE to have four independent transmitters and four independent receivers. This requirement, which will have both business and technical repercussions, is driven by the fact that several key interference signal measurements are performed on radios on ATE systems.

Typically, a desired signal plus one or more interfering signals are simultaneously injected into the device under test (DUT) to determine the receiver's ability to detect the desired signal in the presence of interference, blockers, or jamming signals.

This multi-DUT testing has traditionally been accomplished by the use of a splitter that routes the same input signal to several DUTs at once. Because MIMO takes advantage of the multipath effect, however, this method is insufficient. To assess a DUT receiver's ability to perform as a MIMO system, the ATE will need to inject it with multiple independent signals with different noise, interfering, and channel characteristics. This means simply using a splitter is not enough. Instead, chipmakers will need to use quad-site parallel testing for RF/ wireless chipsets. ATE systems for MIMO devices will need independent vector signal generators (VSGs) and vector signal analyzers (VSAs) as well as multiple and independent digitizers and arbitrary waveform generators (AWGs).

Another challenge facing MIMO test is the amount of data that the test system must handle. MIMO by definition involves considerable digital signal processing. Combining the processing requirements with the need to test multiple MIMO chips in parallel (that is, quad-DUT 4x4 MIMO) leads to a dramatic increase in the amount of test data captured, transferred across the backplane/bus, and processed.

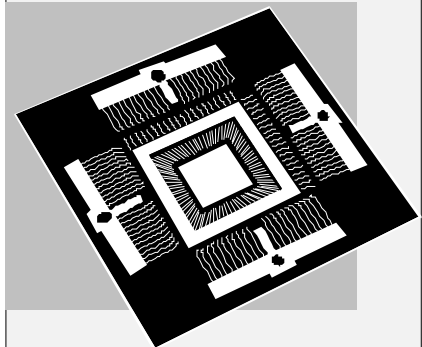
Consequently, meeting the required cost of test (COT) targets can become very difficult. Some vendors have tried to meet this challenge by providing local digital signal processors (DSPs) or field-programmable gate arrays (FPGAs) to reduce the amount of data transferring and reduce the load on the system computer.

While this approach does help to reduce the load on the system backplane (bus) and the system controller, the system controller then becomes the master gatekeeper.

As a result, the master controller, which still must make all of the decisions regarding all of the MIMO sites, ends up becoming the bottleneck. Not only does this negatively impact throughput, but site independence is lost. Fortunately, ATE systems that employ multicore processors can now support independent site controllers; this allows each MIMO site to operate completely independently from the other sites. Effectively, the ATE system behaves as if it were four ATE systems in one, enabling device manufacturers to employ innovative testing strategies that drastically reduce the cost of test. With total independence architected into the ATE, new testing models can be created, which ultimately allow target test costs to be met for both characterization and production.

You can download Keith Schaub's entire article and graphics from: www.tmworld.com/article/CA6545484.html?q=MIMO

ATE/DFT MEETINGS



June 4 - 6

*Global STC Conference
Hilton Hotel Mission Valley
San Diego, CA
<http://www.semitest.org>*

June 8 - 11, 2008

*SW Test Workshop
Paradise Point Resort
San Diego CA
<http://www.swtest.org>*

June 8 - 13, 2008

*Design Automation Conf
Anaheim Convention
Anaheim, CA
<http://www.dac.com>*



INDUSTRY

Gartner-Dataquest once has again lowered its worldwide capital spending forecasts for 2008. The ATE segment's revenue was supposed to decline 8% in 2008. Now it expects ATE sales will fall 13.2%. The packaging and assembly equipment (PAE) segment's revenue was supposed to decline nearly 10% in 2008. Now it expects PAE to fall 18.1%.

Friedman Billings Ramsey analyst **Mehdi Hosseini** however upgraded the chip equipment sector to 'Overweight', saying he thinks sales will improve in the second half of the year, and the stocks are at low prices, raised his ratings for both **Teradyne** and **FormFactor** to 'Outperform'.

iSuppli slashed its forecast for NAND FLASH revenue growth in 2008. It said that due to the worsening consumer spending NAND FLASH revenue is expected to rise just 9% YoY to \$15.2 billion in 2008, compared to its previous forecast of \$17.9 billion which would have represented a 27% YoY growth.

COMPANIES

Advantest America and **Teradyne** both reportedly reduced their US staff by about 10% last month.

GSI Group (Billerica, MA) is also said that it is cutting its U.S. workforce by approximately 10% during the first half of 2008.

Wentworth Laboratories announced the *Pegasus S200A* automatic 200-mm prober for high volume wafer probing of light emitting diodes (LEDs) and discrete devices.

Q-Star Test (Brugge, Belgium) and **Source III** (El Dorado Hills, CA) announced a partnership targeting the automated insertion of *Q-Star Test IXXX* module control using *Source III's VTRAN* tool into test pattern data when starting from ATPG data or translating between ATE formats.

LogicVision said it had selected **Shanghai Youhe Techvision** as the sales and product support representative for its products in China.

Teradyne will present two \$12,500 college scholarships to McGill University in Montreal and Texas A&M University, in College Station, TX., to commemorate the 25th year of the *Teradyne Users Group* technical conference (TUG).

PEOPLE

James Moniz was named as CFO for **Photon Dynamics**. He was previously the finance chief, treasurer and assistant secretary of **Nextest Systems**, recently acquired by Teradyne.

Byron W. Milstead, who has been Sr. VP, General Counsel and Assistant Secretary of **Credence Systems** since Nov. 2000, informed the Company that he intends to resign from his position effective May 13, 2008.

Irv Pfister - who was appointed to the board of **Credence Systems** in mid-December 2007 - is no longer in that position. After the resignations of **Jon D. Tompkins** and **Richard M. Beyer** from the board last month, the number of Directors was reduced from nine to six and Pfister "was not nominated for re-election."

Brennor Brophy has been named president/CEO of **Nanonexus**, replacing **Dr. Wilmer 'Bill' Bottoms** in those positions, who continues as chairman. Brophy had worked at **Cypress Semi** since 1994, most recently as director of Test Engineering for its Data Communications Division.

Ronald Vogel, a 19-year veteran of **LSI**, has joined **FormFactor** as a corporate VP and president/GM of its European operations. He will be based in Munich, Germany.

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