Focus groups analyze design and test integration

"Design for testability is something we've heard about, but we don't do it."
"Test is a production problem, not a design problem."

These are only a sample of the comments recorded at two focus groups on the integration of design and test, commissioned by Prime Data, an independent market research firm, last May.

Two separate focus groups discussed progress toward design and test integration. One group consisted of nine design managers from integrated circuit manufacturing companies; the other of nine printed-circuit board design managers from the computer and communications industries. Each discussion was led by a trained moderator who followed a preplanned format that covered design for testability, relationships between design engineering and production test, and prototype testing.

In general, the discussions indicated that IC designers are more aware of the value of design for testability, simulation, and fault coverage than are board designers. One board designer commented that while he personally recognized the value of design for testability, his colleagues did not, and his company imposed no standards of testability.

Some of the board designers seemed to feel that the CAE industry was directing most of its effort toward IC design, and is largely ignoring the needs of board designers, particularly those who work in the analog area.

But IC designers had complaints, too. One designer said that his simulator told him what fault coverage was provided by a set of vectors, but provided no information about which nodes weren't covered, and did not help in identifying the additional vectors required to raise the coverage.

The discussions indicated that there are differences in the relationships between design and test functions in companies that build ICs and in companies that build boards. In IC companies, designers work closely with test engineers who, in turn, work with production test—consequently, designers are not closely involved with production test. On the other hand, board designers, in at least some companies, work closely with production test.

The need for standards was recognized by both groups. All the designers urged CAE and ATE companies to get together and agree on standards for communications, interfaces, networking, libraries, and symbols used to represent circuit elements on display screens.

The IC group was familiar with the concept of personal prototype testers, but had reservations: the testers would have to be fast and accurate. They tended to agree that it was desirable to offload prototype testing from production test systems. Board designers generally felt that test is a function of production, and the limited tests they perform do not justify a separate system.

A 32-page summary and analysis of the focus group sessions and audio tapes of the four hour discussions are available from Prime Data for $500. For more information, contact Ken Neff, Prime Data, 4030 Moorpark Ave., Ste. 110, San Jose, CA 95117; (408) 249-7111.

Report details CAD/CAM/CAE industry shakeout

The long-predicted shakeout in the CAD/CAM/CAE industry appears to be underway, according to a report published July 5 by Daratech, Inc., a Cambridge, Massachusetts research firm. A decline in revenue growth—industry sales grew 53 percent from 1983 to 1984, but are projected to grow 24 percent from 1984 to 1985—has resulted in more cautious capital spending and a better educated market.

Daratech's 700-page survey, which contains information on 114 vendors and 236 systems, concludes that the survivors of the shakeout will be companies that maintain a technological edge and those with products that can coexist with IBM's mainframe, workstation and network strategies.

Many analysts were stunned by the red ink and declining sales at Compuvision and Calma, two of the industry's leading vendors in 1984. However, the survey indicates that the problems at those two companies are not widespread. Most other leading vendors, including IBM, Intergraph, Applicon, Prime, and Control Data, report that 1985 first-quarter sales either met or exceeded expectations. Indeed, most continue to anticipate healthy, though somewhat smaller, revenue increases in 1985 despite a sluggish economy and a significant move by users toward PC-based systems, the survey found.

The impact of personal computers. Acceptance of PC-based CAD/CAM/CAE products by all market segments has been explosive: Daratech estimates that more than one-third of all stations were PC-based as of March—an estimated 42,000 units.

Daratech says that Autodesk, Inc., of Sausalito, California, currently dominates the PC-based CAD software market. Autodesk reports that it is selling more than 2000 copies of its AutoCAD system per month, claiming a 44 percent share of this market segment.

More than 25 companies now sell PC-based CAD/CAM/CAE software, the survey found, and most major vendors and computer companies intend to follow suit. Many established turnkey vendors appear to be licensing private-label software from companies with a proven product, but building revenues in this market segment has been difficult for these firms because of low unit prices. Also, users apparently prefer to buy PC hardware independently or use computers already purchased for other purposes. The chief beneficiary of this tendency has been IBM: Daratech estimates that in 1984, users spent $360 million for PC-based CAD/CAM/CAE systems—most of it for IBM hardware.
IBM in a commanding lead. IBM is forecast by Daratech to increase its share of the CAD/CAM/CAE market to 23 percent in 1985 on system sales of about $790 million—seven percentage points ahead of Intergraph, its nearest rival. IBM does not disclose CAD/CAM/CAE revenues, but the company does say that 1985 first-quarter sales have been consistent with IBM’s growth plans in the CAD/CAM/CAE sector.

IBM is also believed to be readying a number of single-user CADAM systems based on PCs, and powerful new general-purpose engineering workstations similar to products made by Apollo and Sun Microsystems. The new workstations are rumored to be 32-bit machines in the 1- to 4-MIPS class, with graphics capabilities similar to those available on the IBM Model 5080 graphics terminals. According to industry sources quoted by Daratech, the new workstations will use Unix, and will start at between $15,000 and $40,000.

Intergraph moves into second. Intergraph moved past Computervision in the first quarter of 1985 to become the number two CAD/CAM/CAE vendor in the world. Revenues for the quarter were $109 million, up 38 percent from first quarter 1984, according to the report.

The report attributes Intergraph’s success to its highly rated line of CAD/CAM/CAE systems based on Digital Equipment Corp.’s 32-bit VAX computers and its proprietary dual-screen graphics terminals. Intergraph’s new 1-MIPS engineering workstation, Interpro 32, provides a Unix environment for third-party software, and an MS-DOS capability for IBM-compatible PC applications, the report says.

With Computervision and Calma faltering, Daratech says Intergraph is well positioned to further increase its market share this year. Daratech projects Intergraph 1985 revenues of $550 million, for a growth rate of 36 percent, and a market share of 16 percent.

The slump at Computervision. Computervision, the industry leader in 1984 with sales of $556 million, was forced to lay off about 950 employees worldwide following a 1985 first-quarter loss of $19 million. Revenues for the quarter were $106 million, down 13 percent from the same period last year—and 35 percent below an all-time high in the previous quarter, the survey found.

Computervision’s strategy over the past three years has been to broaden its product offering so as to capitalize on its large customer base. According to Daratech, this strategy worked well in 1983 and 1984, but is now failing because of delays in making system upgrades, delays in bringing new systems to market, incompatibility among overlapping products, and confusion about the company’s products. However, some Computervision products appear to be doing well, the report says, including MEDUSA, a system that competes with CDS 4000, and Personal Designer, an IBM PC-based CAD system for mechanical design.

The survey also found that Computervision lost sales in the electronics market segment to a group of new companies led by Mentor Graphics Corp., Daisy Systems Corp., and Valid Logic Systems Inc., who virtually took over the market in 1983 with a new breed of automated engineering products for electronic design.

However, the report says that Computervision has a chance to reestablish itself in the electronics market with the introduction of a series of integrated systems, all of which will be ready for volume shipment by the end of 1985. These new systems combine CAE functions developed by Metheus-CV, Inc., with physical layout functions taken from Computervision’s traditional technology.

Calma also struggling. Calma Company, General Electric’s CAD/CAM/CAE subsidiary, continues to have problems, with first-quarter performance again failing to meet expectations, according to the report. Calma does not disclose revenues, but Daratech estimates that their 1984 sales grew 16.5 percent to $205 million, giving the company 7.4 percent market share.
According to a company spokesman, Calma is working to upgrade its product line, which the company acknowledges has sometimes been unreliable in the field. Indeed, Daratech reports that the new release of Calma’s popular DDM software is meeting with user approval, and the company’s new GDSII/32 workstations have been well received.

Mentor and Daisy move up. These two firms, along with Valid Logic, in 1984 accounted for 77 percent of the revenue generated in the booming electronic CAE market, according to Daratech. This segment of the market accounted for 10 percent ($280 million) of overall CAD/CAM/CAE sales in 1984, a 180 percent increase over 1983. Daisy, the traditional leader in this field, was passed by Mentor in 1984, the report shows.

McDonnell Douglas holds its own. McDonnell Douglas’ recently renamed subsidiary, Manufacturing and Engineering Industry Systems Co., is challenging Applicon for fifth place in the CAD/CAM/CAE industry. Daratech projects the firm will realize a 35 percent growth in 1985, on sales of $140 million. Improving McDonnell Douglas’ outlook is the agreement signed last December with IBM to market turnkey Unigraphics II systems using IBM Model 4361 mainframe VM/SP operating software, and IBM Model 5080 workstations.

Optimistic forecast from Prime. Prime Computer, Inc. whose 1985 CAD/CAM/CAE revenues are projected by Daratech to reach $130 million, is growing for significant growth in 1985. According to Andrew C. Knowles, vice president in charge of the company’s CAD/CAM business group, Prime’s CAD/CAM/CAE business will grow a whopping 50 percent in 1985, the report says. Knowles said this growth will result from the company’s strength as a systems integrator, and its investment in a worldwide sales and support infrastructure for MEDUSA, the highly regarded CAD/CAM software that it purchased from Computervision last year.

Applicon cuts workforce. Applicon, the Schlumberger Ltd. CAD/CAM subsidiary which has been struggling to reestablish its revenue growth in recent years, laid off 40 people in May, but president Alex N. Beavers remains confident that company revenues will grow 20 percent in 1985, according to the report. Daratech forecasts a 10 percent growth for Applicon in 1985, on sales of $116 million, but those figures do not take into account the recent merger of Applicon with Manufacturing Data Systems, Inc., another Schlumberger subsidiary. The survey found that the new version of BRAVO is beginning to gain broader recognition among users, particularly overseas.

Control Data predicts a strong ’85. Control Data is also predicting a good year in 1985, the report says. Having claimed 3.4 percent of the overall CAD/CAM/CAE market with worldwide sales of $93 million in 1984, the company exceeded its 1985 first-quarter objectives in both revenues and unit sales, the report says.

A one-year subscription to CAD/CAM, CAE: Survey Review and Buyers’ Guide is $368, available from Daratech, Inc., 16 Myrtle Ave., PO Box 410, Cambridge, MA 02238; (617) 354-2339.

The VLSI design revolution

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One of the worst slumps in history has hit the computer and semiconductor industries; employment in these sectors is down by a frightening 27 percent since the beginning of 1985. What puzzles many, however, is the fact that this rapid decline is taking place during a time when the overall economy is relatively healthy, and certainly not in a recession.

As a result, industry observers and analysts are hard at work trying to explain the situation to investors, engineers, politicians, and anyone with a vested interest in high-technology industries. Japanese competition, IBM aggressiveness, the strong dollar’s impact on exports, excess manufacturing capacity, overcrowding of suppliers, a confusing proliferation of new products, overinvestment in the early 1980s, and the inability to manage torrid growth rates are all being put forward as contributing factors.

We would add to this litany a few other factors that are often left unmentioned by the industry and the trade media. During the last few years a number of research organizations made numerous, overly optimistic forecasts of growth in many high-technology sectors. These forecasts were often used as a basis for launching new ventures and products without sufficient analysis of the overall end-user absorption potential. As a result, many companies started up by offering products and services to others within the industry, rather than to end users.

A major restructuring. There is no question that all the above factors are responsible in some degree for the current plight of the semiconductor and computer industries, but we feel that a major restructuring of these industries is also under way.

This restructuring is the result, in large measure, of the rapid development of VLSI devices, increasingly powerful CAE tools to design such complex components, and the ready portability of such advanced technologies. Countries, states, and municipalities are discovering that many technologies are easily transferred. They are scrambling to create local incentives to lure such firms into their localities because it means immediate jobs for workers, but they have not been concerned about who is going to buy the output of their factories.

All this is beginning to happen at a time when the semiconductor industry is undergoing its first VLSI crossover period, switching from the widely used 64K-RAM memory chip to the 256K chip that the Japanese are throwing at the market sooner and at lower prices than anyone expected. Industry analysts estimate that the prices of 256K-RAM chips are declining faster than the 35 percent annual decline experienced for previous generations of memory chips.

But this is only part of the story. The Japanese already control 92 percent of the 256K-RAM market so US, European, and Asian competitors are accelerating their programs to introduce 1M-RAM chips. South Korea’s Samsung Semiconductor, of example, is already advertising 1M-RAM chips for 1986 delivery.

Texas Instruments is expected to beat AT&T by bringing out its 1M-RAM six months earlier than originally planned. As a result, the 256K-RAM chip may have a life cycle of only one year, instead of the usual four years for a new generation of memory chips.

Symptoms of the Osborne syndrome. This means that a massive “Osborne syndrome” is overwhelming the industry, and end users are reluctant to
upgrade their equipment knowing that much more powerful and cost-effective devices and systems are just around the corner. This plays havoc on manufacturers who embarked on upgrading their products based on 256K-DRAM chips, only to realize that their competitors plan to go directly to 1M-DRAM-based products that will clobber them in the marketplace before they even get a chance to recoup their investment.

It now appears that a short-lived VLSI redesign revolution is leading directly into ultra large-scale integration (ULSI) which will include chips in the over-1M category. The initial 1M-DRAM market, valued at about a million dollars in 1986, is expected to skyrocket to about $7 billion by 1992. Some forecasts suggest that by the early 1990s, two-thirds of the overall semiconductor memory market will consist of 1M or larger RAM chips.

As competition intensifies, the 1M-DRAM chip may be superseded by the 4M-DRAM chip by 1990, again earlier than expected. If that happens, 16M products would normally follow about four years later but, given the enhanced CAE development tools based on the more powerful custom-designed chips, these products may also come to the market sooner than expected.

Already, IBM scientists have admitted to making the world's densest IC as part of a program leading toward the development of 16M-DRAM chips. Not to be outdone, Toshiba has made it known that it expects to be producing 64M-DRAM chips by the year 2000; Tokyo University researchers have proposed development of a 100M-DRAM chip. Other sources indicate that gigabit memory chips may be possible before the end of the century.

Clearly, such spectacular developments in memory technology will bring about revolutionary changes in the consumer electronics industry, as well as in industrial and business products.

The VLSI and ULSI revolutions, occurring so closely together in an internationally competitive environment, will create more, rather than less, stability in the electronics industries. Most high-technology market segments that depend on microchips are in line for even more intense, rapid change, and an unprecedented multitude of shakeouts. We are entering an era of survival only of the fastest-moving and best-financed enterprises, operating globally from enclaves of politically supportive, advantageous environments.


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Cooperative ventures abound

During the last few months many new cooperative agreements between companies in the design and test industries have been announced. Some of those that have come to our attention:

- NCR has announced that Manhatton, Skyline, London, will operate as a design center to serve the standard-cell market in the UK and Europe.
- Vector Graphic Systems and FutureNet have an agreement that couples Vector's DNA2000 Electronic Design Automation software with FutureNet's IBM PC-based line of DASH personal workstations.
- An agreement between Analog Design Tools and Apollo will result in ADT's Analog Workbench software running on Apollo's DOMAIN family of 32-bit workstations.
- Altera will purchase FutureNet's DASH engineering workstations to remark as value-added turnkey systems for use with UV-erasable, programmable logic arrays.
- Silicon Design Labs and Tangent System Corp. will jointly develop silicon compiler software products to be marketed by Intergraph. SDL has also announced that its Generator Development Tools will be available on Daisy and Apollo workstations.
- Hitachi has signed a joint development agreement with American Automation for the latter to provide development systems for the support of products which incorporate the Hitachi HD64180 microprocessor.
- Intel and Teradyne have an agreement under which the design databases for 21 Intel VLSI devices will be converted into a format compatible with Teradyne's LASAR Version 6 logic simulator, and will be made available to other companies to use for board-level design verification and test program generation.
- Seattle Silicon has signed agreements that will make the company's Concorde VLSI compiler available on the Tektronix CAE 2000 workstation and on Mentor Graphic's IDEA series of workstations.
- Data General has announced a $2 million investment in Cericor; the availability of Cericor's CDA-5000 design software on Data General's Eclipse workstations; the availability of Viewlogic's Workview software on the Data General One personal computer; and the use of Data General's workstations as the basis for Royal Digital Systems' AutoMate board design system.
- Calma and Integrated Measurement Systems have signed a joint marketing agreement under which Calma will promote the IMS Logic Master series of test and verification systems as an adjunct to its TEGAStation workstations. The two companies will cooperate to maintain system compatibility. Calma has also announced joint marketing agreements with Meta-Software and ZyCAD as a result of which HSPICE from Meta-Software and ZyCAD's simulation engines will be available on TEGAStation workstations.

Henkels anticipates CAE compatibility

Speaking at a corporate luncheon during the Design Automation Conference, Lutz P. Henkels, president of HBB-Softron, identified the trend toward low-cost, front-end engineering workstations functioning in concert with shared central resources as a dominant characteristic of industry today. The use of central resources, when coupled with workstations, could bring the total CAE/CAD/CAT cost-per-engineer to within the $20,000 to $40,000 range, he said.

Shared resources that can easily be integrated into an overall system are critical to achieving this cost, Henkels argued. Such tools as CAD layout, simulators and accelerators, as well as hardware models and multipurpose computers, will be supplied by a variety of vendors in an open-systems approach. No one vendor will be able to supply superior products for all CAE/CAD/CAT needs. Therefore, the market will be open to a broad range of task-specific suppliers.

Henkels sees the need for complete integration as a key factor controlling the diversity of tools and vendors. Since users have already invested heavily in engineering, design, and test products, and are not willing to discard that investment, future products will have to be easily assimilated if their suppliers are to be successful, he said.
**IBM engineers win ITC Best Paper Award**

William McAnney, Paul Bardell, and Ved Gupta, engineers in the Advanced Engineering for Manufacturing group at IBM, Poughkeepsie, New York, have been chosen to receive the Best Paper Award for ITC 1984.

The jointly authored paper entitled "Random Testing for Stuck-at Storage Cells in an Embedded Memory" was presented at the conference by McAnney. A panel of judges from the testing industry and conference attendees chose the paper from the more than 100 papers presented at the conference. The selection was made on the basis of a number of qualities, including technical content and presentation.

Announcing the selection, the judges cited the paper in the following terms: "The paper addresses an area that is recognized as a current problem in VLSI testing and it made a significant contribution to the understanding of this area. The material was well grounded in previous work and proper references were included."

Peter Bronecke, 1984 ITC program chairman, will present the $1000 award and commemorative plaque to the authors during the opening ceremonies of the 1985 ITC on November 19 in Philadelphia, Pennsylvania.

**Young and Shebanow win design contest**

Mark Young of Advanced Micro Devices and Michael Shebanow of Integrated Automation have been selected as winners of Seattle Silicon's Compile-Your-Chip design contest. Runners-up were Ying W. Ng of Triconex, John H. Wharton of Applications Research, and John T. Johl of Hughes Aircraft.

To promote the Concorde VLSI compiler, Seattle Silicon offered IC designers the opportunity to enter a competition for innovative chip designs. The winning entry would be compiled by Concorde and featured at Seattle Silicon's booth at the Design Automation Conference. In addition, the company offered a grand prize of $1000, $10,000 credit towards the purchase of Concorde software, a free trip to the conference, and 10 free working parts.

The winning entries were selected by members of Seattle Silicon's engineering staff and a team of independent experts on the basis of originality and utility, as well as the utilization of Concorde's capabilities. After being selected as the winning entry, the design by Young and Shebanow for a laser printer controller was compiled in two and a half weeks. The two engineers designed their chip specifically for the contest, the result of their mutual interest in laser printers.

**Sentry realigns product divisions**

Sentry has consolidated its analog, digital, memory test, and Computer Integrated Manufacturing Systems divisions into two major product divisions. The new divisions will be known as VHSIC Test Systems, and Production Test Systems.

Under vice president and general manager Michael Hampson, the new VHSIC Test Systems division is responsible for the Sentry 20, 21, and 50 VLSI test systems.

The Production Test Systems division, headed by vice president and general manager Daniel Pujol, is responsible for the company's analog and memory test products, the Sentry 10, and a line of production digital testers slated for introduction at the end of the year.

**IBM engineer patents new testing technique**

IBM engineer Mark McLeod has developed a new technique that is claimed to give a ten-fold improvement in the accuracy of testing delays of VLSI devices. The technique, patented as the "Test Circuit For Turn-on and Turn-off Delay Measurements," solves the problem of knowing-to within picoseconds—the circuit speeds provided by present-day and future technologies.

The measurement technique will be used in the development of ICs that IBM says are the densest and most sophisticated in the industry.
**TI to open new CAD software facility in India**

Texas Instruments has announced plans to open a new CAD software facility in Bangalore, India to develop proprietary software for IC design.

Texas Instruments (India) Private, Ltd., is a wholly-owned subsidiary of TI and will be the firm's first permanent facility in the Asia-Pacific area, according to a spokesperson. The center is scheduled to open in April 1986.

Approximately 50 engineers from the Bangalore area will receive six months of training in the US and England before the new facility opens, said Robert Rozeboom, vice president of the semiconductor group and manager of design automation at TI's Dallas, Texas headquarters.

"This is an extension of our existing design automation software capabilities," Rozeboom noted, referring to two similar TI facilities in the US and in Bedford, England.

The new company represents a $3 million to $5 million investment for TI and will have a satellite receiving station for direct communication with the US and England, he added. All software developed there will be shipped to the US for worldwide distribution to other TI operations; the programs will not be commercially available, according to Rozeboom.

Selection of the Bangalore location, he added, was a "strategic move to establish a Texas Instruments presence in the Asia-Pacific area because of the projected (high) growth rate for the electronics business there through the 1990's."

He also praised the quality of India's educational system in comparison to those in surrounding countries, noting that "the availability of about 20,000 graduates a year in the sciences offers great potential, and many of them are currently underemployed."

Bangalore, located in southern India, is considered by many to be the center of electronics activity in that nation.

**DAC speaker predicts $10 billion market**

Delivering the keynote speech at the Design Automation Conference earlier this year, Stephen Szygenda remarked, "The evolution of this conference is unique in that it closely parallels the DA industry from technical, professional, and commercial standpoints. Just as few of us ever envisioned the conference being this size, we never envisioned the rapid growth of this area as a whole, with estimates of $10 billion by 1990. However, since DA is technology-driven, the viability of DA is a given; but the size of the growth is amazing."

After reviewing the growth of the DA industry from its small beginnings in a few companies and universities, Szygenda said the tone for the conference by saying: "The time is exciting, the opportunities are countless, the failures will be numerous, and the rewards substantial—a perfect environment for inquiring minds and an entrepreneurial spirit."

**Optimum semiconductor evaluation outlined**

A new report argues that the problems and risks of device failure tests run by semiconductor users—recently highlighted by the Department of Defense’s actions over devices supplied by several leading manufacturers—can be minimized by the adoption of practical device evaluation procedures.

Benn Electronics Publications published the report, authored by Product Assessment, a component consultant company. The report warns that even the well-defined approval tests used by many purchasers of semiconductor devices may not be cost-effective. Often, users fail to appreciate that their tests are superfluous compared with the data already available from the device manufacturer. In many instances, users do not realize that the devices they test for approval may bear little resem-

**Sierra offers free training course**

Sierra Semiconductor Corporation is offering a free day of intensive training at the company's new Customer Design Center in San Jose, California. The one-day course offers design engineers hands-on training with the Sierra Custom Design System, which is used to design circuits employing Sierra's Triple Technology that combines analog, digital, and non-volatile memory in the same CMOS device.

The day's session includes time for hands-on laboratory work, professional instruction, and discussion with Sierra's design experts. For information, write to Sierra Semiconductor, 2075 N. Capitol Ave., San Jose, CA 95132; (408) 263-9300.

**Harris offers gallium arsenide fabrication**

Harris Microwave Semiconductor is offering custom fabrication of half-micron, gallium arsenide, custom monolithic microwave integrated circuits (MMICs).

Joseph Barrera, director of gallium arsenide operations, says that Harris' internal experience with MMICs has demonstrated its designs and capabilities to the point of offering these services to others. "The results of our own applications with microwave components and gallium arsenide FET devices gave us the confidence to offer half-micron, custom MMIC fabrication services," he said. Barrera added that Harris has established and verified models for all major circuit elements.

The cost of the standard custom fabrication program is $85,000. Harris will honor the confidentiality of customer designs, and guarantees two DC-qualified wafers that meet process control monitors within 15 weeks after receipt of the customer's CAD implementation. Optional program services include computer-aided simulation of designs, physical layout from customersupplied schematics, CAD implementation of the physical layout, and specialized testing.