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Business Update

by Bob MacKnight, President and CEO

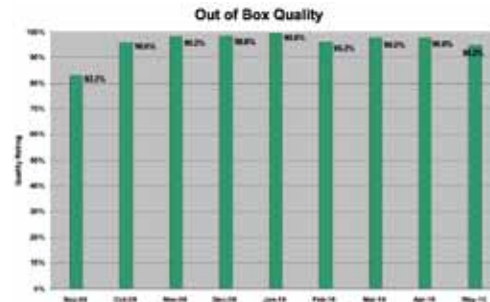
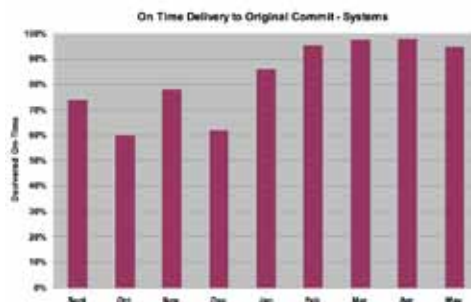
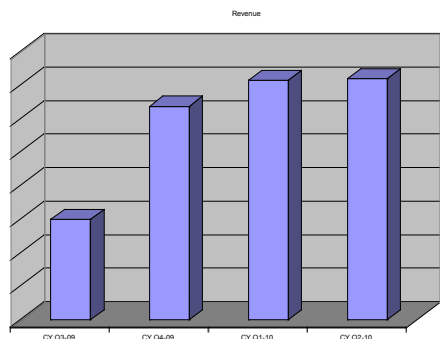
As we head into the summer months of 2010, and quite unlike a year ago, it is a good time to be a participant in the global semiconductor industry. Since coming off its disastrous lows in early 2009, the industry has seen three consecutive quarters of expansion which is expected to continue into 2012. This expansion has been driven by technology node transitions, originally led by the foundry segment, but which have since spread to both DRAM and NAND memory manufacturing. The drive has been from 5X nm to 4X nm at the foundry level, 4X nm to 3X nm in advanced microprocessors and from 4X nm to 3X nm and even to 2X nm at the memory level, with Micron shipping 2X nm memory -- allowing them to claim title to cost leadership.

What has really been driving the industry, however, is the upstream improvement in global economic conditions (save for parts of Europe) with the concurrent strengthening in consumer spending. We are on the cusp of a corporate PC refresh cycle with increasing solid state drive (SSD) proliferation, accelerating smart phone adoption, and displays, televisions and now the new iPad and copycat devices are selling in excess of original forecasts. Devices and capabilities that we couldn't even conceptualize as little as ten years ago are now ubiquitous and indispensable to our daily lives, and all use increasing numbers of integrated circuits.

For the coming quarter, while the industry is digesting the node change activities, we are likely to see a bit of flattening to the growth rate. As we move to the end of calendar 2010, we anticipate reacceleration as spending for new fabs, announced by TSMC, Samsung, Toshiba, Micron and others, begin to take hold.

Crossing Automation has been and is continuing to take full advantage of the positive business climate. Not only did we complete our fiscal year well ahead of plan, but we have started our fiscal 2011 strong by outperforming our targets on revenue, margin, cost containment, and earnings. We have become a financially stable growth company – per plan and commitments.

Although our growth ramp since last September has been steep we have consistently improved our on-time delivery performance on systems and spares to the point where we are consistently and substantively above 90 percent.



(continues on page 5)

Behind the Technology: Wafer Engine™ by Anthony Bonora, VP, Advanced Technology



Automated wafer handling technology began with the use of tweezers and vacuum pencils in the 1970s then moved to O-ring drive systems and other specialized mechanical transfer systems in the early 1980s. The advent of larger diameter wafers, including 150 mm and 200 mm, coupled with the requirements for backside cleanliness, random access

requirements and the advent of the SEMI/MESC standards, resulted in a gradual adoption of the SCARA style folding arm robots in the late 1980s that are still prominent today. The slow adoption of standards and the poor adherence to a wafer transfer plane standard led to a multitude of tool architectures that required diverse and specialized robots with highly customized designs.



In the late 1990s the 300 mm wafer size transition began; this change was accompanied by rigorous new standards for tool loading heights and loadport interfaces for all process and metrology tools in a fab. While these standards narrowed the need for the specialized choices for wafer handling solutions, and in some cases actually reduced tool flexibility and throughput rates, positive benefits included the rapid evolution and adoption of interchangeable front opening unified pod (FOUP) loadports and the adoption of equipment front end modules (EFEMs) and factory automated material handling systems (AMHS) as an industry-wide norm for 300 mm manufacturing. These standards also played an important role for the transition to the AMHS that improved factory scheduling efficiency and removed ergonomic barriers for handling heavier wafer containers.

A fresh examination of wafer handling approaches to optimize EFEM performance was initiated in the early 2000 timeframe. At that time there was significant diversity in new wafer handling requirements, which were challenging to meet with the conventional SCARA robot designs.

These new demands included:

- The ability to perform dual-swap wafer exchanges very rapidly for the higher throughput tools that were coming to market.
- High placement accuracy to minimize the time required for pattern acquisition in certain process and metrology tool applications.
- Flexible and/or extendable horizontal travel to support a growing number of EFEMs utilizing more than three loadports.
- Improved serviceability and access within the EFEM.



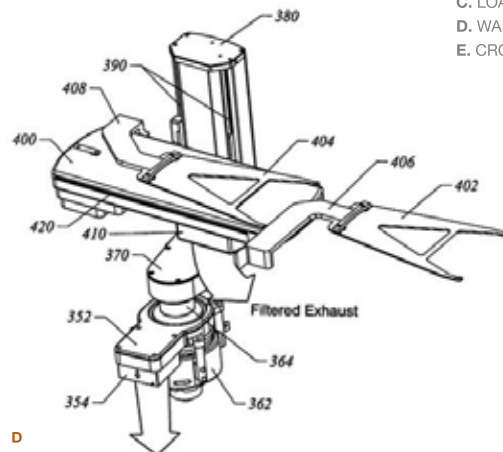
A variety of architectural approaches were analyzed and ranked in terms of their ability to measurably achieve differentiated performance relative to the existing status quo. The Wafer Engine™ approach was selected as offering the most favorable combination of attributes for the anticipated requirements of the next generation of semiconductor processing tools.

The Wafer Engine architecture is decidedly different than conventional SCARA robots in terms of how precision motion profiles are generated and controlled for the different wafer moves that are typically required in EFEMs and Sorters. Key differences include:

- Improved Wafer Exchanges to/from a FOUP
- Improved Airborne Particulate Management
- Extendable Z Travel
- Extendable Horizontal (X) Travel
- Improved Serviceability and Access
- Increased Opportunities for Future Wafer Engine Enhancements

READ COMPLETE WHITE PAPER

- A. O-RING DRIVE SYSTEM
- B. SCARA-STYLE ROBOT
- C. LOADPORT
- D. WAFER ENGINE SCHEMATIC
- E. CROSSING'S WAFER ENGINE



Moving Wafers for Next Generation EFEM Designs: Wafer Engine™ by May Su , VP Product Marketing

As the semiconductor industry continues to drive device performance, there is a need for more testing and monitoring of equipment performance. In the fully automated fab environment, wafer and front-opening unified pod (FOUP) handling have become ever more complex, with the number of test and monitor wafers now rivaling that of production wafers. These trends are leading equipment suppliers to provide more flexibility in their FOUP and wafer handling capabilities.

The standard equipment front end module (EFEM) is usually configured with two or three loadports to support the process tool's nominal throughput. However, the need to manage large numbers of non-production wafers requires more loadports and internal wafer buffering capabilities within the process tool. More buffering in the process tool allows the automated material handling system (AMHS) to operate in a more predictable and efficient manner.

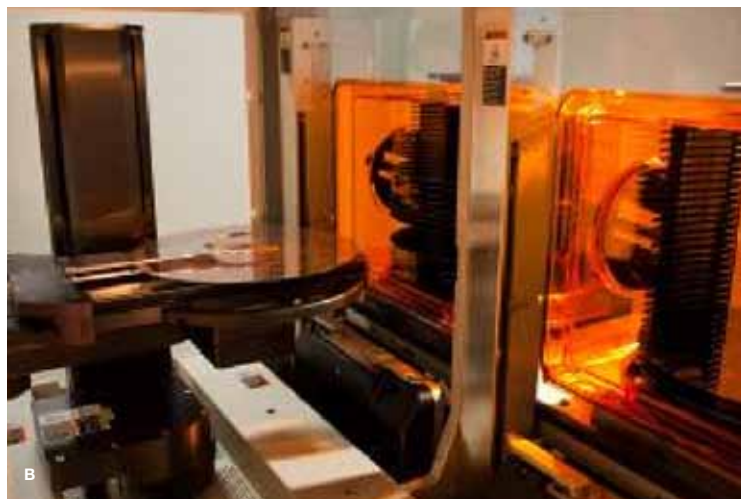
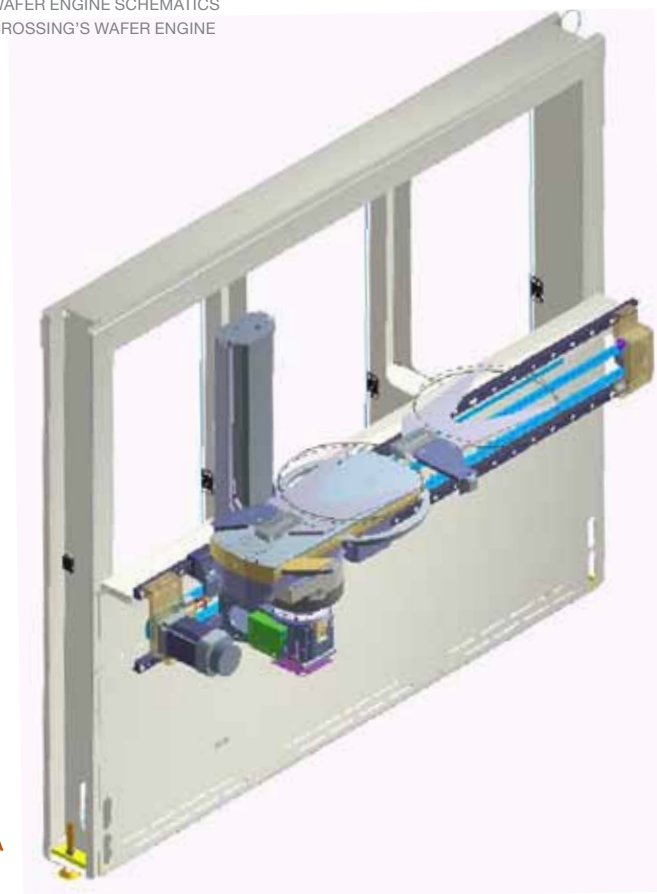
Traditional EFEM designs use selective compliant assembly robot arms (SCARA) or complex linkage robots, however these have extendibility limitations. For instance, across four or more loadports, the linkages must be increased; otherwise an additional track must be added. Longer linkages require a larger turning radius, while the complex compound axes trajectories reduce placement repeatability. Adding a track avoids the longer linkages, but the robot weight can cause vibration and degradation of speed and performance. Furthermore, for internal buffering within an EFEM, the robot may require longer z-ranges. SCARA robots generally need to be twice as long as the z-range due to its telescoping design, which increases both the volume of the mini-environment and makes it difficult to meet the nominal wafer transfer place at 900 mm above the fab floor.

To resolve these issues, Crossing Automation is now offering the heart of its Spartan™ platform, the Wafer Engine™ robot, as a standalone product for EFEM applications. The Wafer Engine is a Cartesian motion robot on a linear rail. Each motion direction in x, z, R1 and R2 (dual end effectors) is independently coupled to separate motion

driver assemblies. The rail is scalable to the width required by the tool maker's application. This is especially attractive when the EFEM must support four or more load ports. Since the Wafer Engine z-mast is above its base only, z-range can also be extended up to 600 mm with no impact to the un-encumbered space to the floor. For tool makers that require internal wafer buffering, the buffer locations may reside above the standard FOUP height for flexible and compact packaging within the EFEM.

In addition to x- and z- extendibility, the Wafer Engine boasts +/- 35um placement accuracy, world-class particles per wafer pass (PWP) performance, and throughput of over 950* wafers per hour (WPH). The Wafer Engine has an installed base of over a thousand units in both Spartan EFEM and sorter configurations.

A. WAFER ENGINE SCHEMATICS
B. CROSSING'S WAFER ENGINE



Contact your account manager for more details.

*950 WPH achieved in a sort application using dual wafer pick and places.

Development Corner: Compact, Cost-Effective Modular Vacuum Platform Design
by Larry Wise, VP Engineering

As the market for integrated vacuum platforms has grown beyond the conventional semiconductor cluster tool, requirements for smaller and lower cost systems have raised the bar for the platform designer. Long process times can significantly undercut the value provided by a one-size-fits-all design and are pushing semiconductor manufacturers to identify alternative approaches.

One such approach is to implement the concept of module re-use and derivative designs that can break through the cost-size barriers. One example of this design (Fig. 1) is built around a standard Shuttle-Lock™ module, which functions as a load-lock as well as a wafer transfer device. A standard BOLTS-compatible loadport, coupled with a compact mini-environment, provides a standard interface to the fab for material movement. An atmospheric aligner provides the required wafer orientation and centering to satisfy any process module requirements. The aligner, loadport, and vacuum transfer elements are all completely standard. Only the packaging is original and supports the existing interface standards prevalent in the industry.

The resulting design (Fig. 2) provides a very compact system (< 0.7 m²) that fully utilizes two process modules running cycle times in the 15-20 minute range. The cost of such a system is easily less than half that of a conventional cluster tool and the software integration can be done in the same manner as any other Crossing platform, leveraging the API interface and device libraries.

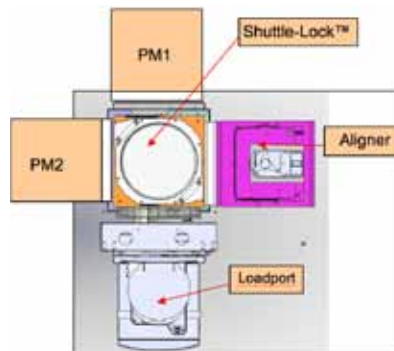


Figure 1: Plan View, Compact Vacuum Platform

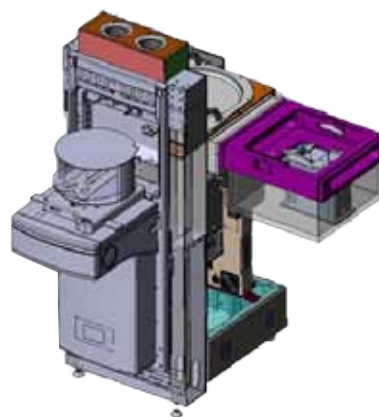


Figure 2: Compact vacuum platform with material interface and alignment

Global Customer Operations: Success Driven by Flexibility
by Randy Clegg, VP Global Customer Operations

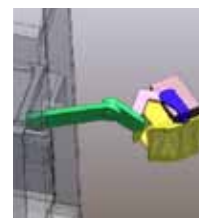
While Crossing's core market remains semiconductor manufacturing, we are seeing critical successes for our technology across multiple new markets where our production proven products and novel automation solutions are winning new customers. Recent sales into the solar and LED lighting markets are allowing us to diversify our product portfolio and highlight the built-in flexibility of our vacuum and atmospheric automation solutions.

One new win was for a new configuration designed for an equipment OEM in the LED market to meet their requirements to handle 4-inch, 6-inch and 8-inch wafers with one device. The beta test is going smoothly with production shipments scheduled for later this year.

We also recently secured a significant order from a tier one PV manufacturer for a data acquisition and substrate management system. Customized for the customer, the system will assist with process optimization and improve product yield. Leveraging our experience in similar semiconductor-related applications allowed us to design a solution within just a few weeks.

In the semiconductor space, we continue to expand our 200 mm presence with new loadport (LPT) solutions. We are also seeing a large number of 200 mm fabs moving towards SMIF technology to achieve a balance between particle performance and cost of ownership. This shift has offered Crossing a significant opportunity as the bulk of the tools in the market are open cassette and do not easily convert to a SMIF configuration, but the inherent flexibility of our platforms allows us to adapt them to the many varieties and styles of tools that exist at our customer sites. We further support this market with solutions that can be retrofitted to existing LPT's and require almost no software integration to install in the tool.

LPT Theta extend move for angled load lock



LPT Extent with X move for narrow Load locks



If you have 200 mm SMIF needs or are facing an automation challenge, you can be confident that Crossing Automation will remain the leader in wafer-level automation. Our ability to deliver production-proven technology with simple design integration ensures that particle and productivity performance is maintained or improved as new technologies are adopted.

Business Update

by Bob MacKnight , President and CEO (continued)

More importantly, our quality performance has remained strong as we ramped capacity and increased our delivery rates.

With the creation of our strategic plan, the focus of our activities is shifting from product to “innovative automation solutions.” This means that we seek to solve our customers’ problems and improve their performance by creatively applying our automation knowledge to their needs. Additionally, while the majority of our revenues still originate within the semiconductor market, we have been pushing aggressively into solar, high brightness LEDs and life sciences.

Most of these efforts are in the development and gestation phase, however, we have secured our first business opportunity within the LED market. This market uses a wide variety of materials, sizes and shapes of substrates which historically required hardware changes to support; by developing a cleverly conceptualized and designed fixture for our MOCA loadport, these hardware changes have been eliminated. This product has been enthusiastically received by a major OEM customer and we are currently manufacturing additional units to meet their delivery requirements.

Another example that validates our approach to market is a new purchase order for a fully integrated platform for a Tier 1 OEM to help them bring to market their most advanced new technology. The platform will integrate our Spartan™ EFEM, Load-Lock and Shuttle-Lock™ modules and tie them together with a jointly implemented control system from Alta Stream. Although the ultimate market acceptance of our customer’s product is presently unknown, the potential is huge and the confidence that this selection demonstrates for our business, our designs and our people is a wonderful affirmation of our company direction.

To conclude, my congratulations to the Crossing Team for their continued high levels of performance and my thanks to our customers around the globe for giving Crossing Automation the opportunity to support the growth of their businesses.

Links Corner

[Artificial Butterfly in Flight and Filmed](#)

[Robotics for Electronics Manufacturing, a new book by Dr. Karl Mathia](#)

[Crossing Automation Names Hakuto Corporation Exclusive Distributor for Japan](#)

[Crossing Automation Names Cecilia Hayes Vice President of Human Resources](#)

[Leading Semiconductor Equipment Manufacturer Selects Crossing Automation’s Spartan EFEM for Second Generation Metrology Tool](#)

[Crossing Automation Receives Four Key Patents for Semiconductor Manufacturing Automation](#)

Special Events Corner

SEMICON West Hospitality Lounge

Tuesday, July 13 & Wednesday, July 14

B Restaurant and Bar

720 Howard Street

Yerba Buena Gardens

(above Moscone North)

[RSVP Here](#)

