

ARC INSIGHT

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Emerging Technology Provides a Backdrop of Innovations at Hanover Fair



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Keywords

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Overview

As ARC Advisory Group witnessed at this year's annual Hanover Fair in Germany, the elements of "Industry 4.0," (the fourth industrial revolution) were most notably manifested in the robotics hall. These elements included embedded intelligence, autonomy, networking, and distributed

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intelligence. Industry 4.0's roadmap is well under way as numerous examples of embedded intelligence pervaded markets that typically, undergo relatively little change, such as forklift trucks. Society's greater acceptance of self-navigating machines in chaotic environments along with a steadily declining cost of technology and sensors will create the perfect storm.

ARC believes that Industry 4.0 will exceed the expectations of industry veterans as a new wave of IT technology will be embedded in the machinery, creating a more robust, self-regulating manufacturing environment.

Catalysts for Mobile Robotics

An increased number of exhibitors at the Hanover Fair filled the robotics hall with mobile technology. Unleashed, unguarded, and free-roaming robots crisscrossed the exhibition. Well-established robotics suppliers such as Adept demonstrated a second generation of mobile technology. Adept's Lynx robots, for example, have already proven their commercial viability in healthcare facilities and semiconductor fabs. Kuka's mobile platform, omniMove, has been integrated with an autonomous navigation system called





**Kuka Mobile Platform “moiros”
Using Autonomous Navigation**

“moiros.” Kuka presented the “moiros” as a concept vehicle targeted for aerospace and wind power production environments. Kuka’s vision of mobile technology is more applicable to agile and flexible manufacturing environments. With a robotic arm mounted on the mobile platform, the work piece can remain stationary while the robotic arm is relocated using an autonomous vehicle. The concept presents a new way to envision discrete manufacturing processes, as production lines for large structures may now involve transporting the robot to the work in process.

These innovations are part of the visionary concepts of Industry 4.0, in which autonomy and distributed computing technologies are now all interconnected.

Mobile technology is clearly beginning to move beyond the early adopter phase after incubating in research labs over the last ten years. The combination of declining prices for sensors, cameras, and control systems; and increased reliability means that manufacturers can now economically justify mobile technology in many applications. The warehousing and logistics industry has been undergoing a quiet transformation as the wire-guided AGV utilized for the last 40 years is now being replaced by AGVs with autonomous navigation systems. Egemin and E&K Automation have been actively promoting the use of laser-guided AGV and fork lift trucks, adopting technology widely used in the mobile robotics market.

Due to concerns over worker safety, the industry is moving slowly toward unmanned vehicles in the warehouse. Historically, the regulatory environment for human safeguarding tends to err on the side of over-caution



An Egemin AGV in Action

when considering the adoption of new technologies. The industrial market experienced this when the safety PLC and safe motion were introduced in the market. Regardless, the AGV/forklift suppliers claim that self-guided vehicles can provide tremendous gains in worker productivity.

Bluebotics and MetraLabs, two relatively small startups in the mobile robotics space, pursued two different strategies. Bluebotics does not intend to offer mobile platforms, but plans to grow its busi-

ness by offering mobile intelligence installable on any mobile platform. In contrast, MetraLabs is developing purpose-built mobile platforms for a variety of applications using its own mobile guidance and navigation systems.

Robotic Assistant Carves a Niche in Staid Market

The market for cage-less robots has been developing over the last year as startups such as Rethink Robots and Universal Robots have created a new category in the burgeoning robotic market. In addition to being able to be deployed without a cage, these systems can be “taught” without programming, even by workers with low skill levels.



**Kuka’s “LBR iiwa”
Lightweight Robot with
Integrated Forces
Sensor in Each Joint**

Kuka’s launch of the LBR iiwa robot at the Hanover Fair signaled the company’s entry into the light assembly market. With torque sensors in every joint, the company claims that LBR iiwa can replicate human touch. According to company representatives, the robot is viable for human-machine collaboration. However, at this time it has not received safety certification for this type of configuration. However, Kuka’s road map for the LBR iiwa makes it the first major robotic supplier to enter this new category of robots. Kuka finished 2012 with its best year ever and the LBR iiwa-class of robot should provide the company with growth opportunities in previously untapped market sectors.

The major robotic suppliers have been seeking diversification outside of the automotive industry and ARC believes that the combination of collaborative and mobile robotics will position the market for a sustained period of growth.

Additive Manufacturing Complements Industry 4.0

By locating the additive manufacturing/3D printing technology suppliers, in the Digital Factory Hall, the event’s organizers helped underscore the importance of digital modeling and CAD/CAM design tools in the additive manufacturing design process. As explained in a recent [ARC Insight](#), digital prototyping – combined with the rapid prototyping capabilities of additive manufacturing – reduces concept design costs, expedites time to market, and enables manufacturers to design products with features not economically feasible with traditional design processes. Moreover, designers now have the ability to actualize complex designs, which previously

could not be achieved due to either cost or productivity limitations in traditional machine tools.

Additive manufacturing had a limited presence at the Hanover Fair. Market leaders 3D Systems and Stratasys were both represented. South Carolina-based 3D Systems by Kisters, its European distributor, and Minnesota-headquartered Stratasys was represented by its EMEA office. Autodesk recently partnered with desktop 3D printer-manufacturer, MakerBot, to market and distribute MakerBot's Replicator 2 printer series in conjunction with Autodesk's 123D software suite ([see related ARC commentary](#)).

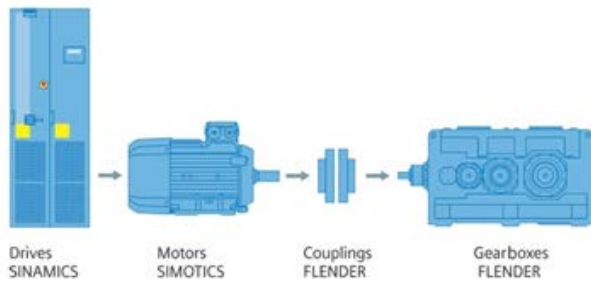
Additive manufacturing complements the vision of Industry 4.0 by enabling increased flexibility in the manufacturing process, both for prototyping and, increasingly, for low-volume production parts.

To promote this collaboration, Autodesk displayed a MakerBot printer in its booth in the Digital Factory Hall.

Additive manufacturing complements the vision of Industry 4.0 by enabling increased flexibility in the manufacturing process, both for prototyping and, increasingly, for low-volume production parts. By integrating product design with product production, manufacturers can expect to reduce costs in the design phase of a product and expedite time to market. Additive manufacturing is part of the integrated product planning and production process envisioned by Industry 4.0 for certain products. Additive manufacturing's inherent benefits for producing smaller batch sizes and ease of customization lines us well with Industry 4.0's vision for streamlining the art-to-part production process.

Streamlining a Staid Business

Siemens recently introduced Integrated Drive Systems (IDS), a completely assembled, pre-integrated drive train package. The company will initially focus IDS on applications requiring drives above 1,000 horsepower, specifically in the three key vertical markets of cement, oil & gas, and mining. From ARC's perspective, IDS is an enabler to the future of more intelligent drive systems that incorporate intelligent condition monitoring and predictive maintenance tools, an integral part of Industry 4.0. Siemens is taking a radical step by streamlining business practices that have been in place for decades to create an opportunity to develop more intelligent drive trains engineered using a systems approach.



Siemens Integrated Drive System Components

IDS brings together the products from Siemens' Industry Automation, Drive Technology, and Flender mechanical drives as an engineered solution that is fully integrated from inverter to coupling. Horizontal integration on the drive train level provides the benefit of a single source for the motor, gear, coupling, inverter, and controls. With IDS, the entire system is purchased from a

single source, eliminating multiple relationships and compromises between vendors to help reduce implementation time and costs.

Recommendations

Based on ARC's take ways from this year's Hanover Fair and our related research and analysis, we recommend the following actions for manufacturers:

- Evaluate your manufacturing organization to determine where you are on the adoption curve for Industry 4.0.
- Robotic mobility will provide a competitive manufacturing advantage in many areas both for replenishment and providing greater utilization of costly capital equipment. Determine a timeline for adopting this technology.
- Additive manufacturing offers the potential to enable manufacturers leapfrog many of the current hurdles in manufacturing operations.

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