



FCA Melfi plant (Italy). 18 Robot Open RoboGate.

Flexible Manufacturing for a Future with Mixed Materials

ComauFlex is more than a flexible production system—it's a modern modular manufacturing strategy

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As automotive manufacturers around the world begin to invest in products and components made with a variety of advanced lightweight materials, the ComauFlex body shop solution—developed and refined over the past decade—has been demonstrating how it can accommodate dissimilar materials while incorporating a wide range of processes. By optimizing the layout of working areas using modular, integrable and inherently flexible systems, this manufacturing approach has proven itself to be a cost-effective solution for the times.

Comau, which is based in Turin, Italy, and has North American offices in Southfield, MI, has more than 40 years of experience providing production systems, including complete body shops. And it believes ComauFlex is much more than a body shop solution, referring to the system as an “advanced manufacturing strategy.”

Built from the ground up to help original equipment manufacturers (OEMs) meet the dynamic changes and demands

in the market, ComauFlex provides solutions required by today's car manufacturers: operational flexibility, minimum facility requirements, high volumes and multiple models, along with the possibility of using advanced material joining technologies. In other words, ComauFlex modernizes the traditional concept of the production factory.

"The ComauFlex philosophy is the culmination of an evolution of assembly processes and components that Comau has developed and refined over the last 10 years," said Ennio Chiatante, Comau Global Solutions Development Product Engineering & Management Director.

Chiatante said ComauFlex provides "extreme operational versatility" to automotive manufacturers in terms of volume, number of models, production logistics management and use of advanced materials, like aluminum and high strength steels. That means the companies that have adopted the system receive "significant savings in terms of time, long-term costs and improvements in operational efficiency," he said.

Benefits of ComauFlex

Developed to streamline the high-speed production of all vehicles, including multimaterial vehicles, the flexible, comprehensive and field-proven system ensures:

- Model flexibility with random build sequencing
- Diverse materials and joining methods
- Volume flexibility
- Improved logistics and reduced traffic flow
- Consolidation of direct labor placement
- Compressed program timing
- Reduced facility footprint

Among the automakers using the ComauFlex system, or its components, include Fiat Chrysler Automobiles (FCA). In one plant, the ComauFlex has enabled Fiat to produce two very different models, the Fiat 500 and Fiat Freemont, on the same lines. Ford Motor Co. also uses the system to

build its new Ford F-150, which has been redesigned to feature a body made primarily of aluminum.

ComauFlex enables Ford to enhance production capabilities, reduce work-in-process, improve material logistics, save energy and minimize the floor space required for Body-in-White (BIW) manufacturing. The system also supports high-speed transfers, high density joining, flexible parts handling, flexible logistics, complete model flexibility and random build sequence manufacturing of up to four unique models.

And Eye on the Future

With a presence in the automotive sector that spans over four decades, and extensive know-how in production systems for the assembly of bodies, subassemblies and complete body shops, Comau has a proven track record of offering versatile and turnkey plants that keep pace with the requirements expressed by the market.

Long before OEMs began working to meet the 2025 standards governing

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CO₂ emissions, Comau was already researching manufacturing solutions that could accommodate a lightweight material mix. “Comau has always focused its development efforts towards the future market trends in the body assembly industry, among them the demand for the highest flexibility in a production plant,” Chiatante explained.

The primary advantage of using advanced materials in vehicle manufacturing is that a reduction in vehicle weight leads to increased vehicle efficiency, which translates to lower emissions. Within BIW, for example, a reduction in vehicle mass of 8–10% can generate tangible savings in fuel economies of around 3–4%.

As today's OEMs begin to look at every process, product and material in the mix, many are starting to integrate multiple materials within the same vehicle, and even within the same body structures. This phenomenon is driven by two main factors. The first is that



Overhead-mounted inverted robots during welding process.


premium lightweight materials are becoming more commonplace, which means they are more readily available. The second, and perhaps more important consideration, is that their prices are starting to drop.

As the materials mix expands to include not only aluminum but magnesium, carbon fiber and reinforced plastics, innovative joining processes are being refined and used to complement traditional joining processes. Over the last several years, in fact, both the production rate and the variety of different joining processes deployed within vehicle manufacturing have significantly increased. In addition, while many of these technologies, such as resistance spot welding, arc stud welding and laser welding, are processes commonly used with steel, they can have different application requirements when utilized with advanced materials.


To support the inherent difficulties associated with a multimaterial approach, and ensure the continued success of its clients, Comau's ComauFlex manufacturing solution can accommodate both new materials and new joining processes/construction types within a streamlined and flexible production solution. In other words, it fully satisfies today's key market driv-

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ers: scalability, model flexibility, adaptability to new processes and optimized logistics.

Restructuring the Bodyshop While Increasing Flexibility

Unlike conventional manufacturing systems with multiple feed points, the ComauFlex philosophy essentially reorganizes production into two distinct areas that are fully interconnected. Within this structure, all materials are kitted and loaded into part carriers at the beginning of the line and then automatically transported through the build sequence with robots removing parts as they are needed within each cell. This eliminates the traditional method of line side supply of parts using forklifts, racks and small part conveyors. With faster part feeding and loading, fewer conveyors and less possibility for breakdowns or part shortages, automotive companies can see tangible improvements in both MTBF (Mean Time Between Failures) and MTTR (Mean Time To Repair).

Comau's restructuring of the traditional bodyshop is not only revolutionary in its design, but also in its vision, as it takes into account the whole factory and not just the single processes.

The advantage of this approach is clear: a better arrangement of the working activities that, subdivided and concentrated in specific areas, reduces operational standby times and also reduces the number of necessary steps to accomplish the complete production course.

Modular Manufacturing Systems

A fundamental part of the ComauFlex manufacturing approach is the main and subassembly lines of the production system—VersaRoll and VersaPallet. Developed by Comau to support its flexible manufacturing philosophy,

both are modular systems that are configured to address the whole production process, redefining the arrangement and structure of all body assembly lines. Both systems assure a fast transfer of material through the line, which reduces

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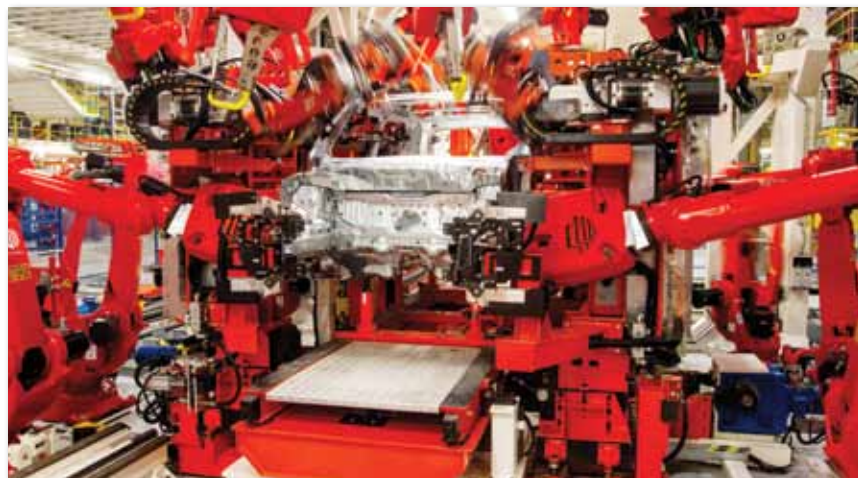
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nonvalue-added time. Thanks to their standardization and modularity, cells can be shipped to the factory completely assembled and tested, facilitating very short installation and launch times.

More specifically, VersaRoll is a closed-loop assembly and joining system that is primarily used for setting the geometry of subassemblies, such as body sides and the chassis. The VersaPallet system, on the other hand, can be defined as a high-performance in-line transfer system used to complete underbody and framing, joining and assembly operations. It is based on a GeoPallet that moves the body through the lines, and is able to replace the fixed underbody tooling required by the various models assembled in the system.



FCA Goiana Plant (Pernambuco - Brazil). Body Framing Process.

Another important part of the ComauFlex approach is the innovative body framing station, called Comau Open RoboGate, which is integrated within the VersaPallet framing line. Open RoboGate is a modular, flexible and expandable system that can be equipped with a maximum of 18 robots and up to six dedicated framing gates. All three systems—VersaRoll, VersaPallet & Open RoboGate—use overhead-mounted inverted robots, allowing production lines to use the highest possible density of robots, thus reducing the overall footprint of the production system and enabling a higher volume of joining operations within each station.

The ComauFlex philosophy is also unique in its construction, given that it is a modular system built around standard products that are combined within an expandable design framework. This means that the production environment can be expanded with reduced risk to existing production and in a limited timeframe. This expansion can be executed by adding additional modules called BRICs (Basic Robot Integrated Configuration) to the same line and relocating the final stations. And because each pre-assembled BRIC cell is ready for installation upon arrival, the line can be expanded in shorter timeframes than with traditional approaches.

Because ComauFlex is able to manage high volumes and multiple models within a compact multifunctional workcell, many of the world's highest volume automotive manufacturers are currently using the ComauFlex system to optimize assembly processes, enhance production capabilities, reduce work-in-progress, improve material logistics, save energy and minimize the floor space required for BIW manufacturing.

“Comau’s goal is to propose innovative and efficient ways to optimize production processes for our customers, while respecting each customer’s unique requirements and expectations. For this reason, we prefer to work together

with our customers to jointly develop the optimum solution which fully satisfies their production and investment requirements,” said Chiatante. “It is not necessary, in fact, to install all three systems considering that they can be used independently.”



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Volvo, for instance, initially purchased a complete VersaPallet line, even though it preferred not to adopt the principle of high-density stations with overhead-mounted inverted robots at the time.

In 2013, the company’s TA3 project was launched when Volvo Cars entrusted Comau with the design, installation and commissioning of several new lines, including a framing line, underbody respot line, roof line, laser line and the deployment of the air recirculation system. Working together in a team that included Volvo and its external partners, the line was built around Comau’s Open RoboGate structure, a modular system that guarantees high repeatability and can handle up to six different models for maximum flexibility and return on investment. The compact and lean architecture enables high-density spotwelding.

Similarly, Jaguar Land Rover adopted the VersaRoll and VersaPallet systems for the production of a new model that will be on the market at the end of 2015, asking Comau to integrate their standard framing station into the new Comau line.

ComauFlex’s operational strategy improves production logistics management and handles advanced joining materials including aluminum, high-strength steels and more. Yet it also ensures advanced operational flexibility. This is because ComauFlex is able to manage both high volumes and multiple models within a compact and complete multifunctional workcell. The results speak for themselves. ↻