The Modular Solution

Modular manufacturing changes the way Tier Ones deal with their suppliers and the OEMs.

by Walter Woods

Remember when there were snap-together model cars? When you could buy classic Chevys and Fords, snap them together and roll them down the driveway?

That's essentially the concept behind a theory of automobile assembly that's come to be called modular manufacturing, and it's quickly and dramatically changing everything about the industry.

Technically, anything that integrates more than one component is a module, including everything from a windshield wiper control to a convertible top to a headliner. But when OEMs and Tier Ones speak of the trend of "modular manufacturing," they mean more unprecedented, complete and complex modules, including full cockpits, front ends and even, perhaps in the not-so-distant future, complete chassis and interiors. Some analysts say the car of the future could be reduced to an assemblage of as few as 20 large modules, with the interior being built from as few as four.

"Modularity is beyond experimental. The OEMs and the large Tier Ones are doing it," says Maureen E. Sobolewski, staff project engineer for General Motors North American Operations Interior Body Center. "For instance, almost all the cockpits now are going in as modules. The question is, 'Are they being built in the assembly plant by the OEM? Or are they being shipped as an independent, stand-alone module from an outside supplier?'"

The original design of Delphi's cockpit module for the Mercedes Benz ML 320 SUV would have required a worker with three hands. Involving Tier Two suppliers in the development changed the design and saved an operator, says Delphi's J. Christopher Duda.

Sobolewski, who works in cockpit engineering, spent part of January and February touring modular assembly plants in Europe, looking for ideas for her program.

Jim Masters, president of the technical division of Lear Corp., Southfield, Mich., says the trend toward modularity has moved faster than Lear anticipated. Most quotes that Lear now gets from the OEMs around the world are for fully modular interior packages.

"We're ready, the Tier Ones are ready and the technology [for modularity] is ready," Masters says. "It's really a matter of the OEMs organizing themselves from a procurement, engineering, assembly standpoint to accept them.

"The OEMs that aren't modular are now moving the module assembly operations in-house so it's kind of a modified modular. They have all the pieces and parts, and they just assemble them into modules on the assembly floor," Sobolewski says. "But the big jump is people doing modules outside of the point of installation."

That's how modular assembly works at DaimlerChrysler's Vance, Ala., ML 320 and ML 430 sport-utility plant. Modules, such as seats (from Johnson Controls) and cockpits (from Delphi), are delivered fully assembled, just in time and just in sequence. Assembly workers install the cockpit, which is made at a Delphi plant about a mile away, in about 30 seconds.

That kind of efficiency is exactly what OEMs want out of modular assembly. All of the major OEMs are smacking at the potential cost savings, says Sandy Munro, president of Munro & Associates Inc., a manufacturing and design consulting firm in Troy, Mich.

A feasibility study Lear did with a North American OEM found that supplying a front row seating module would save the OEM $100 per vehicle, Masters says. "And that's just the seats, that's not looking at the overhead module or IP or the doors or anything, not even the rear row seating," he says.

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Modularity Brazilian style

Modularity not only improves efficiency and the bottom line, it changes the way cars are designed, and how OEMs source their new models. In GM's case, it actually reversed the supply process.

General Motors is hoping cost savings from modularity can help it make money off small cars, which have been a serious drain on the company's profitability. Different estimates put GM's losses at between $1,000 and $2,000 on every small car it sells.

In Brazil, where the small car market was promising before the recent financial crises, GM is planning to build small cars under the tropical code name "Blue Macaw."

Blue Macaw is actually a concept in which small cars are assembled from as few large modules as possible, says Sobolewski. To maximize efficiency, suppliers supply the various modules from separate facilities, which GM calls condominiums, based in the same campus with the OEM. In the future, suppliers, as many as six or seven, may be housed together in a large building (designed without interior walls, in some cases) so they can coordinate the assembly of a single, large module. Lear, for instance, which has a facility at the Blue Macaw campus, gets painted sheet metal from GM, then assembles a door module with Lear parts and sends it back to the main assembly line, Masters says.

The overall campus is operated by GM, which does everything from running the cafeteria to trimming the hedges.

Ford has a similar concept called Project Amazon. Both facilities are in the Rio Grande do Sul province in Southern Brazil near the border with Uruguay and Argentina. Daimler-Chrysler and Volkswagen also have modular assembly plants in Brazil.

Designing the cars for Blue Macaw with an emphasis on modularity reversed the way General Motors typically dealt with its suppliers, Sobolewski says. First, suppliers did most of the design of the various modules. "For us, the big thing was in learning how to deal with the suppliers," she says. "For instance, the cockpit wasn't even a co-design, meaning fifty-fifty. In fact, the suppliers did the bulk of the design."

General Motors sourced the cockpit for Blue Macaw with a very fuzzy concept of what it would look like, Sobolewski says. German-based Mannesmann VDO was selected as the cockpit supplier, and a team of GM and VDO people worked intense, 70- to 80-hour weeks for the first six weeks to hammer out the specifications of the modules. After some specifications had been set, GM and VDO picked the Tier Twos, says Sobolewski.

This was all a big deal for GM, she says. "Typically, we source everything with statements of requirements and subsystem tech specs. Down there, it's something totally different. They call their specs a 'Technical Base,' and it defines how the whole module is going to be executed," she says. "The Technical Base reads something like, 'Part A will be injection molded and painted and vibration welded to part B, which is blow molded and painted, and that makes up the glove box.' It starts off as very, very general, and then it grows in detail," she says. "We generally do it the other way. We specify and then try to source to the specification. With Blue Macaw, the specifications were developed after the sourcing."

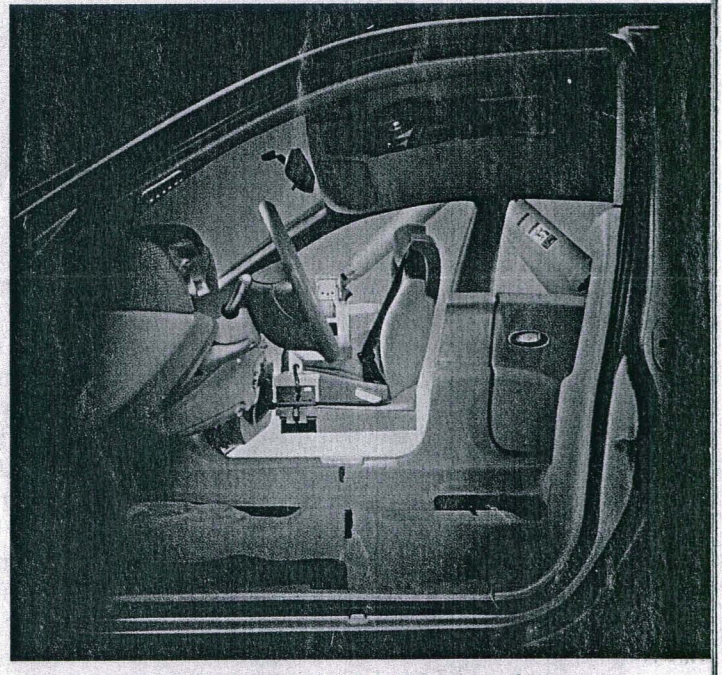
Involving Tier Two

J. Christopher Duda, Delphi's customer manager for Mercedes Benz North America, has a similar story.

Duda was brought to Alabama after Mercedes awarded Delphi a contract in late 1993. Mercedes wanted Delphi to co-design the cockpit for its new luxury SUV and assemble it to be shipped to the Mercedes plant just-in-time.

"In the design phase, we had resident Delphi engineers in the same offices shoulder-to-shoulder with the Mercedes teams in Stuttgart (Germany)," Duda says. "Some were product people, some were assembly people and so on. It was a cross-functional group of folks, but we were considered team members of the Mercedes-led efforts."

Mercedes had a picture of how the module would be structured, but again, much of the design was left up to Delphi, Duda says. "Mercedes had the general idea of what would be attached to the cross-car beam and how the cross-car beam would be attached to the ➥44



Some analysts predict the vehicle of the future may be an assemblage of as few as four interior modules. This front seat module is part of Lear's Revolution seating system, which also includes a rear seating/integrated package tray module.

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body through A-pillars and the fire wall," he says. "Then, with that, the styling was set. Once the styling was set, our role was to really package all that stuff that as an occupant of the vehicle you don't necessarily see — the HVAC, etc."

It was Delphi, Duda says, which brought in the Tier Two suppliers. "When we were building the early prototypes, we had the Tier Two people in our Delphi assembly facility in Germany," he says. "We basically said, 'Watch us build through this and help us with your expertise.'"

That expertise saved Mercedes and Delphi a significant amount of money, Duda says.

"For example, the cross-car beam and HVAC unit, though not particularly heavy, was rather bulky, what we call a two-hand lift," he says. "As we viewed the original design in the prototype build with the Denso (the HVAC supplier) people standing there, we came to realize very quickly that one operator would have both hands engaged in lifting and positioning the HVAC to the cross-car beam. Then he needed to grow a third hand to use the fastener, to drive the fastener from the plastic into the metal.

> "Involving the Tier Twos [in modular design] is essential. It helps with the whole integration strategy because everybody needs to understand what the integration of the components between Tier One and Tier Two is going to be."
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> *— Maureen E. Sobolewski*
> *Staff Project Engineer*
> *General Motors NAO Interior Body Center*

"Not being capable of finding three-handed people, we said, 'Gee guys, if you could just design this little tab in there — for a scarce amount of money!' And from this we saved an operator. That was the kind of interface we might have." ♦

Modularization, or outsourcing?

The OEMs may see a great opportunity for cost savings and efficiencies with modular manufacturing, but at least one important party may prove to be a barrier to modularity, particularly for General Motors.

Early statements from the United Auto Workers have been less than enthusiastic when it comes to modularization. The wire services reported in March that UAW president Stephen Yokich told union members that modular manufacturing was code language for outsourcing. "There's nothing new about modular manufacturing," Yokich said. "It's just another word for outsourcing."

The most important man at General Motors? Gary L. Cowger's negotiations with the union may pave the way for more modular manufacturing at GM, an analyst says.

Outsourcing is a dirty word to the union. It sees it as an OEM strategy to eliminate union jobs and move the work to the suppliers, where workers are paid less and often not represented by unions.

The flash point may be what GM calls "Yellowstone," a plan to build small cars in North America with modular assembly. Yellowstone is the American version of the "Blue Macaw" Brazilian assembly pilot (see "The Modular Solution," Page 40). GM was to break ground on new small car assembly plants using the Yellowstone concept last month, but at press time, labor questions had delayed those projects.

"Yellowstone is the whole idea of trying to build a small car at some degree of profit in North America. We think the only way to do that is to fully utilize modularity," says Maureen E. Sobolewski, staff project engineer, General Motors North American Operations Interior Body Center.

The question for GM is whether the company can do it in its existing plants or whether it is going to have to build new plants. Though the company appears to be leaning toward the latter, it hasn't announced a decision yet and won't till the labor issues are resolved.

In either case, modularity does not necessarily mean the loss of assembly plant jobs. For instance, moving modular assembly, whether seats, cockpit or other interior system, out of the assembly plant often frees up that same area of the plant for something else, such as the expansion for a second line or other new business. Such a strategy can keep workers from being displaced, which industry insiders say should appease the union. One way or another, the plants want additional business.

Though the focus of attention may be on GM at the moment, any unionized North American OEM has to deal with similar labor questions. What is encouraging from the point of view of the U.S. auto industry is that GM and Ford are both talking about modular manufacturing here at home. In GM's case, the company wants to continue to make small cars in North America rather than shift assembly offshore. Still, GM can't ignore the labor issue.

"Labor is a problem for General Motors," says Sandy Munro, president of Munro & Associates Inc., a Troy, Mich., manufacturing and design consulting firm. "And as far as I'm concerned, General Motors' future hinges on Gary Cowger and the relationships between him and the UAW and Steven Yokich."

Cowger was appointed vice president and group executive in charge of GM labor relations in November. He was previously chairman and managing director of Adam Opel, GM's subsidiary in Germany.

"Everything is hinging on those relationships," Munro says. "I don't care what a great idea you've got, if you don't have the union as your new best friend, then you're out of the picture. You're not going to be playing. Period. That's just the way it is.

"I don't think any analyst realizes how important Cowger's position is going to be in making all these Yellowstone-type programs work," Munro says.

"But I can tell you flat, it's not going to work unless Cowger can make things happen. He's the most important guy at General Motors right now." ♦

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