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Knowledge drives the future of vehicle design

The future of the vehicle development process is a key focus area for UGS. Many of our largest customers are global leaders in this arena. Our team is continually pushing the envelope to keep ahead of evolving market conditions with a focus of meeting our customers' business goals today and in the future.

Observing and understanding the requirements and possibilities for tomorrow's vehicles helps set a picture of the challenges ahead. Tomorrow's cars will be safer and more fuel-efficient, while at the same time being constructed with increasing amounts of recyclable material. Greater amounts of electronic content providing sophisticated monitoring of and communication with a vehicle will be the norm, as will the ever-increasing ability to change key features in the vehicle in real time—such as performance, stability, and torque—at the touch of a button. There will be more models to choose from as automakers target increasingly specific consumer niches, including regional requirements as well as stylistic and performance preferences. And it's likely that vehicles of the future won't cost any more, on a relative basis, than those of today.

Automakers will face a number of challenges as they develop these next-generation vehicles. Some are challenges they face already, such as accelerated development schedules, global operations, growing product variation, and ever-increasing quality standards. Other vehicle design challenges are just now

beginning to be addressed, such as requirements for recyclable content and hazardous material tracking, processes for developing and testing mechatronics—the vehicle's interdependent system of increasingly sophisticated electro-mechanical components—and validation strategies for systems that vary the vehicle characteristics instantaneously.

The UGS Global Automotive Center for Excellence has identified certain key capacities automakers need to succeed in the face of these challenges. In addition to effective global collaboration, one of the most important capacities is an overall system-level design approach that enables knowledge re-use. Knowledge re-use implies much more than part re-use, although part re-use is certainly critical to the profitability of a vehicle. Knowledge re-use means capturing the entire intellectual endeavor that goes into producing a new vehicle: all of the testing that goes into meeting quality and safety standards, for instance; the validation of manufacturing processes; even such considerations as choosing the most appropriate suppliers.

Knowledge re-use is important now and will become even more so as cars incorporate more electronic content. Consider a car that lets the driver change the handling from sports-car-like responsiveness to a luxury ride. Every component of this mechatronic system—from the electrical switch to the mechanical moving parts—must be designed, tested,



Concept vehicle architecture



Managing mechatronics

validated, and produced. All of the wiring and connections, as well as the operation of the overall system, must also be designed, tested, and validated, which requires a huge multidisciplinary effort. When knowledge at this level of complexity can't be integrated and captured, the entire effort must be repeated each time that system is incorporated into a new vehicle.

Today, automakers are not capturing as much vehicle development knowledge as they would like. This is understandable. It is difficult to take time out to capture knowledge when a company is racing to meet a constantly accelerating development schedule. In addition, products for capturing and re-using knowledge typically require process changes to optimize their use. As a result, automakers may need to adopt new procedures and revamp organizational structures to meet future vehicle development goals.

In our vision of the future of digital vehicle development, innovation is performed off-line, in advanced vehicle program engineering, research, and manufacturing centers. Then validated knowledge is assembled at the system level into a digital library and made available to future vehicle programs in the form of a concept vehicle architecture (CVA). The CVA is then combined with program-specific inputs, such as cost targets or performance characteristics, to generate a pre-validated, requirements-driven program vehicle architecture (PVA).

The elegance of this approach is that much of what is needed for vehicle development—knowledge of system interdependencies, time frames, cost, supplier information, and so on—is known from the start. Changes can still be made but their consequences are quickly understood through user-friendly computer summary screens known as executive-level dashboards. For example, if a lower price point is desired, an automaker might decide to use press-frame doors instead of roll-frame doors. Every part and process affected by a change in doors can be determined from the interconnections within the program vehicle architecture. This method enables automakers to take the next big step that will enable them to meet the time, cost, quality, and innovation requirements of the future.

Knowledge and innovation are keys to future vehicle development, but only if they can be applied repeatedly and strategically from program to program at the highest quality. We believe a top-down, requirements-driven development process that leverages the knowledge of the organization is the best way for automakers to rapidly develop the variety of new vehicle models they'll need in the future. **aei**