

Ford Invests in Mechatronics

PERSPECTIVE

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IN THIS PERSPECTIVE

This Manufacturing Insights Perspective looks at the challenges of mechatronics design and the significance of a recent worldwide implementation of a mechatronics solution from UGS at Ford Motor Company.

The notion of mechatronics was proposed in 1969 as the synergetic integration of mechanical engineering, electronics, and computational power. Mechatronics, or, as it is sometimes simply referred to, embedded systems design, includes disciplines and practices in intelligent control, motion control, robotics, vibration control, and power electronics as well as system design and system integration. Applications of mechatronics design are standard in many industries, most commonly in automotive, aerospace, medical equipment, and manufacturing machinery.

The automotive industry in particular focuses on enhancing the technology and the capabilities of in-vehicle control systems. Carmakers invest heavily in improving mechatronics, and as much as 90% of future innovation in new vehicle systems will be in in-vehicle software and electronics. By 2010, as embedded systems gradually replace traditional mechanical and electromechanical systems, the ever-growing number of software-embedded control units will represent 35–40% of the value of the average car, and the electronic control module market is expected to grow at a CAGR of 6–8%.

Mechatronics presents a number of new engineering and product development challenges:

- The key disciplines of mechatronics — mechanical engineering, electronics, and software — have very different development life cycles, and synchronizing them is a critical task that many manufacturing organizations are unfamiliar with.
- As suppliers and design partners carry an increasing role in innovation and engineering work, manufacturers must establish new processes to optimize development in different locations and with multiple participants and to ensure system-level interoperability.

- In such a complex and intricate development environment, quality management is difficult. The current practice to develop mechatronics as individual subsystems requires careful attention to system quality and diagnosability, a need that is underscored by the high rate of electronic controllers that are replaced during warranty repair, and more than 80% of them are later diagnosed as "no fault found."
- The current mechatronics engineering practices also have a propensity to develop application-specific controllers, reducing reuse and increasing per-unit cost.

These challenges are not lost on the developers of product life-cycle management (PLM) and CAD tools. On April 25, PLM vendor UGS announced that Ford Motor Company had deployed UGS' in-vehicle software data management solution in 57 vehicle programs worldwide. This solution implementation helps Ford handle the growing volume of embedded software by standardizing the development process and data management throughout its global innovation network and enhancing enterprisewide collaboration across vehicle lines.

Recognizing embedded software as a unique design discipline that must be incorporated into the product design life cycle is key to succeeding in this fast-growing critical vehicle technology. Successful manufacturers will develop better methods and apply advanced tools to synchronize the different life cycles of mechatronics subsystems to improve time to market and system quality and to reduce warranty costs. As manufacturers work to streamline and standardize system decomposition, they will improve modules and subsystems reuse, furthering these benefits, and reduce per-unit costs.

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Related Research

- *Product Life-Cycle and Digital Manufacturing Software — Industry Maturity Study and Lessons Learned* (Manufacturing Insights #MI10171, March 2006)

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