APRIL 2020

The Whole is Greater Than the Sum of its Parts in Automotive Subsystem Design by Engineering Service Providers

Author: Pareekh Jain, Founder and Lead Analyst, EIIRTrend

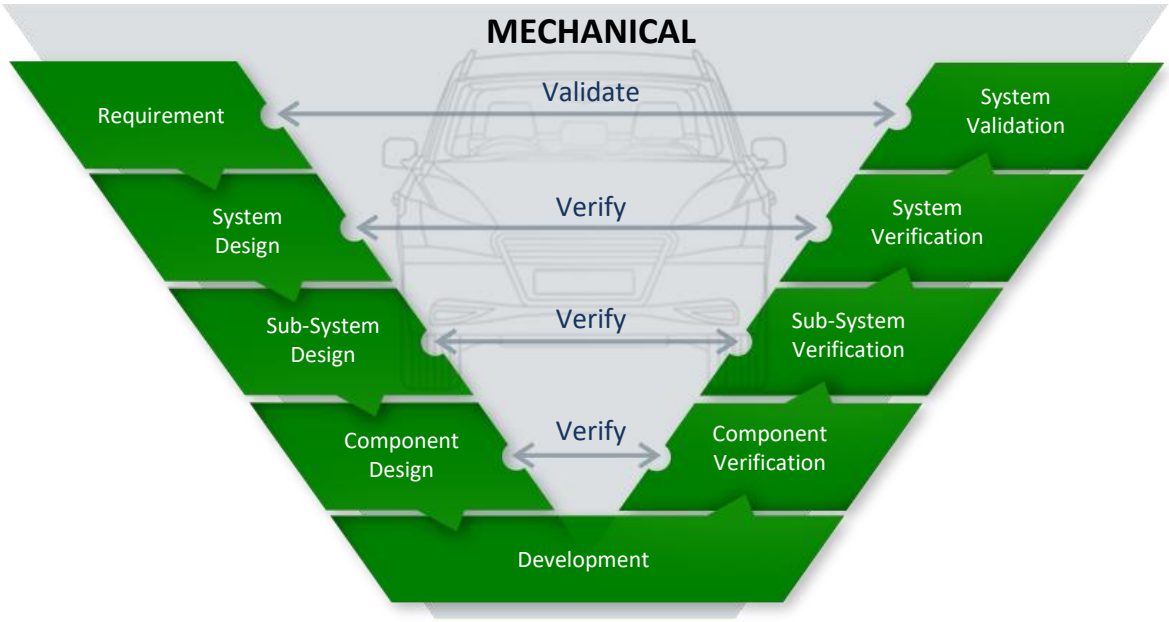
The automotive industry is passing through a disruptive phase. In order to survive, tier-1s need to reduce their legacy engineering R&D costs and increase investment in emerging automotive technologies of electric and autonomous cars. Automotive tier-1s can adopt the strategy of accelerating partnerships with engineering service providers who have subsystem design capabilities. It is thinking and delivering in whole subsystems, which is greater than the sum of its parts or components. This PoV discusses automotive subsystem design by engineering service providers with the examples of ITC Infotech.

Subsystem automotive engineering expertise requires program management in addition to breadth and depth of expertise

A car is a system made up of many subsystems, including engine, seating, braking, transmission, electrical infotainment, lighting, fuel, etc. Each subsystem is made up of numerous components working together. Subsystems are generally designed and manufactured by tier-1 suppliers and then sent to OEMs.

The V model of automotive engineering is explained in the exhibit below. Automotive design and engineering starts from gathering requirements and systems design, moving down to subsystem design and component design, and then all the way up from component verification and subsystem verification to system verification and validation.

Exhibit 1: Automotive Engineering V Model



Source: EIIRTrend, ITC Infotech

Tier-1s need to try many combinations and create many variants because they need to customize for different OEMs. Automotive engineering service providers help automotive tier-1s to design components and subsystems. Both these areas require deep domain and engineering skills, but designing subsystems requires additional capabilities and responsibilities. Subsystem designing and engineering requires:

- **Breadth and depth of expertise.** End-to-end new product development (NPD) capabilities are needed for both component and subsystems. Additional depth is required to analyze and design at the subsystem level, considering the change in behavior of the subsystem due to interactions of different components. Expertise required:
  - Complete NPD design process with functional characteristics
  - Performance analysis capability at the subsystem level
  - Follow-up supplier and manufacturing support in different geographies, including China and India.

ITC Infotech has end-to-end NPD capabilities, offerings, and operational experience necessary for both components and subsystems. It has the breadth and depth of skills and offerings in each of the NPD areas to work at the subsystem level, as shown in the exhibit below.

Exhibit 2: Automotive Subsystem Engineering Offerings by ITC Infotech

Capability	Offering Details
Concept design	• **Market research**: Data collection and analysis of OEMs, volume, platform/program, cost target • **Benchmarking:** Current product portfolio mapping, reliability study on competitor products, review findings, establishing functional goals • **Packaging:** Input data from the customer, packaging studies, proposing the initial concept, reviewing, and securing approval • **Concept approval:** Creation of concepts, brainstorming techniques, functional reliability study, creating decision matrix, concept review and approval
Design and development	• **Concept to DMU:** Creation of 3D models, creation of preliminary BOM, articulation kinematics study, initial hand calculations • **Engineering/tolerance stack-up studies:** Analysis of stack-ups, 2D and 3D stack-ups, position variation analysis for rotating parts, worst-case stack-up analysis, optimizing design • **Finite element analysis:** Analysis of strength and dynamic impacts, optimizing design • **Kinematic/dynamic analysis:** Creating mechanism simulation, using design studies to optimize mechanisms performance, animation of assembly sequences for efficient manufacturing • **Costing:** Detailed costing of components and sub-systems are worked out and is used to select the optimum design • **DFMEA:** Planning the list of failure modes, analysis by providing rankings, prioritization and optimization
Prototype	• **Proto design:** Generation of proto design, initial evaluation, testing proto design, refining and optimizing design • **DFM/DFA:** Optimizing best process and materials, minimizing manufacturing cost, minimizing the number of parts, reducing the number of tools, optimizing for assembly • **3D prints:** Creation of 3D prints, basic fit study, refining design • **Machine-cut samples:** Procuring machine-cut samples from vendors, supporting sample builds, basic functional tests • **Manufacturing drawings:** Generation of manufacturing drawings with all standards, tolerance optimization • **Functional fixtures:** Creating fixture design, 3D models/drawings for fixtures, validating design and function, testing fixtures • **Prototype build and support:** Traveling and supplier coordination in different

	geographies, including India and China
Product support	• **Tooling and fixture designs:** Creation of fixture design • **Supplier evaluations:** Collecting the list of suppliers, analyzing supplier history, validating cost, quality, and timelines, finalizing supplier • **PFEMA:** Analyzing plan layouts • **EOL testing:** Conformance check for customer specs • **Tooling handover:** Freezing process flow and handing over the tooling
Warranty	• **Problem solving:** Issue identification, interim containment actions, analysis of root causes, defining potential solutions, implementing solutions and checking efficiency, 8D analysis • **Temporary containment**: Input data from customer • **Resolution**: Creation of concepts

Source: EIIRTrend, ITC Infotech

- **Program Management.** The technical ability of subsystem design should be coupled with program management capability of the complete subsystem program in alignment with program goals and objectives. These goals and objectives are often related to improvement in quality and optimization of development times and costs. Engineering service providers should offer end-to-end package ownership on subsystems, which will include a robust framework of delivery with metric-based performance measurements, service-level agreements tied to quality and schedule commitments, and flexible resourcing models to handle varying capacity demands. Finally, it should result in business benefits.

  ITC Infotech has delivered program management for subsystem development of a tier-1 seat manufacturer, the details of which are given in the exhibit below.

Exhibit 3: Automotive Subsystem Engineering Engagement by ITC Infotech

Customer: A leading tier-1 seat manufacturer

Solution

- Complete end-to-end NPD engineering solution from concept designing, design and development, prototyping, product support to warranty solutions
- Flexibility in case of sudden change in specs, design change within six months with extensive testing
- Design and prototype support across India and China

Benefit

- Program budget savings up to 25%
- Time to market is reduced by 10%
- Projects delivered with high quality up to 98% FTR
- Flexibility increased by 30%

Source: EIIRTrend, ITC Infotech

Bottom line: To survive disruption, automotive tier-1s should consider engineering service providers with subsystem expertise to expand their design and engineering capability.

The automotive tier-1s can reduce NPD cost and improve velocity by partnering with engineering service providers. Component design and engineering are relatively common, but subsystem design requires additional depth and breadth of expertise along with program management capabilities. Automotive tier-1s should engage with engineering service providers who can provide subsystem expertise. They can test the expertise of these engineering service providers with small projects and then gradually scale up engagement. Auto enterprises cannot avoid disruption, but they can survive and thrive with smart strategies.

About the Author

Pareekh Jain

Pareekh Jain is Founder and Lead Analyst of EIIRTrend and Pareekh Consulting.

EIIRTrend.com is a neutral platform to discover emerging engineering, IoT, Industry 4.0 and R&D (EIIR) trends across 12 industry verticals. Pareekh Consulting is a focused analyst and advisory firm for EIIR.

A seasoned EIIR professional, Pareekh has seen the EIIR industry from four perspectives: service provider, sourcing advisor, enterprise buyer, and industry analyst.

He is regularly quoted in the media on engineering services, IoT, and outsourcing trends, including Harvard Business Review (HBR), NDTV, Times of India, Economic Times, Business Standard, Hindu, Business Line, Livemint, Financial Express, Rediff, Voice of America, and Business Insider.

Pareekh is a thought leader, having authored various publications on topics related to EIIR outsourcing. He loves business fiction writing in his free time, and has authored a novel, Who Is That Lady?

Pareekh received his MBA from the Indian Institute of Management (IIM), Bangalore and his Bachelor of Technology degree from the Indian Institute of Technology (IIT) Delhi.

Pareekh can be reached at pareekh@pareekh.com. Follow him on twitter @pareekhjain.