

Rise of the digital revolution



Times are certainly changing when it comes to the world of transportation. The **introduction of stringent** emission norms and regulations by governmental bodies, has seen an increase in demand for fuel efficient vehicles resulting in a sharp rise in alternative fuel vehicles (AFV's); with varying propulsion technologies being developed from hydrogen, battery to hybrid electric, as well as **solar**.

These disruptive propulsion technologies are having an impact on the way we engineer and companies are making great strides to accommodate the growing need for rapid product development; not only in automotive but also the aerospace and motorsport sectors

In today's digitised world companies face disruption from existing companies as well as new market entrants. The demands on manufacturing and engineering has never been greater. Make it quicker, better, cut costs, be environmentally friendly and of course the customer/consumer wants a personalised product created to meet their specific requirements. Digitalisation is affecting every industry and to survive, manufacturers must rethink every aspect of their business, become a digital enterprise, and take advantage of the new and disruptive technology drivers across each phase of their operation to reduce cycle time, increase yield and create new business opportunities. Maintaining business success in an environment stimulated by disruptive technology and innovative business models is going to be

challenging and businesses need to "Engineer for the Future".

Industry 4.0 heralded the advent of new technologies and processes that could deliver the much needed efficiencies and productivity enhancements to maintain a competitive edge, today we have the unique opportunity to connect each business function within a core technology together with their respective processes and manage them in the real time within platforms, intelligently crafted for each business. Product development will have its processes intuitively managed through real time dashboards and system wide analytics to provide unique insights that will drive greater productivity in areas not traditionally thought of as opportunities for automation. Meanwhile the increasing use of internet enabled sensors will provide all the necessary information required to self-manage and optimise many of the key manufacturing operations and processes.

The Birth of CAD



Johns and Waygood Drawing Office 1956

Historically companies worked in a world of drawing offices with row after row of engineer with pencil and slide rule designing everything from household equipment to industrial machine and vehicles. One of the first recorded applications of PLM was in 1985 by American Motors Corporation who were looking for a way to speed up the product development process of the Jeep Grand Cherokee.

The first step was using CAD tools with the primary objective of increasing the productivity level of the draughtsmen. Accuracy and consistency was enhanced because drawings and documents were stored in a central repository in their database. This in turn facilitated the engineering change process with easy access to correct documentation, allowing quick and effective resolution of design errors.



Modern Day Drawing Office

This novel approach was so effective that when Chrysler purchased American Motors in 1987 they retained it, and this helped to make them the lowest cost American manufacturer in the next decade.

Industry 4.0 and The Multi-Disciplinary Collaboration

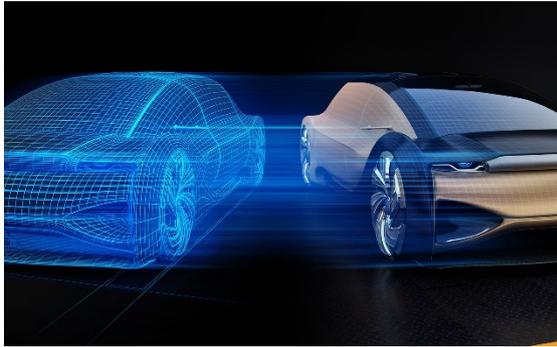
The design of any product calls for a multi-disciplinary approach involving different departments each with their specific expertise. Enabling electrical, structural, software and other disciplines to seamlessly work together on the same data facilitates decision-making and helps avoid errors that can drive costs and project schedules in the red. “The Fourth Industrial Revolution is upon us, where equipment and humans collaborate in real time.

Engineering through innovation

As you innovate new, improved products, your design evolves through a large number of incremental changes. You need to be able to predict how these intended improvements influence real world performance, for better or for worse.

Computer Aided Engineering (CAE)

simulation allows engineers to see into the future, predicting the consequence of any design change on the real- world performance of their products. Deployed effectively, it can be used to improve designs through multiple iterations, providing data to guide the design process from its earliest stages, through to production and beyond.



Engineered Digital Twins Electric Vehicle

Smart Products, Smart Engineering

Next-generation smart products are complex systems within systems making current development processes inadequate. Smart factories with smarter, faster and cheaper robots along with additive manufacturing processes are disrupting factories and transforming the manufacturing industry. This requires a new approach to development – a model-based design and manufacturing approach that creates a digital twin and then connects that detailed digital information with people throughout the organization through a *digital thread*. Digital twins allow global teams across all business disciplines to have the detailed information they need to evaluate opportunities and predict performance.

From Humble Beginnings

Becoming a world leading high performance electric motor technology supplier, is not an easy feat. [Integral Powertrain Ltd](#) (IP) was formed as an engineering consultancy with expertise in CAE by its current four directors when they left Cosworth in 1998. They were using intelligent engineering (IE) principles to meet their business goal of “providing a better customer experience than the

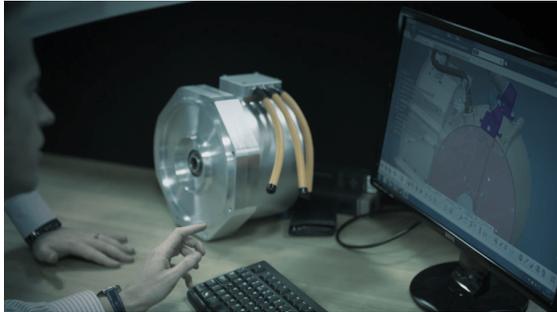
competition.” IP used their expertise as powertrain consulting engineers to implement major CAE upgrades in clients businesses. Their first big job was for Ilmor Engineering [F1] and was the first of a growing succession of contracts.

In those early days the technology and process sides of the IE triangle were being used to create automated design tools that enabled engineers to create high confidence concept solutions to meet client requirements in remarkably quick times. As the CAE capabilities increased, IP had a growing competitive advantage as real users of Intelligent Engineering systems and formed Intrinsic (now [Technia UK](#)) to focus on this. Early success with the latest 3D design technologies from Dassault Systèmes, and their own best practice processes, combined with bright and innovative engineers, caught [Dassault Systèmes](#)’ attention. They became the go to authority for the DS [3DEXPERIENCE](#) Platform. Intrinsic was acquired by [Addnode Group](#) in 2017.

Engineering at the Heart

Today IP has engineering at the heart of the organisation and business processes. The appetite for applying intelligent engineering processes remains very strong today. Their award winning e-Drive division fully utilise the [3DEXPERIENCE](#) platform from Dassault Systems to design, validate and manufacture their unique high performance, record breaking electric motors and inverters ensuring minimal non-recurring engineering and high manufacturing efficiency. Their ability to expand the number of concurrent programmes whilst delivering in

accelerated times wrapped up with world leading technologies has made them very popular with everybody except their competition!



Engineering is at the heart of Integral Powertrain

The underlying concept is what they call “Core Technology Bespoke Product” (CTB) within which they develop a number of core technologies that can be described at rule level and are highly scalable. The CTB concept starts with a bit of a sales and marketing challenge to engage potential customers but once IP are sat with clients they can develop very rapidly an outline solution using an in-house-developed linear design tool which calculates a range of performance and system attributes from fundamental high-level motor parameter inputs. This allows clients to explore with us the art of the possible in real time and focus in on what will be optimal. This is a form of co-engineering, but with suitable interfaces this tool also allows a number of streamlined processes to begin -

- Relevant sections of the specification document are populated to underpin a proposal (mechanical, life, electrical, electronic, software)
- Preliminary BoM, BoP and tooling requirements are generated allowing

estimation of design resources and cost

- A validation plan is generated communicating with development and allowing resource planning, speeding up the task of making a proposal, minimising exposure to any mismatch between what is being promised versus what the client expects
- Above all it allows the organisation to prepare to deliver.

This approach is extremely compatible with quality requirements and the driving of continuous improvement. The focus on core technologies drives a common language and this parametric, scalable approach is now also increasingly applied to documentation, tests and analysis tasks.

By taking this well engineered process you will find Integral Powertrain working with clients such as Aston Martin on the upcoming All-Electric Rapide E, the Valkyrie and Volkswagen Motorsport on their record breaking ID R All-Electric race car. Recently IP announced their collaboration with Triumph Motorcycles to develop an electric motorbike capability.

Integral Powertrain's team of engineers have a wealth of experience in the automotive, motorsport and aerospace sectors and develop, validate and manufacture world leading [electric motors and inverters](#). Designed to perfectly match client specifications these products have broken records and won many awards. To learn more take a tour of their [website](#) or call 01908 278600 to discuss your requirements with one of the Engineering Team.