



get it right®



VIRTUAL PRODUCT ENGINEERING  
SOFTWARE & SERVICES

# Accelerating industrial innovation with Virtual Product Engineering

Current global economical issues bring along tough competitive challenges for the Industry, calling for immediate innovative answers. For ESI and for its customers, this reveals more than ever the evident need for **Virtual Product Engineering**.

**With Virtual Product Engineering, manufacturing industries prepare themselves to face the greatest industrial challenge: to deliver innovative products at lower cost, faster, and with increased reliability.**

**Specific requirements include:**

- ✓ Identifying safety and performance issues early in the design cycle;
- ✓ Assessing how new materials and manufacturing methods will impact product performance and integrity;
- ✓ Implementing best practices that assure an optimum maintenance cycle and cost;
- ✓ And predicting equipment performance under extreme conditions, therefore planning actions that will reduce downtime and repair costs.

ESI aims to give customers across many industry sectors the ability to virtually manufacture and assemble, part by part, complete and physically realistic virtual products that can be tested under normal and exceptional operating conditions. ESI customers can thereby expose practical issues related to manufacture, assembly and coupling between different product attributes and performance domains – and this, long before physical prototypes can be tested.

Virtual Product Engineering delivers key information for design iterations that also helps prepare physical testing in the best possible way – up to pre-certification or in some cases, entirely eliminating the need for physical tests until final validation.

Moreover, recent immersive and interactive 3D technologies now offer real time visualization of Virtual Prototypes. Using Virtual Reality systems such as ESI's IC.IDO solutions, industrial organizations can now bring their product to life long before it even exists in real sense and without requiring a physical prototype. This revolutionary technology enables collective, concurrent decision-making (cross-functional, cross-sites and cross-physics) at each and every significant stage of the design process.

**In a word, Virtual Product Engineering enables ESI's customers to get their product right: robust, innovative, for the right cost and at the right time.**

## Company Profile

ESI is a pioneer and world-leading solution provider in virtual prototyping for manufacturing industries that takes into account the physics of materials.

ESI has developed an extensive suite of coherent, industry-oriented software applications to realistically simulate a product's behavior during testing, to adjust manufacturing processes in accordance with desired product performance, and to evaluate the environment's impact on performance.

ESI's solutions fit into a single collaborative and open environment for End-to-End Virtual Prototyping, thus eliminating the need for physical prototypes during product development.

The company employs about 850 high-level specialists worldwide covering more than 30 countries.

ESI Group is listed in compartment C of NYSE Euronext Paris.



**Alain de ROUVRAY,**  
Chairman & CEO

## Acquisitions

### Acquisition of IC.IDO, the leading European vendor of immersive 3D solutions



IC.IDO (“I see, I do”) specializes in the development of collaborative decision making solutions that primarily serve industries manufacturing complex products across multiple sites. IC.IDO’s Virtual Reality technologies enable customers to clearly present, manipulate in real time and exchange product information virtually in order to resolve manufacturing and serviceability issues in an immersive and distributed environment.

### Acquisition of Efield, specialist in electromagnetic virtual simulation solutions



Founded in 2006, Efield developed a set of solutions for virtual simulation of electromagnetic emissions of electric or electronic installations or devices, with the objective of assessing electromagnetic interference or disruption. These solutions, originally aimed at the aeronautic and defense sectors, are quickly becoming essential for the increasing proportion of manufactured products that incorporate mechatronics or electronic components.

## Partnerships

### The China Aviation Industry Corporation (AVIC) signs a 5-year strategic cooperation agreement with ESI



AVIC is an ultra large state-owned enterprise and an investment institution, authorized and managed by the Central People’s Government. ESI has signed a 5-year strategic R&D cooperation agreement with BIAM, the Beijing Institute

of Aeronautical Materials of AVIC. The mutual agreement entails a very close collaboration between BIAM and ESI, sharing expertise in complementary technologies and with the objective of creating a common research team operating as the Joint Research Center for Digital Technology of Aeronautical Materials.

### ESI announces a pilot version of its Adjoint Solver for design optimization



The pilot version of ESI’s Adjoint Optimization Solver was developed over the past 2 years thanks to a close collaboration between ESI and Intel. Adjoint-based optimization methods benefit customers across a wide range of industry sectors, and for instance help reduce vehicle drag.

*“Intel was delighted to help ESI build their advanced solver with the Intel Fortran Compiler. This is a nice illustration of benefits of Intel’s long-standing enabling engagement in code optimization with ESI. This collaboration gave ESI the added performance they wanted and helped improve the Intel compiler for all customers”,* says **Laurent Duhem**, Software Application Engineer at Intel.

## Awards

### ESI is awarded “Innovation” trophy by Ernst & Young and Syntec Numérique



ESI was granted the “Innovation” trophy in September 2011 during the first presentation of the “Top 250 software creators in France” by Ernst & Young and Syntec Numérique, the French Professional Chamber for Digital Trades. Counting over 1100 member companies, including 550 software editors, Syntec Numérique has mustered its best expertise in order to publish a ranking that could provide the most objective vision of the current French software market.

# Filling gaps in Virtual Product Engineering with ESI's end-to-end approach

**Prototyping** is essential to traditional product development processes. Organizations build and test hardware prototypes to evaluate design effectiveness and assess potential improvements on a trial and error basis.

**Computer simulation** helps reduce time and cost incurred in producing and testing real prototypes; offering the alternative to anticipate test results, and thus cutting the number of real tests needed.

However, once a real prototype is produced, it is still customary and prudent to **calibrate** the simulation model to match the actual test results, in order to build confidence in the simulation models.

While the above traditional methodology does deliver concrete gains, it has some inherent **risks and gaps**:

- Coupling effects between design disciplines and regulatory domains are unclear;
- Consequences of manufacturing process and resulting defects in product parts – also in assemblies – are unknown;
- Calibration is often global, late, and ad hoc on prototypes that do not represent the actual product, since manufacturing steps are not taken into account;
- Innovations may be unduly rejected due to unmanageable complexity.

In contrast, ESI's Virtual Product Engineering provides a rational and effective end-to-end answer to these fundamental concerns by placing Virtual Manufacturing and Virtual Reality at the core of a comprehensive design methodology for building reliable models:

- **Step by step**, virtually fabricate, control and assemble product parts and components;
- **Evaluate multi-domain performance** virtually, and progressively optimize;
- **Build cause and effects relationships** between design and fabrication parameters: **end-to-end** from part to component to system, and perform intelligent **trade-offs** on interactive virtual reality models of progressive complexity;
- Right at the onset of modeling, **calibrate** basic material properties to ensure realistic **predictive** models within identified circumstances and limits;
- Rigorously update these predictive models through **pre-defined processes** during assembly and multi-domain testing;
- **Evaluate robustness** and safety interactions duly controlled at each step and in full **transparency**, while **updating processes towards best practice**.

End-to-End Virtual Product Engineering manages risks, complexity, trade-offs and interactive decision making. It supports industrial competitiveness by reducing costs and time to market. It can benefit each and every stage of product development processes, leading up to virtual pre-certification and to successful real testing, as may be required for final validation.

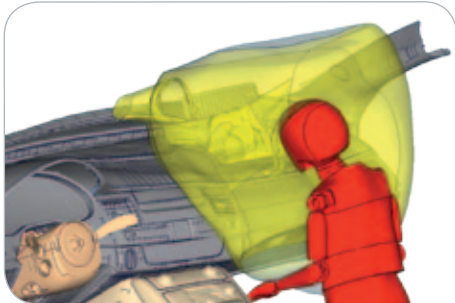
Innovations become dramatically easier to evaluate and implement.

The successes presented hereafter, including many recent and spectacular examples of End-to-End Virtual Product Engineering achievements, are the result of an effective collaboration and co-creation approach between ESI and global leaders in various industries.



Courtesy of Volkswagen AG

# Ground Transportation



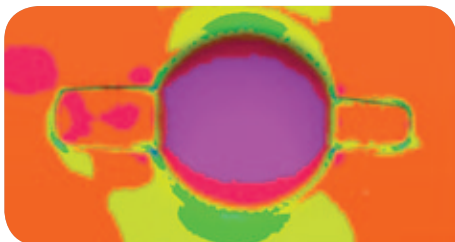
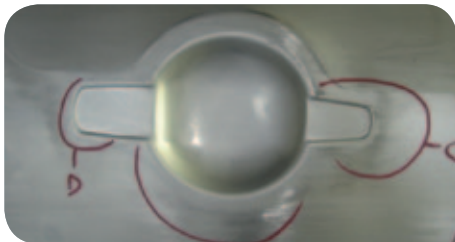
Out of Position simulation model: airbag deployment  
Courtesy of Audi AG



## Audi saves cost and development time with virtual airbag prototyping

“The major benefit of simulation is that we have a reproducible workflow keeping in details the influence of one or several parameters. With Sim-Folder, when we change one folding sequence, we can run the entire process again and obtain a folding variation overnight instead of one week for curtain and driver airbags.”

Dr. Erich Blümcke, Vehicle Safety Simulation Engineer, Audi AG.



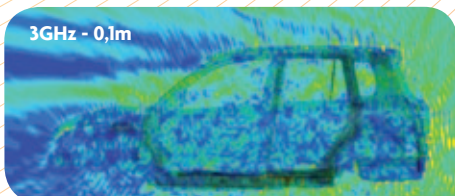
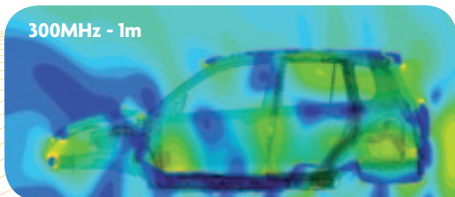
Typical problems in external panels can be predicted with simulation  
Courtesy of Aethra Automotive Systems



## AETHRA reduces try-out time on automotive body components with sheet metal forming simulation

“AETHRA Automotive Systems (...) significantly improved the results in prediction and resolution of surface defects in external panels using PAM-STAMP 2G. Now, to satisfy customer needs, we can test different strategies in the process development because we have confidence that we'll see the same behavior in try-out.”

Micheletti Viana, Mechanical Engineering - Formability,  
Wellington Caetano Soares, Mechanical Engineering - Formability,  
and Arlem Picinin Campos, Simulation Manager - AETHRA Automotive Systems.



Electromagnetic fields getting more complex with the frequency (distribution from 3 MHz up to 3 GHz)  
Courtesy of Mazda Motor Corporation



## Mazda Motor Corporation reduces development lead times on its electronic control technology thanks to PAM-CEM

“The introduction of PAM-CEM has allowed us to conduct very precise electromagnetic wave simulations. We believe electronic control systems will be increasingly important in the development of the cars of the future.”

Yasushi Hamada, Manager of the Electronic Testing and Research Group at MAZDA Motor Corporation.

# Aeronautics



## Simulating NASA space missions with Vdot™

“Vdot’s intuitive visual interface brings Virtual Missions to life by turning static, paper-based processes into active electronic processes that can be deployed, executed, managed, verified and continuously improved. Multiple iterations of this engineering process enable organizations to continuously improve their businesses and produce reusable process models for developing new business processes.”

As Presented at the AIAA 49th Aerospace Sciences Meeting, Orlando, FL January 6, 2011.  
AIAA-2011-0607 Authors: Roger Herdy, Qualis Corp., Jacobs ESTS Group / Daniel O’Neil, NASA Marshall Space Flight Center / Ian Sturken, NASA Ames Research Center / Michael Nix , Qualis Corp., Jacobs ESTS Group / Damian Yañez, ESI North America.



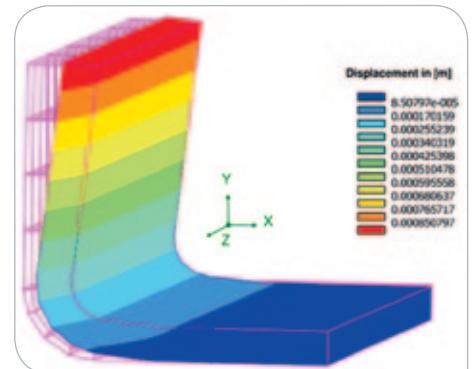
Vdot™: process visibility, distributed mission simulation and execution



## LTDS predicts composite materials distortion with SYSPLY

“We used SYSPLY to predict virtually the residual stresses, early in the development process. There was a good correlation between the virtual and the physical results. The use of simulation with SYSPLY was really successful.”

Dr. Olga Klinkova, Research Engineer, LTDS-ENISE & Centre de la Science des Matériaux et des Structures.



Predicted spring-in due to residual stresses release at the end of the manufacturing process

Courtesy of LTDS-ENISE and Centre de la Science des Matériaux des Structures



## Global Seating Systems uses PAM-COMFORT to achieve best-in-class seat comfort

“The end result we achieved thanks to PAM-COMFORT is what we believe to be best-in-class comfort, which is one of the most important elements for the occupant.”

Jeff Krueger, Director of Product Development, Global Seating Systems, USSC Group.

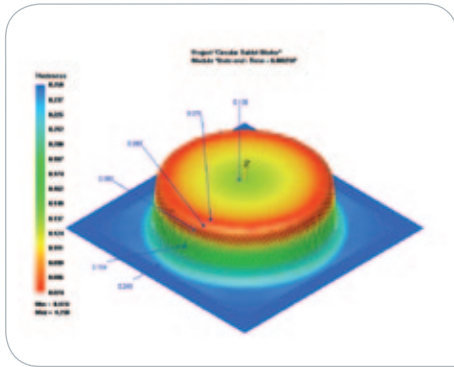


GSS's new military seat with foam & comfort development executed in ESI's PAM-COMFORT

Courtesy of Global Seating Systems, LLC

# Other industries

## PHARMACEUTICAL



Thickness distribution simulation in PAM-FORM  
Courtesy of Bilcare Research

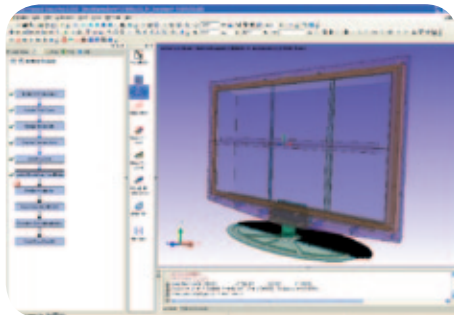
**Bilcare**  
Research

Bilcare optimizes package design using plastic thermoforming simulation

“We developed a system to predict the thinning profile on blister formation and the barrier property using PAM-FORM. With PAM-FORM we’re able to predict this behavior more accurately with great flexibility and user friendliness, all of which has helped us speed up our process.”

Samir Bagalkote, Assistant Manager, Research & Development, Bilcare Research.

## ELECTRONICS



Workflow for wobble analysis  
Courtesy of Samsung Electronics Corporation

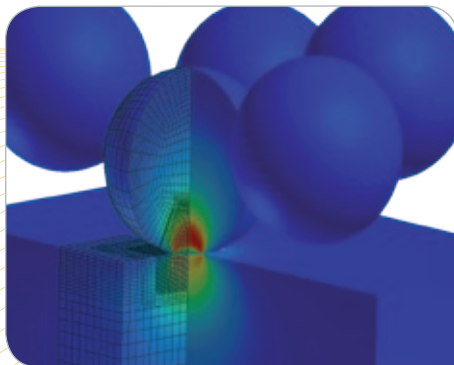
**SAMSUNG**  
ELECTRONICS

SAMSUNG Electronics benefits from a virtual prototyping platform, saving up to 90% in engineering time

“Using guided CAE automation early in the design process enables us to identify the right concepts and verify design changes in order to save time and cost. As we are very satisfied with ESI’s support and assistance throughout the project, we are looking into implementing the simulation data management system in other divisions.”

Mr. Jeong-Rho Lee, Senior Engineer, SAMSUNG Electronics Corporation.

## ENERGY



Mechanical surface treatment (2 million nodes)

**A**  
**AREVA**

AREVA makes a breakthrough in nuclear power plant simulation for optimal safety

Enhancements to SYSTUS solvers combined with fast and powerful Intel hardware helped AREVA perform accurate computations of models 10 times bigger than previously. In addition, this solution significantly reduced computation times up to a factor of 4 while bringing greater precision thanks to a global method. This new approach of realistic simulation through reduced conservatism enhances productivity and safety in nuclear power.

# esi AROUND THE WORLD

ESI provides services and support to its international industrial customer base. With subsidiaries, agents and distributors established in more than 30 countries, ESI Group employs over 900 professionals worldwide.



# esi

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