



Corporate Brochure



 **CREATE**
WITHOUT LIMITS

Profile

Pioneering Virtual Engineering

ESI Group is a pioneer and world leading provider of digital simulation software for product prototyping and manufacturing processes that take into account the physics of materials.

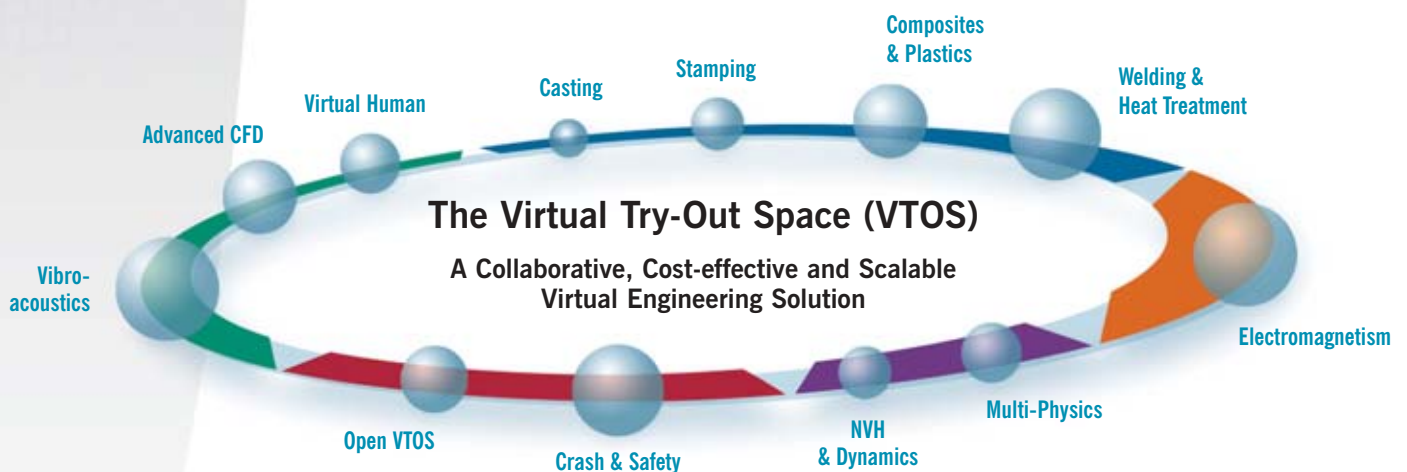
Founded in 1973 by four Berkeley Ph.D. graduates, ESI Group now occupies a unique position in the high-potential Product Lifecycle Management (PLM) market.

ESI Group has developed an entire suite of coherent, industry oriented solutions to realistically simulate a product's behavior during testing, to fine tune the manufacturing processes in synergy with the desired product performance, and to evaluate the environment's impact on product usage.

By drastically reducing costs and development lead times, ESI Group solutions integrated into its global "Virtual Try-Out Space" (VTOS), offer major competitive advantages by progressively eliminating the need of physical prototypes during the product development phase.

With the collaboration of nearly 500 high-level specialists worldwide, the company and its global network of agents provide direct sales and technical support to customers in more than 30 countries.

As ESI Group development is based on continuous innovation, the Group is qualified as "innovative company" by Anvar, the French National Research Agency.



Chairman's Message

Innovate with realistic Simulation

Fostering sustainable growth under the pressure of a global economy and time-to-market challenges obliges companies to manage simultaneously their network of business processes while maintaining a strict focus on product excellence and innovation.

Industry now needs to move away from the traditional trial-and-error methodology, which places primary confidence in physical prototypes, and must embrace a new paradigm called Virtual Product Development and Simulation-Based-Design, more favorable to innovation and overall more effective and less expensive. Many decisions affecting the final design result from computer simulations of the model's physical properties. Physical prototypes are thus progressively replaced, not only because they are cost, time and energy consuming, but because a physical prototype cannot always be used: in some situations, it cannot even exist!

Paramount to the reliability of virtual simulations is the realistic account of the physics of materials and of the fabricating processes which determine them. This is why Virtual Manufacturing (VM) is at the core of our VTOS solutions, to predict product performance "as built" and not only "as designed" ideally.

Keeping pace with such needs, ESI Group's Virtual Try-Out Space is developing fast, driven by the ever more challenging requirements of the automotive and transportation market.

To enhance diversification opportunities, ESI Group has further enhanced its product portfolio and capabilities through the strategic acquisition of EASi's CAE software and its flagship products, EASi-CRASH/SAFE and EASi Process, opening our VTOS to leading ISV (Independent Software Vendor) products.

And thanks to the recent acquisition of CFDRC's CAE product division, new leading fluid dynamics software has been added to our product portfolio in the area of semiconductors, biotechnology, fuel cells, and MEMS (Micro Electro Mechanical Systems).

New subsidiaries in India and China have been opened to answer market needs and growth. And most importantly, major new versions of our most prominent products have also been released (e.g. 2G solutions).

Simulation-Based-Design is no longer a futuristic methodology for early adopters: it does accelerate the introduction of new products, strengthening market competitiveness, and presents an opportunity not to be missed.

 **Let's move forward**
and take the PLM / VPD turn 

Alain de ROUVRAY
Chairman and
Chief Executive Officer



A development strategy based on the advent of the 'Digital Factory'

The remote digital factory of the future represents a genuine methodological advance. The concept is based on providing all players with a common digital prototype, on which they will be able to operate simultaneously.

ESI Group's strategy is based on this vision, which assumes that manufacturing industries will inevitably shift toward the 'all-digital' technology. This shift is currently being accelerated by demands of increased competition and spectacular productivity gains that are expected to result.

Product Lifecycle Management (PLM) is a crucial part of the digital factory. It is intended to provide computerized monitoring of all activities related to products made by manufacturing companies, including design, production, maintenance and withdrawal.

Virtual simulation approach for SBD

ADEQUATE

Technologies for test simulation (1G)
Compute modeling per type of **virtual test**
Boundaries / Anomalies



RIGOROUS

Methodologies for performance improvement
Compute modeling **virtual prototype**

- Value chains per discipline (2G)
- Multi-disciplinary space: 'Open VTOS' (3G)



ROBUST

Process of design "**best practice**" per discipline

- Visual-Process



RELIABLE

for the "**JOB TO BE DONE**"
Simulation Based Design

Strategy

3G PLM, a decisive step towards the digital factory advent

A development strategy in 3 stages

Single-trade or first-generation (1G) applications

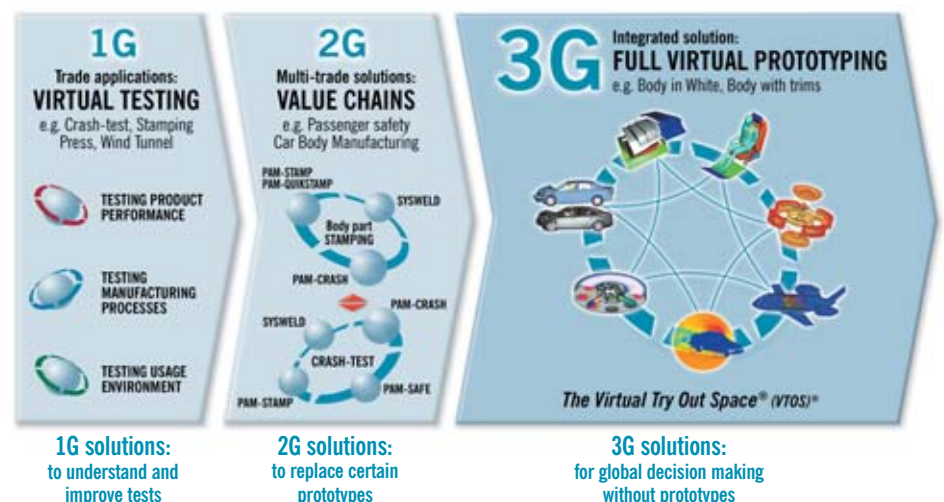
These single-trade software packages focused on specific applications for test simulations (crash tests, vibro-acoustic tests, material fabrication and assembly processes, etc.) form the basis of ESI Group's constantly-developing strategy.

Multi-trade value chains or second-generation (2G) solutions

In response to manufacturers' need to achieve synergies between the various types of tests involved in product design, sizing and manufacturing, ESI Group created integrated solutions called 'multi-trade value chains'.

Third-generation (3G) solution or Virtual Try-Out Space: ESI Group's main strategic project

ESI Group's 3G-PLM arises from the integration of multi-trade value chains, and is guided by the VTOS (Virtual Try-Out Space) concept. The 3G solution involves an integration protocol, currently being developed by ESI Group, which will allow all the company's solutions to work with each other and with solutions developed by other extended enterprise players. This is made possible by the unique diversity of ESI Group's product range. This integrated multi-physical and multi-trade solution is the cornerstone of ESI Group's strategy. It will also incorporate customizable "best practice" work flows (Visual-Process) to support Simulation-Based-Design by non simulation experts.



An industry-oriented strategy

ESI Group's strategy is developed to fulfill industry's demand for lower costs and shorter lead times as the number of suppliers decreases and the design of products and associated processes is optimized

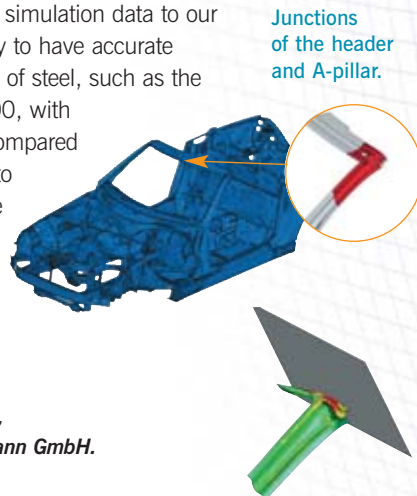
Multi-trade value chains or second-generation (2G) solutions

→ KARMANN

Optimization of crash-test simulation

"The addition of PAM-STAMP simulation data to our crash simulations is necessary to have accurate results when using new types of steel, such as the new high-strength steel DP600, with increased hardening effects compared to common steel. The ability to include this information in the PAM-CRASH simulation can make a crucial difference in the correlation between simulation and prototype testing."

*Mr. Norbert Schulte-Frankenfeld,
Manager of CAE, Wilhelm Karmann GmbH.*



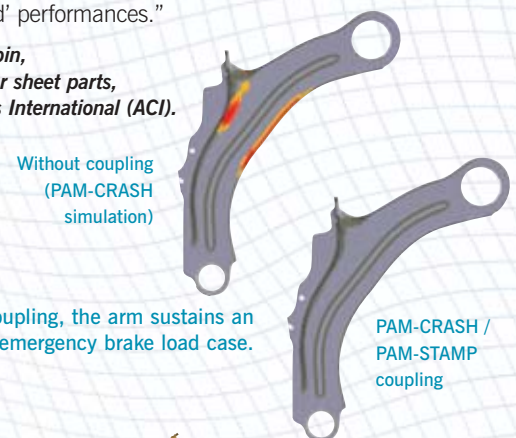
Junctions
of the header
and A-pillar.

→ ACI

The importance of accounting for material property variations due to a forming on predicting component crash behavior

"Taking into account forming effects, PAM-CRASH / PAM-STAMP coupling proves efficient for design optimization of Renault's Megane II suspension arm and opens new perspectives for other automotive components. A coupled PAM-CRASH/PAM-STAMP approach brings considerable benefits, helping to design parts to their 'just needed' performances."

*Laurent Taupin,
CAE manager sheet parts,
Auto Chassis International (ACI).*



Without coupling
(PAM-CRASH
simulation)

With coupling, the arm sustains an
emergency brake load case.

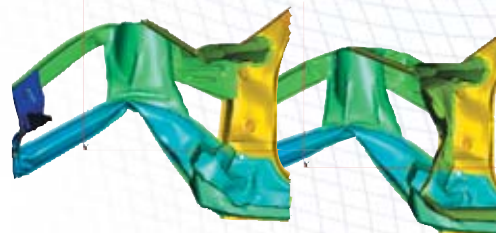
PAM-CRASH /
PAM-STAMP
coupling

→ ARCELOR

Reduction in number of physical prototypes

"Using PAM-STAMP and PAM-CRASH solutions on very high-strength steels led us to achieve a lighter car structure, as well as improving the accuracy of crash tests simulation results."

*Dr. Gilles Tremouilles,
Design Department Manager,
Arcelor Group, Arcelor Innovations, Isoform.*



Third-generation (3G) solution

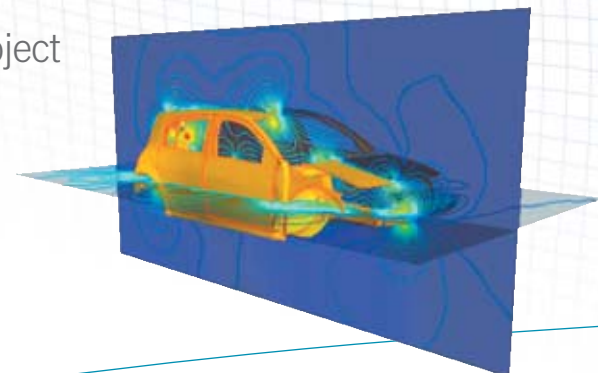
or Virtual Try-Out Space: ESI Group's main strategic project

→ RENAULT

Placing digital simulation at the heart of the automotive design process

"Simulation at Renault is linked to the product digital mock-up, providing numerical data for each part or component. Our major challenge is to finalize the integration of digital simulation in the design process. We have been working in partnership with ESI Group for more than two years to develop a new computational environment which will be closely linked in the future with a simulation data management system."

Bernard Thomas, CAE expert engineer, Renault.



PAM-CEM 2004 simulation of the
environment of a Renault vehicle under
external electromagnetic aggression.

Products and Services

Transportation (Automotive, Railway, Aircraft)

Success stories

→ CIDAUT

“Successful validation of door panels using PAM-CRASH helped us to design new paddings and high-energy absorbing systems in order to reach acceptable EUROSID dummy injury values in side impact tests.”

Alberto Negro,
Simulation Manager, Cidaut.

Door module paddings.
Courtesy of Grupo Antolin



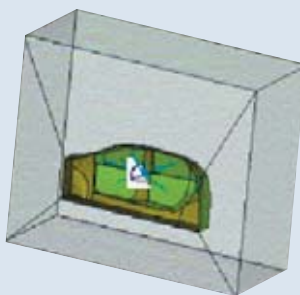
→ ELASIS

“AutoSEA2 allows engineers to build complex mathematical energy flow models of real structures and to predict responses to simulate vibration and acoustic environments.”

Anna Galasso,
*Senior CAE Specialist, Vehicle Dynamic,
Acoustic and Vibration Department*

Gianfranco Montuori,
Acoustic and Vibration Department Manager, Elasis.

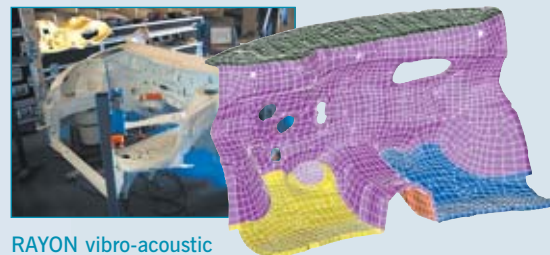
AutoSEA2 model of a longitudinal
section of a passenger vehicle.
Courtesy of Elasis S.C.p.A.



→ TREVES

“The simulation of the acoustical performances of car components in the early stages has become a critical requirement in order to lower weight, to reduce prototyping costs and lead-times, and to contain noise levels inside and outside the car. Using ESI Group's complete vibro-acoustics solution, we were able to analyze the full frequency spectrum. In particular RAYON's PEM techniques proved their accuracy for the characterization of complex sound package systems in the low frequency range.”

Maurice Fortez, *Technical Director, Trèves.*



RAYON vibro-acoustic
response of a trimmed
firewall.

Courtesy of Trèves

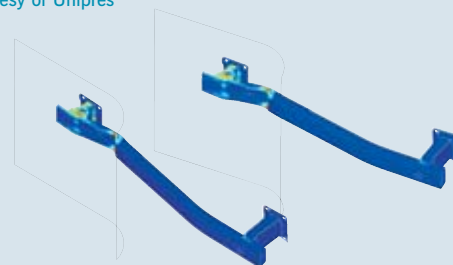
ESI Group offers a set of dedicated solutions for the transportation industry in the following fields:

- Body-in-white: simulation of manufacturing processes: stamping and welding of a vehicle body.
- Body-with-trim: simulation of crashworthiness and passenger passive safety in the vehicle interior.
- Comfort, noise and vibrations: simulation of acoustics and thermal comfort of a vehicle.
- Engine and powertrain: suspension systems, dynamics and performance.
- Interactions of the vehicle with its environment (air, water, electromagnetic waves, biofidelic human,...)

→ UNIPRES Corporation

“Coupling PAM-CRASH with PAM-STAMP helps to achieve more accurate and realistic simulation results. This approach enables users to accomplish more optimum and robust design, and the weight of products can often be reduced.”

PAM-CRASH low speed collision simulation
on bumper system.
Courtesy of Unipres



Crashworthiness



Stamping



Vibro-Acoustics

Products and Services

Manufacturing Industries and Energy

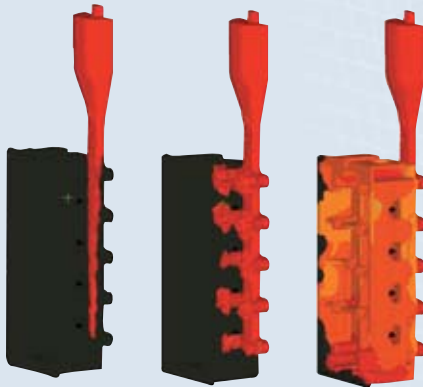
Success stories

→ MONTUPET

“ProCAST effectively predicts the filling patterns and helps control temperature gradients in lost foam casting.”

Temperature contours during the progressive filling of the casting.

Courtesy of Montupet



Addressing transformation industries, energy and heavy industry, ESI Group solutions answer various simulation needs such as:

- Manufacturing processes of metallic, plastic or composite parts.
- Design and optimization of assemblies, including simulation of their behavior within their environment.
- Simulation of physical and chemical interactions involving industrial processes such as electromagnetic compatibility.

→ AREVA

“SYSWELD 3D multipass welding simulation with mesh refinement reduces computation times by a factor of 5 and provides realistic results, especially for stress estimation. SYSWELD brings deep insight into the effect of multipass welding as it considers proper boundary conditions, such as, the bead retrain due to successive material deposits.”

Philippe Gilles, Framatome ANP, Senior expert in Fracture Mechanics.



3D displacements of the pipe.



Temperature distribution during the second pass.

Courtesy of Framatome ANP



Von Mises stresses in the overlapping area.

→ INASMET

“ProCAST’s inverse module will bring much improvement opportunities for casting optimization in the coming years. It’ll be the next step in simulation.”

Antton Meléndez, Materials and Processes Dept., Inasmet.

Metal melting in Inasmet facilities.



Courtesy of Inasmet

→ UMICORE

Umicore tunes the manufacturing process of a thin-walled zinc safety spool with ProCAST simulation software.



Casting



Heat Treatment

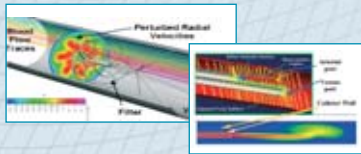
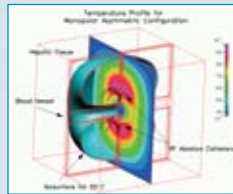
Products and Services

Electronic Components, Defense and Space Industries

Success stories

→ MEMS

Micro-Electro-Mechanical Systems (MEMS) is the integration of mechanical elements, sensors, actuators, mirrors, and electronics on a common silicon substrate through microfabrication technology. MEMS and microfluidics devices, like integrated circuits can be manufactured in high volume at low cost and promise to revolutionize telecommunications, biology and precision tools by making possible the realization of complete systems-on-a-chip.



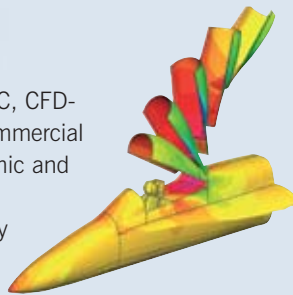
Modelization of lab-on-a-card solutions for high-tech pharmaceutical, biotech and diagnostic applications.

→ DEFENSE / AEROSPACE



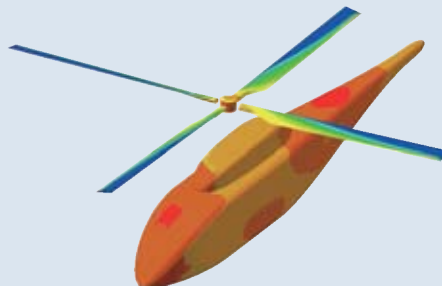
Newly acquired from CFDRC, CFD-FASTRAN is the leading commercial CFD software for aerodynamic and aerothermodynamic applications. It is specifically designed to support the

aerospace industry. It employs state-of-the-art multiple moving body capability for simulating most complex aerospace problems including a missile launch and store separation. Recently in CFD-FASTRAN structural analysis capability has been added that allows the modeling of aeroelastic applications.



"Our helicopter unsteady simulation capability has been built up totally based on CFD-FASTRAN for the last two years," says Dr. Hongyi Xu, NRC. "CFD-FASTRAN is very user-friendly and is ideal for modeling complex helicopter aerodynamics. Initial validating exercises performed for rotor flow at IAR/NRC indicate that its results are very reliable as they have matched very well with the available experimental data."

Dr. Hongyi Xu
National Research Council of Canada



A new portfolio of software applications coming from the acquisition of CFDRC software division strengthens existing ESI Group solutions in the following business sectors:

- **Aircraft and Space Industries:** design and optimization of internal and external air flows.
- **Defense:** simulation of complex physical phenomena occurring during aerodynamics operations such as missile launch, seat ejection, ...

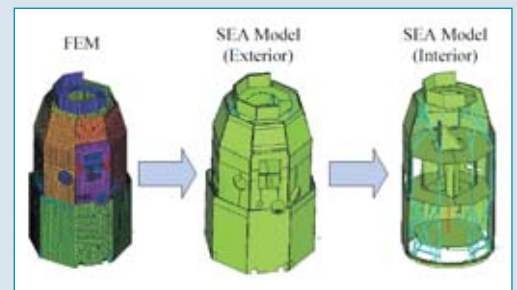
Micromachines, Micro-Electro-

- **Mechanical-Systems (MEMS),** Biomedical and Biotechnologies, microfluidics, plasma and semiconductor processes, fuel cells, ...

→ THE AEROSPACE CORPORATION

"The results obtained with AutoSEA2 for the assessment of the dynamic response of a C/NOFS spacecraft showed good correlation with acoustic tests."

Dr. Juan F. Betts,
Engineer with The Aerospace Corporation



AutoSEA2 model of the spacecraft.

Courtesy of SMC Air Force, The Aerospace Corporation



International Strategic Partnerships

Partnerships play an essential part in ESI Group's business strategy

→ PARTNERSHIP WITH DASSAULT SYSTEMES

ESI Group's extended product portfolio and V5 based solutions will enable on-line decision making by creating the ideal platform for product and process resource optimization, reducing time-consuming and expensive hardware prototyping. This will improve significantly physical testing within the PLM (Product Lifecycle Management).

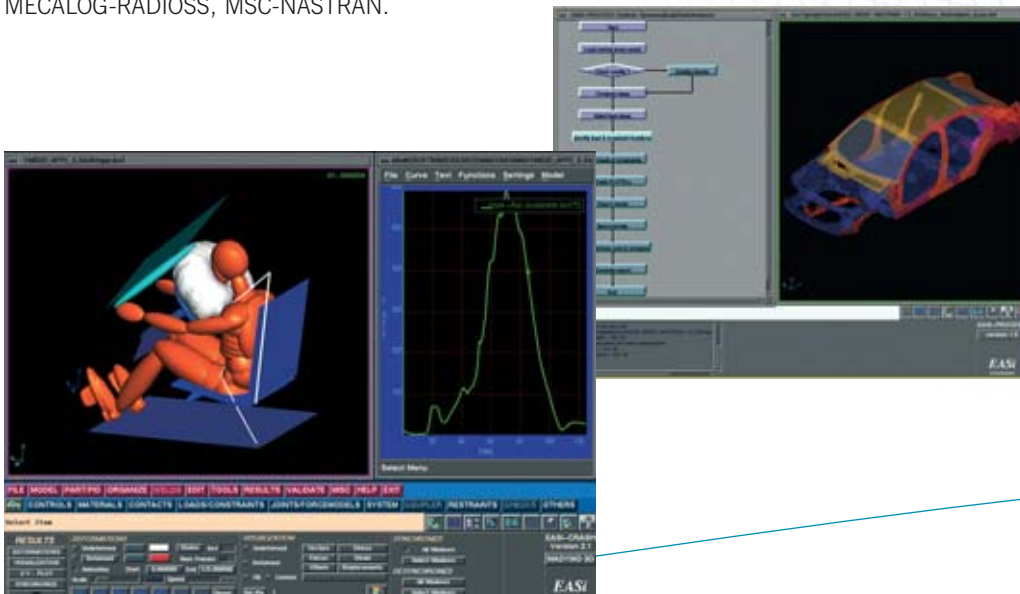
New ESI Group CAA V5 based products will take major step toward realistic PLM simulation in the "Virtual Try-Out Space".



→ OPENING OF ITS VIRTUAL TRY-OUT SPACE TO OTHER VENDORS

The integration of EASI's CAE software allows ESI Group to accelerate its strategy toward the digital factory while offering a simulation design and control tools for the automotive industry.

At the same time, ESI Group is opening its Virtual Try-Out Space (VTOS) to software packages developed by other vendors, such as LSTC-DYNA, TNO-MADYMO, MECALOG-RADIOSS, MSC-NASTRAN.



R&D INVESTMENT FOR TECHNICAL EXCELLENCE

Through long-term partnerships with industrial and academic partners ESI Group is pioneering leading edge innovative projects.



RESEARCH CENTERS:

Ashland, Pechiney, Cetim, EWI, FAT, Framatome, FTSS, INPRO, ITWN, Jari, Neilsoft, Onera, SDS

UNIVERSITIES:

Cambridge, Compiègne, Delft, Georges Mason, Imperial College, INPG, INPL, Montreal Polytechnics, Oak Ridge

Established International Presence

A broad and expert distribution network

With twelve field subsidiaries and several distribution agents spanning four continents, ESI Group provides worldwide services and support to its international industrial customers.

Our distribution network is based on twelve ESI subsidiaries (France, China, Germany, India, Spain, Netherlands, United Kingdom, Czech Republic, Japan, Korea, Switzerland, USA), two regional technical support offices (Brazil for South America and Malaysia for South and South-East Asia) and a network of agents and distributors in more than 30 countries.

Each distribution unit exclusively covers an assigned geographical region, selling both software licenses and consulting services. This strategic and complementary activity brings high added value solutions to ESI Group's customers, with personalized training programs and high-level technical support. Due to this local presence, ESI subsidiaries can initiate strategic partnerships between their clients and ESI Group for the development of new products and specifications.

Employing nearly 500 professionals worldwide, ESI Group provides local, effective assistance to all major industrial customers.



International Presence

Providing ‘as good as real’ virtual solutions

Working hand in hand
with customers,
ESI Group’s consulting
experts worldwide
are committed to
answering customers
needs and concerns by
providing new virtual
testing capabilities or
achieving a realistic
simulated behavior
with minimal
complexity and costs.

ESI Group’s engineering services include:

- joint studies aimed at developing and validating new virtual simulation tools
- leading-edge technology projects consisting of R&D developments supported by industrial consortia
- and a set of customized services such as application studies, training, contracting, porting and technical assistance.

ESI Group’s engineering services are at the heart of the company’s in-depth technical expertise and are sustained by the organization of ESI Group Centers of Excellence gathering engineers specialized in one of the emerging fields of application, such as biomechanics, material rupture, vibro-acoustics, electromagnetism, metallurgy, to name only a few.

A worldwide team of high-level specialists set up proven modeling methodologies based on ESI Group’s advanced Virtual Try-Out Space solutions. This in-depth approach allows truly predictive virtual tests and experiments to be performed, drastically reducing costs and lead times and improving quality of the end products.

ESI Group’s software development activities are ISO 9001 certified; this international standard guarantees setting up of a quality system and assurance procedures linked to each activity of the company, from software edition to the execution of dedicated engineering studies.



REFERENCES

Transportation:

Alstom, Audi, Autoliv, BMW, Bombardier, Breed, Daewoo, Daihatsu, Daimlerchrysler, Delphi, Faurecia, Ford, GM, Honda, Hyundai, Isuzu, Mazda, Mitsubishi, Nissan, Porsche, PSA, Renault, Samsung, Seat, Skoda, Subaru, Toyota, TRW, Valeo, Visteon, VW, ...

Manufacturing industries and energy:

Air Liquide, Alcan, Arcelor, AREVA, Bridgestone, Canon Inc, Corus, Eastman Kodak, EDF, GE Lighting, Kobelco, Kotobuki, LG, Matsushita Electric Industry, NKK, Osaka Gas, Osram Sylvania, Posco, Tokyo Gas Co, ...

Electronic components, Defense and Space industries:

Air Force Research Lab, Boeing, DGA, EADS, ESA-ESTEC, Indian Air Force, Israeli Aircraft Industries, Korea Aerospace Research Institute, LG Electronics, Lockheed Martin, Martin Baker, NASA, Naval Surface Warfare Center, Naval Undersea Warfare Center, Parker Hannifin, Rolls Royce, Thales, Tokyo Electron Limited, Toshiba Corp., US Navy, ...

ESI GROUP HEADQUARTERS

8, RUE CHRISTOPHE COLOMB
75008 PARIS - FRANCE
Phone: +33 (0)1 53 65 14 14
Fax: +33 (0)1 53 65 14 12

ESI GROUP MARKETING

PARC D'AFFAIRES SILIC - 99 RUE DES SOLETS
BP 80112 - 94513 RUNGIS CEDEX - FRANCE
Phone: +33 (0)1 41 73 58 00
Fax: +33 (0)1 46 87 72 02

ESI NORTH AMERICA COMMERCIAL HEADQUARTERS

36800 WOODWARD AVENUE - SUITE 200
BLOOMFIELD HILLS, MI 48304 - USA
Phone: +1 (248) 203 0642
Fax: +1 (248) 203 0696

ESI GROUP WORLDWIDE

ARGENTINA	POLAND
AUSTRALIA	ROMANIA
AUSTRIA	RUSSIA
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www.esi-group.com
info@esi-group.com