# INTERVIEW OF ALAIN DE ROUVRAY

Chairman and CEO of ESI Group

**You mention the "Hybrid Twin™". Could you further explain this concept and its positioning compared to the "Virtual Prototype"?**

From inception forty years ago, Product Lifecycle Management (PLM) traditional solutions have relied on the exponential power of High Performance Computing (HPC) to develop Products 'right the first time', initially by Computation, then by Simulation, and finally by "as built as tested" Virtual Prototyping. This has been done for the Product in its brand *new* state, without much attention for its real life once in the user's hands.

Thanks to the in-life connectivity of the Product with the IoT and Big Data, the Hybrid Twin™ can now offer a powerful alternative to represent the aged Product in its 'in-Service' conditions, i.e. as it is used and integrated in its specific operational environment. This disruptive solution enables a continuous feedback to ensure optimal usage and performance during the Product entire lifecycle up to ultimate withdrawal.

Thus, the new Hybrid Twin™ solutions enable companies to virtually provide predictive maintenance and optimize assisted operation of the Product, by connecting information of the present (IoT) and of the past (Big Data), and combining with interpretations (I.A.) of the possible future (updated and extrapolated Virtual Prototype). These disruptive solutions are tackling the key challenges of Industry 4.0, while also allowing the development of new materials and manufacturing processes which will create the innovative and competitive Products of tomorrow (ex: light weight, electric, assisted or autonomous vehicle, smart materials, etc.).

**What is the interest for industry to move from Virtual Prototypes to Hybrid Twins?**

ESI's "Virtual Prototype" is a physics–based complete digital model used to achieve the virtual pre-certification of a *brand-new* Product. It enables companies to replace or limit the number of real prototypes and tests to the bare minimum during the development phase of a Product.

ESI's "Hybrid Twin™" builds upon the Virtual Prototype, to which it adds three additional levels of modeling:

- First, Systems modeling to activate the Product (ex: wiring, mechanisms, etc…);
- Then, the immersive physical Environment of the Product and how it operates in that context;
- Finally the in-Service interactions between Product, System and Environment.

Examples of Hybrid-Twin™ Environmental context to the Virtual Prototype would be:

- for a car: the road, pot holes and water puddles, pedestrians and wind gusts;
- for a heart prosthesis: the blood flow, the muscular and nervous systems;
- for a factory assembly line: vibrations and impacts;
- for batteries: the external temperature, vibrations and shocks in operation, etc...

With the Hybrid Twin™, the Product is integrated and interacting realistically in its in-Service Environment. Its actual performance is represented individually rather than statistically, in its degraded condition (damaged, repaired), in its present and specific context. The Internet of Things (IoT) and Machine Learning allow real-time connection and update with collected Big Data, either from the past or from almost real-time events on the in-Service Product. This enables companies to develop and validate processes for assisted or autonomous driving (ADAS); it provides predictive maintenance and optimizes repairs from wear and tear or accidents, to avoid mass recalls of faulty Products or costly interruptions of manufacturing lines.

### What are the current applications of the Hybrid Twin™?

For example, we are currently working on a "WindTwin" (W-T) project in the renewable energy sector. The objective is to improve the performance of offshore wind farms. When the windmill communicates in real time its status to the maintenance station, the W-T model must be able to adjust operational parameters depending on the production results, provide warnings and anticipate any damage. Collected information (Big Data) will be also useful to improve design and manufacturing of future windmills, with the use of innovative materials or manufacturing processes.

This approach should be progressively adopted by all industrial sectors, and in priority by the most innovative and competitive ones such as Automotive, Aeronautics, Electronic and Energy.

ESI is actively engaged in this critical disruptive transformation, which embraces key challenges of "Industry 4.0" and "Smart Factories". To ensure our success we benefit from a major competitive advantage: the realistic virtual modeling of the physics of materials and of their industrial manufacturing, transformation and repair processes, which ESI has developed and validated in global industrial and academic co-creation partnerships over decades.