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2015

Typhoon HIL

2015 Global Hardware-in-the-Loop for Power Electronics New Product Innovation Award

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50 Years of Growth, Innovation & Leadership

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Background and Company Performance

Industry Challenges

Hardware-in-the-Loop (HIL) simulation is a process that is used to test control systems by simulating the controlled equipment/plant (in real-time) in virtual environment and directly interfacing it with real controller system such that controller under test can't tell whether it is controlling a real equipment or simulation. Results of HIL simulations are evaluated to test and verify the controller with both run-time and post-simulation analysis platforms. HIL simulation is an effective platform for developing and testing real-time control units. The controller can be tested under a wide range of operating conditions including faults and in a completely safe and repeatable environment. The plant complexities and the faults are mathematical representation of all related dynamic systems, given as inputs to the controller and tested in a virtual environment. HIL simulation has played an important role in the design and testing of various products for more than two decades. Frost & Sullivan recognizes that it is ideal for the design and testing of complex equipment used in automobiles, airplanes, power electronics, power systems, satellites, missiles, rockets and locomotives. The key driver for HIL testing is the importance of safety procedures in these industries and cost effective testing. Companies are bound to use HIL to increase the test coverage. Apart from safety critical and mission critical applications, companies across industries face a high degree of competition in the market due to price pressures, time to market, quality, and production rate. To maintain their positions in this challenging market environment, they are adopting HIL tools to improve products, improve quality, and speed up the new product development time.

Automotive and aerospace and defense aside, the requirement for HIL testing for power electronics, smart grid, microgrids, and electrical distribution systems are expanding. Power electronics converters are becoming ubiquitous in energy conversion and power-processing devices. This opens up a new market segment in the HIL industry for a broad range of power electronics applications such as solar inverters, battery storage, wind turbines, motor drives, active filters, flexible alternating current (FACTS) devices, and other electric drives. However, existing HIL simulators for power electronics are limited by large real-time simulation time steps between 10 and 50 microseconds, which is not sufficient for high-fidelity real-time simulation needed for HIL testing of power electronics converters. In addition, issues regarding cyber security for energy systems with interconnected power systems have emerged. This is a great challenge for HIL testing today.

Typhoon HIL's New Product Attributes and Customer Impact

Match to Needs

Typhoon HIL is the technology leader in the global hardware-in-loop (HIL) market for power electronics that develops innovative solutions for control system testing and test

automation. The company's HIL solution is used for new design, automated testing, verification, and pre-certification of products across the globe by its clients. Typhoon HIL's main focus is on industrial customers whose critical feedback is continuously used for product development and product improvement. Apart from providing HIL equipment and services, it also supports its customers in the best possible way, which results in better quality control and reduces significantly the cost of test processes. Previously, HIL systems in the automotive and aerospace industries could be run with millisecond-to-second simulation time steps, which was not nearly fast enough for power electronics. Frost & Sullivan notes that Typhoon HIL identified this unmet need and was the first to fulfill the demand for simulators in the power electronics market with just a 1µs time step. Typhoon HIL 4 and 6 Series have been brought to markets for power electronics applications that include solar inverters, battery storage, wind turbines, motor drives, FACTS devices, and other power systems and electrical distribution systems. Another innovative product-HIL Microgrid DSP Interface is a great controller prototyping tool for smart inverter controllers and microgrids that works seamlessly with HIL4 and HIL6 series. Leading automotive companies also use HIL for testing power electronics including converters, motor drives, and battery chargers in cars. Typhoon HIL's product innovation and focus on customer support ensures that customers are highly satisfied with its products. In addition, the company uses its own highly optimized and tightly integrated software and hardware for automated testing, continuous test and integration processes. This product strategy matches the market and customer needs.

Quality

Frost & Sullivan firmly believes that the great feedback from different companies testifies to the product quality of Typhoon HIL. The company is well established in the emerging and fast-growing HIL market for power electronics and power systems by providing the most advanced hardware and software tools together with high-quality support for its customers. The upgraded version of Typhoon HIL's 6 Series Hardware-in-the-Loop real-time simulator system is HIL 602, which includes six core processors, high-speed serial link that enables paralleling up to 4 HIL units into a microgrid/distribution HIL system, high throughput ultra-low latency analog and digital input/output channels, and HIL Control Center software with a number of toolboxes including Solar Inverter Test Suite, Test Script Editor, Custom User Interface and many more. Typhoon HIL's software tool is user-friendly and easily mastered by new users. For example, even obscure controller algorithm issues can be quickly captured with built-in scope/capture function with 32 channels, 32 Mega points record length, and 1MHz sample rate. In addition, the elegant API enables easy writing of python test scripts to fully automate regression testing. Frost & Sullivan's analysis confirms that Typhoons HIL's product exhibits ultra-low latency, ultra-high fidelity, and a small real-time simulation time step of 500 ns to 1 µs for power electronics, surpassing its competitors.

Design

The product design team at Typhoon HIL mainly focuses on developing the industry's fastest, highest fidelity, and ultra-low latency HIL real-time simulators for power electronics customers. Frost & Sullivan finds that with all of the technological features, its HIL solution is faster, more user-friendly, and much more flexible than other HIL solutions available in the market. Typhoon's HIL602 is developed specifically for automated HIL testing of industrial inverter controllers, microgrids and for complete software regression testing. This focus have helped the company achieve success in the global HIL market especially for power electronics and smart grid. Frost & Sullivan expects the power electronics segment to witness huge growth and reach $50 million to $100 million in the next 10 years as a result of the benefits Typhoon HIL brings to customers in terms of new control software testing and quality processes, reduced cost of quality, decreased time to market.

Customer Ownership Experience

Frost & Sullivan's analysis reveals that Typhoon HIL not only provides the most innovative HIL products and the fastest HIL solution for power electronics to customers but also maintains strong relationships with its existing and potential customers from university laboratories to the power electronics, power systems, automotive, and aerospace industries. To achieve a high customer ownership experience, it provides software regression testing, automated testing, and a continuous test and integration processes which translate into a fully integrated HIL solution in the course of designing and releasing control software for power electronics devices. By providing strong technical support and the world's fastest real-time simulator for power electronics, Typhoon HIL has attracted prestigious customers like ABB Switzerland Ltd, Schneider Electric, Woodward, GE, Siemens, Toshiba, Caterpillar, AVL, Enerdrive, research labs and universities.

Customer Service Experience

To ensure a high standard of customer service, Typhoon HIL does not have a special customer feedback mechanism; rather, it has a well-organized customer service where the customers can directly raise any issue regarding products and then also track those issues. Specific engineers and other team members are solely dedicated to resolving customers' issues. Within 48 hours of the initial inquiry, the teams are able to provide proper solutions. Striving to offer the best and most differentiated service experience to customers, the company allows customers to contact specialists directly for any query. This commitment helps the company achieve a positive and highly satisfying customer service experience. Typhoon's global offices, distributors, and value-added resellers all support customers efficiently.

Brand Equity

Since its foundation in 2008, Typhoon HIL has mainly focused on high product quality backed by valuable product services. Its innovative, ultra-high fidelity, real-time Hardware-in-the-Loop solution for the power electronics and smart grid industry has helped the company become the technology leader in this space. Through its own quality hardware and software testing processes, Typhoon HIL works closely with customers and makes any necessary changes accordingly. To strengthen the brand equity of its products, it mainly focuses on three important aspects: quality, technical excellence, and strong product design. Frost & Sullivan's analysis confirms that despite being leaders in the automotive HIL market, Typhoon HIL's top competitors have no simulating solution for power electronics. Typhoon HIL, however, has the ability to hold its market position in HIL for both automotive and power electronics with its unique, embedded real-time simulation systems.

Conclusion

Frost & Sullivan's independent analysis clearly shows that with HIL 4 and 6 Series and HILConnect Interface solutions, Typhoon HIL is a pioneer and market leader in the HIL market for power electronics addressing key end-user challenges, notably the need for real-time test solutions. By providing the industry's best real-time Hardware-in-the-Loop simulators, Typhoon HIL helps to enhance the return on investment (ROI) of customers on its solutions.

With its strong overall performance, Typhoon HIL602 has earned Frost & Sullivan's 2015 New Product Innovation Award.

Understanding New Product Innovation

Ultimately, growth in any organization depends upon continually introducing new products to the market, and successfully commercializing those products. For these dual goals to occur, a company must be best-in-class in three key areas: understanding demand, nurturing the brand, differentiating from the competition. This three-fold approach to delivering New Product Innovation is explored further below.

Innovation is about finding a productive outlet for creativity—for translating ideas into high quality products that are of a consistently high quality and have a deep impact on the customer.

Key Benchmarking Criteria

For the New Product Innovation Award, Frost & Sullivan evaluated two key factors— New Product Attributes and Customer Impact—according to the criteria identified below.

New Product Attributes

Criterion 1: Match to Needs
Criterion 2: Reliability
Criterion 3: Quality
Criterion 4: Positioning
Criterion 5: Design

Customer Impact

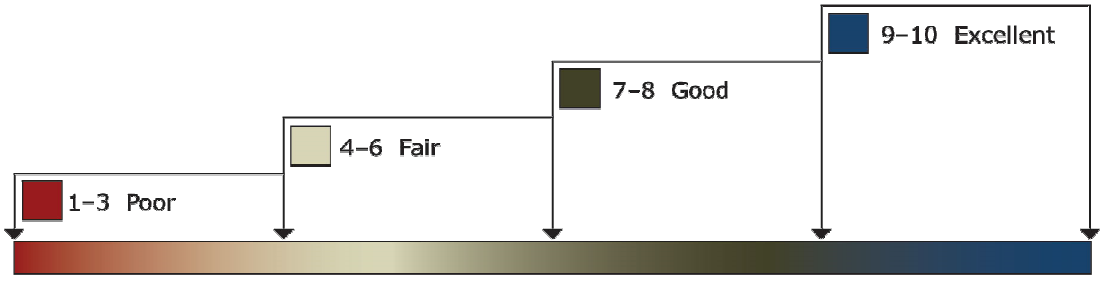
Criterion 1: Price/Performance Value
Criterion 2: Customer Purchase Experience
Criterion 3: Customer Ownership Experience
Criterion 4: Customer Service Experience
Criterion 5: Brand Equity

Best Practice Award Analysis for Typhoon HIL

Decision Support Scorecard

To support its evaluation of best practices across multiple business performance categories, Frost & Sullivan employs a customized Decision Support Scorecard. This tool allows our research and consulting teams to objectively analyze performance, according to the key benchmarking criteria listed in the previous section, and to assign ratings on that basis. The tool follows a 10-point scale that allows for nuances in performance evaluation; ratings guidelines are illustrated below.

RATINGS GUIDELINES



The Decision Support Scorecard is organized by New Product Attributes and Customer Impact (i.e., the overarching categories for all 10 benchmarking criteria; the definitions for each criteria are provided beneath the scorecard). The research team confirms the veracity of this weighted scorecard through sensitivity analysis, which confirms that small changes to the ratings for a specific criterion do not lead to a significant change in the overall relative rankings of the companies.

The results of this analysis are shown below. To remain unbiased and to protect the interests of all organizations reviewed, Frost & Sullivan chose to refer to the other key players in as Competitor 2 and Competitor 3.

DECISION SUPPORT SCORECARD: NEW PRODUCT INNOVATION AWARD

Measurement of 1–10 (1 = poor; 10 = excellent)			
New Product Innovation	New Product Attributes	Customer Impact	**Average Rating**
Typhoon HIL	9.8	9.8	9.8
Competitor 2	9.0	9.0	9.0
Competitor 3	8.5	8.5	8.5

New Product Attributes

Criterion 1: Match to Needs

Requirement: Customer needs directly influence and inspire the product's design and positioning

Criterion 2: Reliability

Requirement: The product consistently meets or exceeds customer expectations for consistent performance during its entire life cycle

Criterion 3: Quality

Requirement: Product offers best-in-class quality, with a full complement of features and functionality

Criterion 4: Positioning

Requirement: The product serves a unique, unmet need that competitors cannot easily replicate

Criterion 5: Design

Requirement: The product features an innovative design, enhancing both visual appeal and ease of use

Customer Impact

Criterion 1: Price/Performance Value

Requirement: Products or services offer the best value for the price, compared to similar offerings in the market

Criterion 2: Customer Purchase Experience

Requirement: Customers feel like they are buying the most optimal solution that addresses both their unique needs and their unique constraints

Criterion 3: Customer Ownership Experience
Requirement: Customers are proud to own the company's product or service, and have a positive experience throughout the life of the product or service

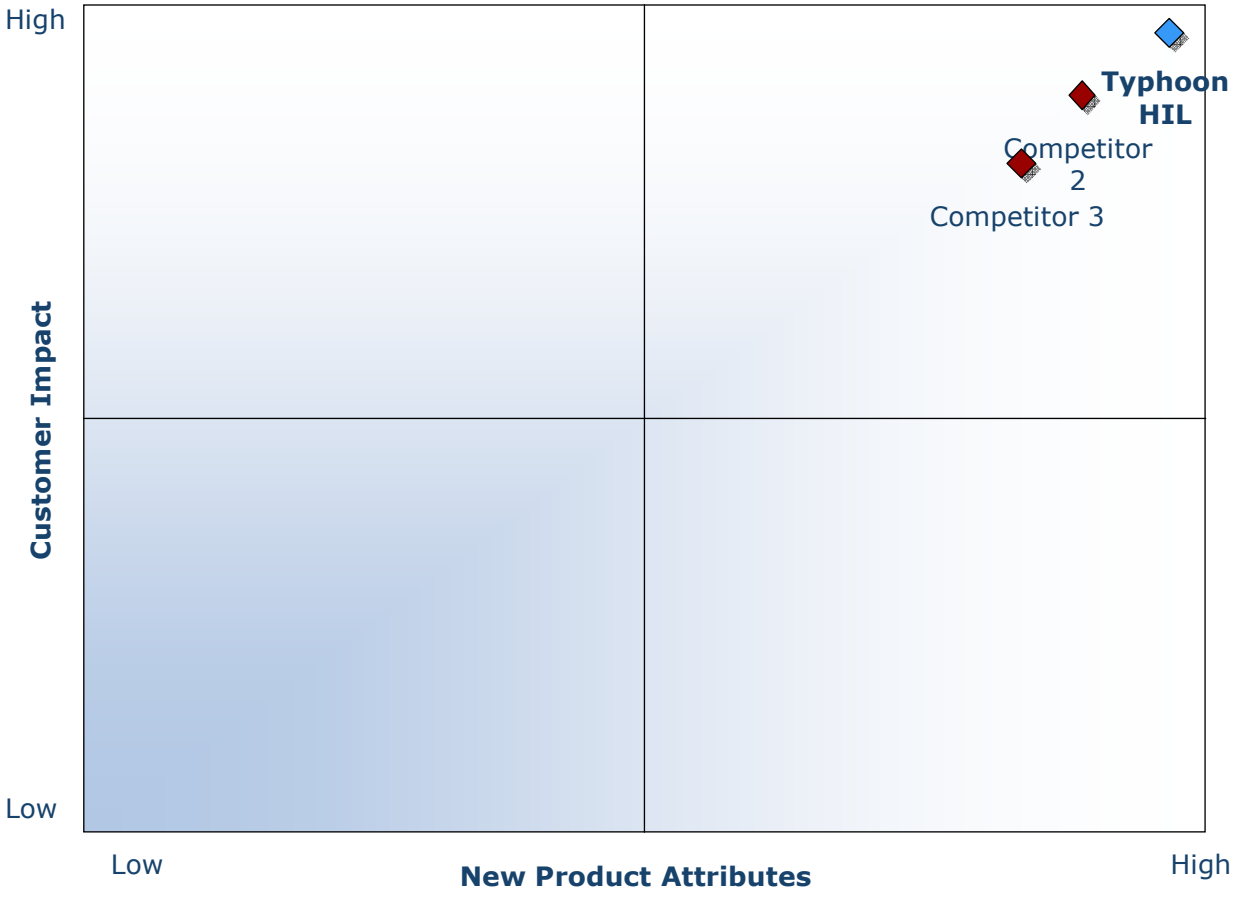
Criterion 4: Customer Service Experience
Requirement: Customer service is accessible, fast, stress-free, and of high quality

Criterion 5: Brand Equity
Requirement: Customers have a positive view of the brand and exhibit high brand loyalty

Decision Support Matrix

Once all companies have been evaluated according to the Decision Support Scorecard, analysts can then position the candidates on the matrix shown below, enabling them to visualize which companies are truly breakthrough and which ones are not yet operating at best-in-class levels.

DECISION SUPPORT MATRIX: NEW PRODUCT INNOVATION AWARD



The Intersection between 360-Degree Research and Best Practices Awards

Research Methodology

Frost & Sullivan's 360-degree research methodology represents the analytical rigor of our research process. It offers a 360-degree-view of industry challenges, trends, and issues by integrating all 7 of Frost & Sullivan's research methodologies. Too often, companies make important growth decisions based on a narrow understanding of their environment, leading to errors of both omission and commission. Successful growth strategies are founded on a thorough understanding of market, technical, economic, financial, customer, best practices, and demographic analyses. The integration of these research disciplines into the 360-degree research methodology provides an evaluation platform for benchmarking industry players and for identifying those performing at best-in-class levels.

360-DEGREE RESEARCH: SEEING ORDER IN THE CHAOS

About Frost & Sullivan

Frost & Sullivan, the Growth Partnership Company, enables clients to accelerate growth and achieve best in class positions in growth, innovation and leadership. The company's Growth Partnership Service provides the CEO and the CEO's Growth Team with disciplined research and best practice models to drive the generation, evaluation and implementation of powerful growth strategies. Frost & Sullivan leverages almost 50 years of experience in partnering with Global 1000 companies, emerging businesses and the investment community from 31 offices on six continents. To join our Growth Partnership, please visit http://www.frost.com.